Epistemic bias in embedded polar questions*

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Abstract

This paper argues that 'outside negation' in polar questions shares properties with so-called 'subjective' epistemic modals, but differs from such modals in having to take scope over a question operator. Both outside negation and subjective epistemic modals resist embedding under veridicals, semi-factives and proffering predicates, induce Epistemic Containment, and exhibit further peculiar scope-freezing effects. We argue that these phenomena can be given a unified treatment in terms of the scopal properties of subjective epistemic attitudes, once it is assumed that factive and veridical predicates, as well as verbs of proffering, force their complement to be closed off by a factive operator, irrespective of whether that complement is a proposition or a question (see Spector and Égré 2015 for related ideas). The proposed account relies on a theory of scope in which scope shift is encoded through percolation of scope indices constrained by a minimality condition (the Condition on Scope Shift; Neeleman & Van de Koot 2012). Therefore, to the extent that the account presented is successful, it provides support for this particular view of scope-taking.

Keywords: polar questions, outside negation, subjective epistemic modals, Epistemic Containment, scope freezing, factivity

1 Introduction

As is well known, sentences denoting polar alternatives can be embedded under a wide range of predicates and can also appear in subject position (see, for example, Lahiri 2002). These environments all allow 'inside negation' polar questions (INPQs), which are typically associated with a bias towards the negative alternative and license NPIs. However, their 'outside negation' counterparts (ONPQs), which have a bias towards the positive answer and do not license NPIs (Ladd 1981), show variable acceptability. This contrast between INPQs and ONPQs is illustrated in (1) (for discussion of biases in polar questions, see Büring & Gunlogson 2000, Rooy & Safarova 2003, Romero & Han 2004, Asher & Reese 2007 and Sudo 2013; for recent work on the syntax of polar questions, see Holmberg 2013, 2015).[1]

(1) a. John is wondering if/whether Mary doesn't like spinach (either/too).
b. John is asking if/whether Mary doesn't like spinach (either/too).
c. John knows if/whether Mary doesn't like spinach (either/*too).
d. John remembers if/whether Mary doesn't like spinach (either/*too).
e. Whether Mary doesn't like spinach (either/too) is not very clear to John.

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[1] There appears to be considerable variation among speakers regarding the choice of *if* and *whether* as the preferred complementizer. So readers who are native speakers of English should feel free to adjust the choice of complementizer when judging the examples.

On the ONPQ reading of (1a,b), the attitude holder is the matrix subject John, and these sentences convey that John has a hunch that Mary likes spinach but that he would like confirmation of this positive supposition. This reading is also available in (1e), where again the attitude holder may be taken to be John. However, this example also appears to allow the bias towards the positive answer to be attributed to the speaker.[2] The examples in (1c,d), however, are unacceptable on an ONPQ reading: they do not support the relevant attitude, irrespective of whether the attitude holder is taken to be the matrix subject or the speaker. Similar data can be found in other languages, as shown in the Dutch and Greek counterparts of (1a) and (1c), in (2) and (3), respectively.

(2) a. Jan vraagt zich af of Marie niet ook van spinazie houdt.
John wonders self prt if Mary not too of spinach holds
b. O Giannis anarotietai an tis Marias den tis aresei kai to spanahi.
The John wonders if the Mary NEG cl like and the spinach

(3) a. *Jan weet of Marie niet ook van spinazie houdt.
John wonders if Mary not too of spinach holds
b. *O Giannis kserei an tis Marias den tis aresei kai to spanahi.
The John knows if the Mary NEG cl like and the spinach

ONPQs exhibit a further peculiarity not found with INPQs: the outside negation must outscope a quantified subject in the same way as a 'subjective' epistemic modal does (Epistemic Containment; von Fintel & Iatridou 2003). 'Objective' epistemic modals do not exhibit this behaviour. The difference between objective and subjective readings lies in the relative reliability of the evidence one invokes to evaluate the proposition the epistemic scopes over. Subjective epistemics correspond to the invocation of less widely accepted evidence, and hence highlight someone's personal belief state, whereas objective epistemics correspond to evidence accepted by the relevant community. (See Lyons 1977, Papafragou 2006, Tancredi 2007, and Anand & Hacquard 2009 for further discussion of the distinction between subjective and objective modality.)

Epistemic Containment is illustrated in (4a), where *might* takes its default subjective reading; (4b) shows that the effect is obviated when the context forces the modal to be read with an objective reading.

(4) a. #Every party guest might be the murderer.
(*every* > *might* relatively inaccessible)
b. Given the currently available evidence, every party guest might be the murderer.
(*every* > *might* easily accessible)

Epistemic Containment is not restricted to sentences with subjective epistemic modal auxiliary verbs. The effect can also be found with an epistemic adverb like *perhaps* or *possibly*:[3]

[2] Consider, for example, a situation in which the speaker is trying to assess whether to buy spinach for a dinner with Mary, who he does not know very well. The speaker has a hunch that she might like spinach, but wants to get the opinion of John, who is an old friend of Mary's. In such a context, (1e) seems fine with a speaker-oriented positive bias.

[3] In fact, for many speakers the effect is even stronger with an epistemic adverb than with an epistemic auxiliary. The objective reading seems less accessible, even with an appropriate context preceding the modalized proposition:

(5) #Every guest is perhaps/possibly the murderer.
a. Perhaps/possibly every guest is the murderer. inconsistent, ^{OK}ECP
b. For each guest x, x is perhaps/possibly the murderer. consistent, *ECP

That outside negation exhibits similar scopal properties can be demonstrated by the contrast between (6) and (7). The context in (6) forces wide scope of the QP and, as shown by the deviance of (6a) in this context, the QP cannot be interpreted outside the scope of outside negation. Interestingly, the example becomes fully interpretable if the outside negation is moved to a following tag question (see (6b)).

(6) [*Context: I had 30 students in my final year syntax class. They all passed the coursework, but to obtain their degree, they had to pass my exam. For about 10 of them, I was almost certain that they would. My TAs marked all the scripts and I ask ...]*
a. #Haven't fewer than half of the students managed to pass the exam(, too)?
b. Fewer than half the students have managed to pass the exam, haven't they?

That the unacceptability of (6a) is context-dependent is corroborated by the fact that the same example is compatible with the context in (7), which facilitates a narrow scope reading of the QP.

(7) *[Context: I have 30 students in my final year syntax class and it is a weak cohort. They all passed the coursework. However, they also all have to pass my exam. Usually, around half of each year's cohort manages to pass the exam, as it very hard. Now I'm pretty certain that not even half will pass it. My TAs marked all the scripts and I ask ...]*
Haven't fewer than half of the students managed to pass the exam(, too)?

ONPQs trigger a further scope freezing effect not found with INPQs, but which has also previously been observed with subjective epistemics (see Constantinou & Van de Koot 2015). In particular, an instance of outside negation behaves like a subjective epistemic in that it can give rise to scope freezing between two QPs even if it does not c-command either of them. We illustrate this using Dutch, where both epistemic adverbs and negation in ONPQs have very free placement. Consider first the data in (8). In (8a), two QPs occur in the c-command domain of *waarschijnlijk* 'probably'. Naturally, this sentence may receive a surface scope interpretation, but for a subset of Dutch speakers the inverse scope reading is available as well. However, for these speakers the inverse scope reading becomes inaccessible as soon as one of the quantifiers c-commands the epistemic adverb, as in (8b). More remarkably, the scope freezing effect is also present if *waarschijnlijk* is c-commanded by both QPs.

(8) a. Waarschijnlijk heeft tenminste één student ieder artikel gelezen.
probably has at-least one student every article read
(∃>∀;∀>∃)
b. Tenminste één student heeft waarschijnlijk ieder artikel gelezen.
at-least one student has probably every article read
(∃>∀;*∀>∃)

(i) #Given the currently available evidence, every guest is perhaps/possibly the murderer.

c. Tenminste één student heeft ieder artikel waarschijnlijk gelezen.
at-least one student has every article probably read
(∃>∀;*∀>∃)
'At least one student has probably read every article.'

The data in (9) show acceptability and scope judgments for a negative polar question containing an indefinite and a universal. We report judgments for both the INPQ and the ONPQ reading. On the ONPQ reading, only (9a), with the very high negation not found with INPQs, allows inverse scope. When negation is sandwiched between the two quantifiers, as in (9b), scope inversion is blocked for both INPQs and ONPQs. But interestingly, low negation (as in (9c)) does not block scope inversion in INPQs, but does do so in ONPQs.

(9) a. Had niet tenminste één student ieder artikel gelezen?
had not at-least one student every article read
INPQ: *
ONPQ: ∃>∀; ∀>∃

b. Had tenminste één student niet ieder artikel gelezen?
had at-least one student not every article read
INPQ: ∃>∀;*∀>∃
ONPQ: ∃>∀;*∀>∃

c. Had tenminste één student ieder artikel niet gelezen?
had at-least one student every article not read
INPQ: ∃>∀; ∀>∃
ONPQ: ∃>∀;*∀>∃

A final indication that outside negation has properties of subjective epistemic modals comes from the observation that the attitude associated with ONPQs has indexical properties (Papafragou 2006). Modals require evaluation of the proposition they occur in with respect to a set of possible worlds. For subjective epistemic modals in root clauses the possible worlds in the conversational background are restricted to what the speaker knows *at the time of utterance*. This is not true for objective epistemic modals, for which the set of possible worlds relevant to evaluation include all publicly available evidence to some community.

With this background in mind, consider the variant of (1e) in (10), in the context provided. The example is fine on the interpretation where the holder of the positive bias is John. But the speaker is entirely disqualified from this role.

(10) *[Context: Neither John nor the speaker had any evidence regarding Mary's liking of spinach before last night. But having had dinner with her last night, they now know that she loves it.]*
Whether Mary didn't like spinach (too) was not very clear to John before last night.
✓Reading A: positive bias associated with John
*Reading B: positive bias associated with the speaker

This observation is immediately accounted for if outside negation has the indexical properties also associated with subjective epistemic modals. As we will see in section 2, expressing a positive epistemic bias is incompatible with the presence of compelling evidence supporting the positive polar alternative. As the context makes clear, the compelling evidence regarding Mary's liking of spinach became available to the speaker last night. Therefore, on the assumption that any subjective epistemic bias held by the speaker is indexed to the time of

the utterance, the speaker can no longer express such a bias regarding Mary's liking of spinach at that time.

Constantinou & Van de Koot (2015) account for Epistemic Containment and related scope freezing effects with subjective epistemic modals by (i) assuming that these modals must mark clausal scope (see also Lyons 1977 and much other work) and (ii) adopting a theory of scope that predicts minimality effects: if QP_2 is in the scope extension path of QP_1, then QP_2 cannot extend its scope as well (the Condition on Scope Shift of Neeleman & Van de Koot 2012).

The present paper argues that the negation found in ONPQs is a special subjective epistemic modal that must take scope over a polarity operator (see Holmberg 2015 for a proposal in the same spirit). This allows us to extend the account of Epistemic Containment and scope freezing effects in sentences with subjective epistemic modals to ONPQs. In addition, the embedding restrictions observed in (1) can now be attributed to the very wide scope of subjective epistemics, which triggers incompatibility with certain embedding predicates, namely those that force an 'objective' reading of their complement.

A similar embedding restriction is found with subjective epistemic modals. As discussed by Anand and Hacquard (2009), certain predicates, such as *assume* or *imply*, signal a discourse move to update the common ground with the proposition in their complement. Such verbs do not allow the proposition in their complement to be the target of a subjective modal attitude. We first demonstrate that the relevant restriction is only imposed on the proposition under embedding, so that it must be grammatically encoded, and then argue that the matrix predicates in (1c,d) encode a similar requirement for the polar alternatives in their complement. This proposal allows the embedding restrictions noted by Anand & Hacquard, as well the embedding restriction observed in (1) to be derived from the Condition on Scope Shift.

This paper is organized as follows. Section 2 provides a brief overview of bias in polar questions and argues that ONPQs are alone in being associated with an epistemic bias. Section 3 returns to the scope freezing data, presents a brief overview of the proposal developed in Constantinou and Van de Koot 2015 to deal with Epistemic Containment and other scope freezing effects found with subjective epistemic modals, and shows how it captures the scope freezing data with ONPQs if outside negation, just like a subjective epistemic modal, must mark widest scope in its clause. We conclude the section by presenting data in support of the claim that outside negation differs from other subjective epistemic modals in that it must outscope the question operator. Section 4 investigates the interpretive factors that enter into the embedding restrictions observed with subjective epistemic modals (presenting data from Anand & Hacquard 2009) and with ONPQs (see (1) above) and proposes an implementation of these factors that allows the embedding restrictions to be derived from the Condition on Scope Shift. We wrap up the discussion in section 5.

2 Bias in direct polar questions

Polar questions may be associated with a *bias* towards a particular answer (Ladd 1981, Büring & Gunlogson 2000, Rooy & Safarova 2003, Romero & Han 2004, Asher & Reese 2007, Sudo 2013, and Holmberg 2013, 2015). For example, as already observed by Büring and Gunlogson, a positive polar question (PPQ), such as *Is it sunny?*, has an evidential bias: it is incompatible with compelling contextual evidence suggesting the negative answer, such as someone walking in with a wet coat. Büring and Gunlogson define 'contextual evidence' as follows:

(11) *Contextual Evidence*
Evidence that has just become mutually available to the participants in the current discourse situation.

Following Sudo (2013), we label an evidential bias involving *incompatibility* with compelling evidence as a negative evidential bias, but modify his definition slightly to include the additional word *compelling* without which the definition seems too strong:[4]

(12) *Evidential Bias (¬)*
If a polar question is incompatible with compelling contextual evidence for the positive (resp. negative) answer, it is said to carry a [¬positive] (resp. [¬negative]) evidential bias.

Using this terminology, we say that that a PPQ has a [¬negative] evidential bias.

Outside negation polar questions (ONPQs) have been argued to have a [¬positive] evidential bias; that is, to be incompatible with compelling evidence suggesting a *positive* answer (see Büring and Gunlogson 2000). Sudo (2013) demonstrates this for English using the context and examples below (his (9)), where the addition of *too* in the question forces an ONPQ reading (see Ladd 1981 for discussion). Note that these examples also show that ONPQs are compatible with evidence suggesting a *negative* answer (so they do not have a [¬negative] evidential bias).

(13) *[Context: For a psychological experiment, we are looking for some left-handed subjects. We have asked some of our friends, but only Mary was left-handed so far. To my surprise, John is using a pencil with his left hand.]*
a. #Isn't John left-handed (too).
b. Isn't John right-handed (too).

As shown by Sudo, again working with English data, ONPQs exhibit a second type of bias, which he calls a positive epistemic bias. They convey that the speaker has an expectation compatible with a positive answer. In contexts in which the speaker does not have such an expectation, ONPQs are infelicitous.

Let us finally briefly consider direct negative polar questions with an 'inside negation' interpretation (INPQs). An English example, again taken from Sudo (2013) appears in (14).

(14) *[Context: Bill is right-handed and Mary is left-handed. We're wondering who else is a lefty. John is using a pen with his right hand in front of us.]*
a. #Isn't John right-handed either?
b. Isn't John left-handed either?

The context provides evidence for the truth of the positive polar alternative of (14a) and for the falsity of the positive polar alternative of (14b). It must therefore be concluded that the IN interpretation is incompatible with evidence for the positive answer. The evidential bias is in fact a requirement for the *presence* of contextual evidence for the *negative* answer. This is shown by the infelicity of the following example:

[4] It is too strong because it incorrectly rules out the possibility of non-compelling contextual evidence. That is, contextual evidence for *p* that is balanced by (at least) equally weighted evidence for ¬*p*.

(15) *[Context: In the same context as (14), I think that I have seen Chris, who is not around right now, use a pen with his right hand.]*
#Isn't Chris left-handed either?

To capture this, Sudo (2013) defines a notion of positive evidential bias. We adopt the slightly amended definition in (16), which includes the additional word *compelling*.

(16) *Evidential Bias (+)*
If a polar question requires compelling contextual evidence for the positive (resp. negative) answer, it is said to carry a [+positive] (resp. [+negative]) evidential bias..

We may now say that INPQs have a [+negative] evidential bias.

Finally, we should ask whether INPQs are also associated with a positive epistemic bias, just like their ONPQ counterparts. Sudo (2013) claims that they are, on the grounds that the example in (14b) conveys that, prior to asking the question, the speaker expected the positive polar alternative to be true. While this may well be the case, it amounts to the claim that, in the face of compelling contextual evidence for ¬*p*, the speaker has abandoned this positive bias regarding *p*, *so that she has no epistemic bias at utterance time*. In other words, question (14b) means something like 'I have reason to believe that John is not left-handed; please confirm that I'm right'. Evidence for the absence of an epistemic bias comes from the fact that INPQs do not pass Reese & Asher's (2008) tests for speaker's commitment to a specific answer (i.e. epistemic bias) (see (17)), while ONPQs do (see (18)).

(17) *[Context: same as (14)]*
a. *After all, isn't John right-handed either?
b. Isn't John by any chance left-handed either?

(18) *[Context: same as (13)]*
a. After all, isn't John right-handed, too?
b. ??Isn't John by any chance left-handed, too?

Asher & Reese (2008) use the 'after all' and 'by any chance' tests to investigate the interpretative properties of tag questions. As they demonstrate, *after all* is only compatible with an (expression that contains an) assertion. Tag questions pass this test, similarly to ONPQs (see (18a)), because the speaker commits to a specific answer to the question. The fact that INPQs fail this test (see (17a)) is a clear indication that the speaker is not committed to an answer at utterance time. The 'by any chance' test further confirms this evaluation. Asher & Reese (2008) show that 'by any chance' is incompatible with biased questions, including tag questions. ONPQs are therefore not compatible with this expression (see (18b)), but an INPQ is (see (17b)), because the latter can be a neutral question.

In conclusion, ONPQs seem to be alone in being associated with an epistemic bias. This strengthens the hypothesis that the embedding restriction observed in (1) is connected with epistemic bias (since the relevant restriction does not affect INPQs).

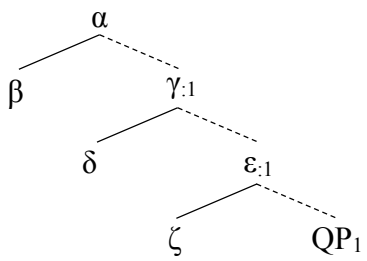
3 Capturing Epistemic Containment

3.1 The Condition on Scope Shift

Constantinou & Van de Koot (2015) provide an account of the scope freezing effects induced by subjective epistemics based on the theory of scope shift developed in Neeleman & Van de Koot 2012. We provide a brief outline of this work, and subsume the scope properties of outside negation under those of subjective epistemic modals.

Williams (1994) assumes that an argument QP carries a scope index that may percolate to a dominating node to mark the QP's extended scope. Thus, the scope of QP_1 in (19) below corresponds to the largest category that carries its scope index (γ), minus the QP itself. Note that a scope index inherited by a node α is placed after a colon. This distinguishes it from an index introduced by α, which appears in front of any colon; we omit the colon when there is no inherited index.

(19)



In some languages, such as German and Japanese, a QP argument may also mark its scope through overt A'-movement, in which case scope is marked in the landing site. We do not discuss this further here, since scope-marking through movement will not feature in what follows (but see Neeleman & Van de Koot 2012 for details). Finally, an argument QP may also fail to percolate a scope index altogether, in which case it takes surface scope.

Neeleman and Van de Koot combine the index-based scope marking mechanism with the following minimality condition on inheritance of quantificational indices:

(20) *Condition on Scope Shift (CSS)*
No node may inherit two scope indices.

It is easy to see that this constraint is incompatible with the widely held view, originating in the work of Chomsky (1976) and May (1977), that there is a syntactic level of Logical Form (LF) that provides a transparent and complete representation of scope relations. A translation of this view into the index-based representations of Williams (1994) yields the representation in (21a) for a structure containing two QPs interpreted as taking surface scope and that in (21b) for the same structure with inverse scope. As can be easily verified, both (21a) and (21b) violate the CSS.

(21) a. *[:1 … [**:1,2** … QP_1 [:2 … QP_2 …]]] $QP_1 > QP_2$
b. *[:2 … [**:1,2** … QP_1 [:2 … QP_2 …]]] $QP_2 > QP_1$

There is an alternative view of scope according to which LF only represents deviations from surface scope (see Reinhart 1983, 2006; see also Lakoff 1972, Huang 1982 and Hoji 1985). On this view, scope extension is limited to structures in which it generates an interpretation that is otherwise unavailable.[5] Reinhart treats scope extension as QR; a translation of her

[5] The view that scope extension is subject to Economy and relativized to an interpretation has been argued for in Fox (1999; 2000). However, unlike Reinhart, Fox assumes that every QP must move.

proposal in terms of indices expresses the readings in (21) with the slightly simpler structures in (22), neither of which violates the CSS, as required.

(22) a. [… [… QP_1 [… QP_2 …]]] $QP_1 > QP_2$
b. [$_{:2}$ … [$_{:2}$ … QP_1 [$_{:2}$ … QP_2 …]]] $QP_2 > QP_1$

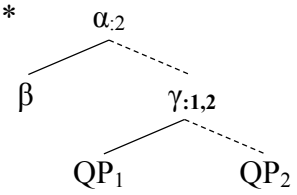
We summarize the main tenets of the proposal in (23). The Economy principle in (23b) is intended to block scope extension where it does not give rise to inverse scope, while (23c) is a mapping principle that, in the absence of scope extension, regulates the association of syntactic structures at LF with their semantic representations.

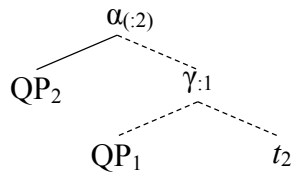
(23) a. *Scope Extension*
If a QP percolates its index to a dominating node α, then its scope coincides with α minus the QP itself.

b. *Economy*
Scope extension must give rise to an otherwise unavailable interpretation.

c. *Default Scope Rule*
If a QP does not percolate its index, it takes scope over its c-command domain.

An important fact about the CSS is that it creates an asymmetry between covert scope shift, analyzed here as index percolation, and scope taking by overt movement. Covert scope shift involves index percolation. It is therefore incompatible with any other scope extensions in its percolation path, as these give rise to CSS violations. This is shown in (24a), where covert scope extension of QP_2 freezes the scope of QP_1. By contrast, overt movement of a QP cannot trigger CSS violations in the movement path, whether the moved QP marks scope in its landing site (because it has undergone overt QR) or not (because it has undergone A-movement, which does not mark scope). This is shown in (24b), where movement of QP_2 does not prevent covert scope extension by QP_1.

(24) a. *


b.


Thus, overt scope marking is freer than covert scope shift, a prediction that is corroborated by a range of QP interactions (see Neeleman and Van de Koot 2012 for extensive discussion). As will be clear, this predicted difference is hard to reconcile with theories that treat overt and covert scope shift as mediated by the same operation, for example movement. With this background, we now return to epistemic modals.

3.2 Scope freezing with subjective epistemics as a CSS effect

We follow much work in the literature, originating from Kratzer (1977), in taking epistemic modals to be propositional operators quantifying over possible worlds and relating them to the proposition under question. Possibility modals (e.g. *may*, *possibly*) are treated as existential quantifiers and necessity modals (e.g. *certain*, *must*) as universal quantifiers. However, we make a distinction between subjective and objective epistemics in how they

may achieve their correct semantic scope. An objective category may take surface scope and rely on existential closure to close any variables in its c-command domain. By contrast, a subjective epistemic category must mark widest scope in its clause through index percolation:

(25) *Scope of Subjective Epistemic Modality (SSEM)*
A category carrying subjective epistemic modality must mark widest scope in its clause (by percolating its quantificational index).

Taken together, the SSEM and the CSS predict that QPs that are clause-mates of a subjective epistemic modal or in the c-command domain of such a modal should be unable to extend their scope across it (because the resulting structures instantiate the offending configuration in (24a)). Consider first the examples in (26), with a subjective epistemic auxiliary, and (5) – repeated here as (27) – with a subjective epistemic adverb.

(26) a. #Every student may have left, but not every one of them has.
(**every > may*)
b. #Fewer than half the students must have passed, but perhaps all of them did.
(**fewer than half > must)*

(27) #Every guest is perhaps the murderer.
a. Perhaps every guest is the murderer. inconsistent, ^{OK}ECP
b. For each guest x, x is perhaps the murderer. consistent, *ECP

As shown in (28), these instantiate cases in which an epistemic modal merges in a position from which it has to percolate its index to the top of its own clause (presumably up to the TP level) in order to satisfy (25).

(28) a. *$[_{TP:\mathbf{1,2}}$ [every student]$_2$ $[_{T':1}$ may$_1$ …]] = (26a)
b. *$[_{TP:\mathbf{1,2}}$ [every guest]$_2$ $[_{T':1}$ is $[_{VP:1}$ perhaps$_1$ $[_{VP}$ …]]]] = (27), on reading (b)

The CSS prevents the subject QP in these structures from percolating its own scope index, as this causes TP to inherit a second scope index. It follows that QP in these structures is unable to outscope the modal category (which in the relevant examples gives rise to contextually inappropriate readings).

We have previously demonstrated that ONPQs pattern with subjective epistemics as regards scope freezing (see section 1, examples (8) and (9)). As shown in section 2, ONPQs are the only type of polar question to signal an epistemic attitude based on personal belief. We may therefore assume that outside negation is a kind of subjective epistemic category in the sense of (25). It follows that it must mark clausal scope through index percolation. As shown in (30), we can now analyze (6a), repeated here as (29), as an instance of Epistemic Containment.[6] Recall that the context for this example forces widest scope for the QP, so that the scope index of QP must percolate past TP. But, by the SSEM, TP must also inherit the scope index of outside negation, so that a violation of the CSS is unavoidable.

[6] Since the head movement in (29) is not motivated by negation, we assume that outside negation takes scope from its base position.

(29) [*Context: I had 30 students in my final year syntax class. They all passed the coursework, but to obtain their degree, they had to pass my exam. For about 10 of them, I was almost certain that they would. My TAs marked all the scripts and I ask ...]*
#Haven't fewer than half of the students managed to pass the exam(, too)?

(30) *[[Haven't] [$_{TP:\mathbf{1,2}}$ [fewer than…]$_2$ [$_{T':1}$ $t_{haven't\text{-}1}$ [$_{VP}$]]]] = (29)

Similarly, the scope freezing effects with outside negation in (31), repeated from (9), fall out from the fact that negation must percolate a scope index past any QP in its clause that c-commands it.

(31) a. Had niet tenminste één student ieder artikel gelezen?
had not at-least one student every article read
ONPQ: ∃>∀; ∀>∃
b. Had tenminste één student niet ieder artikel gelezen?
had at-least one student not every article read
ONPQ: ∃>∀;*∀>∃
c. Had tenminste één student ieder artikel niet gelezen?
had at-least one student every article not read
ONPQ: ∃>∀;*∀>∃

As shown in (32), this has the effect that the CSS only allows QP_3 to extend its scope in (31a), where percolation of its index to a node dominating QP_2 does not overlap with the index percolation path created by *not*. This scope configuration is shown in (32a').

(32) a. [$_{TP:1}$ niet$_1$ [QP_2 [QP_3 …]]] = (31a), ∃>∀
a'. [$_{TP:1}$ niet$_1$ [$_{:3}$ QP_2 [$_{:3}$ QP_3 …]]] = (31a), ∀>∃
b. *[$_{TP:\mathbf{1,3}}$ QP_2 [$_{:\mathbf{1,3}}$ niet$_1$ [$_{:3}$ QP_3 …]]] = (31b)
c. *[$_{TP:\mathbf{1,3}}$ QP_2 [$_{:\mathbf{1,3}}$ QP_3 [$_{:1}$ niet$_1$ …]]] = (31c)

3.3 How wide is the scope of outside negation?

So far we have argued that the scope of outside negation is at least TP. But if it scopes below the question operator in C, then it is not clear in what sense it is 'outside' the question. As already noted by Ladd (1981), an ONPQ is answered in exactly the same way as a PPQ (see Holmberg 2015 for discussion of strategies for answering INPQs):

(33) a. Does Mary like spinach?
Yes (she does).
No (she doesn't)
b. Doesn't Mary like spinach?
Yes (she does).
No (she doesn't)

The observation that ONPQs do not license NPIs lends further support to the hypothesis that, in a very concrete sense, outside negation is not contained in the question.

In line with these observations, Holmberg 2015 assumes that outside negation must outscope the question operator. In the remainder of this section we provide a new argument in support of that analysis.

We have argued that subjective epistemic modal auxiliaries and adverbs must mark clausal scope. This chimes with the idea that semantically they associate an attitude holder with a proposition. When a subjective epistemic modal occurs in an embedded clause under a doxastic verb like *believe*, the attitude holder for the epistemic is the matrix subject (we indicate this showing the scope index of the modal as a superscript on the attitude holder):

(34) John^{1} believes that [$_{:1}$ it [$_{:1}$ might$_{1}$ be raining]]

Now consider what happens when the modal finds itself in an embedded environment that contains a competing attitude holder:

(35) a. *John^{1} believes that [[according to Bill] [$_{:1}$ it [$_{:1}$ might$_{1}$ be raining]]
b. John believes that [[according to Bill^{1}] [$_{:1}$ it [$_{:1}$ might$_{1}$ be raining]]

These examples show that the epistemic auxiliary must associate with the attitude holder in the embedded clause and cannot be linked to any other attitude holder. Of course, one would like to know why the modal cannot associate with the matrix subject. It may be a kind of minimality effect, or alternatively the representation in (35b) is favoured because it is the minimal scope extension that associates an attitude holder with the proposition containing the modal.[7] We put this question to one side here.

If the interpretation of outside negation were completely parallel to that of the subjective epistemic modal in (35) (that is, outside negation relates an attitude holder to a proposition), then we would expect the choice of attitude holder for outside negation to exhibit similar sensitivity to the presence of an intervening attitude holder. But this prediction is not borne out:

(36) a. John is wondering if/whether [$_{:1}$ it isn't$_{1}$ raining]
b. John^{1} is wondering if/whether [$_{:1}$ [according to Bill] [$_{:1}$ it isn't$_{1}$ raining]]
c. *John is wondering if/whether [[according to Bill^{1}] [$_{:1}$ it isn't$_{1}$ raining]]

Just to be sure we should check that the locality effect in (35), with a subjective epistemic auxiliary, is also found in embedded questions, and as (37) shows, it is.

(37) a. *John^{1} is wondering if/whether [$_{:1}$ [according to Bill] [$_{:1}$ it might$_{1}$ raining]]
b. John is wondering if/whether [[according to Bill^{1}] [$_{:1}$ it might$_{1}$ raining]]

This data pattern receives a straightforward explanation if outside negation differs from epistemic modal auxiliaries in having to scope over polar alternatives. In that case, the only scope configuration that satisfies the semantic requirements of this item is as exemplified in (38a). The configuration in (38b) is ruled out because the intended attitude holder is contained in the scope of the attitude.[8]

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[7] The latter type of explanation, essentially an appeal to Economy, would need to explain why this condition is not relative to an interpretation in this case. This may prove an insurmountable objection.

[8] That an attitude holder cannot scope out of a question is confirmed in root environments. The question in (i) means "Is it raining according to John? (My hunch is that it IS raining according to John.)" It cannot mean "Is it raining? (And John's hunch is that it IS raining.)"

(38) a. John[1] is wondering [$_{:1}$ if/whether [$_{:1}$ [according to Bill] [$_{:1}$ it isn't$_1$ raining]]]
b. *John is wondering [$_{:1}$ if/whether [$_{:1}$ [according to Bill[1]] [$_{:1}$ it isn't$_1$ raining]]]

4 Embedding subjective epistemics

4.1 Anand & Hacquard 2009

Anand & Hacquard (2009) investigate which predicates do and do not allow embedded subjective epistemics. If outside negation is a kind of subjective epistemic modal, then we should expect constraints on where subjective epistemics can appear to apply to outside negation as well. We therefore outline their findings, raising some question marks as we go along.

Anand & Hacquard begin by making the observation that epistemic modals can only appear in the complement of attitudes of acceptance. These are attitudes that are said to be correct whenever the proposition expressed by their complement is true (Stalnaker 1984). They cannot, however, appear under bouletics or commands (Anand & Hacquard's example (13)):

(39) a. John {believes, argues, assumed} that the Earth might be flat.
b. *John {hopes, wishes, commanded} that the Earth might be flat.

We therefore predict outside negation to be impossible under bouletics as well. This prediction is confirmed by the following data:

(40) a. *John cares if/whether Mary doesn't like spinach, too.
b. *Whether Mary doesn't like spinach too is important to me.

Anand & Hacquard then distinguish two classes of acceptance attitudes, doxastic attitudes (*believe, think, know*) and proffering attitudes (*claim, argue, demonstrate*), and argue that epistemics receive a subjective reading in the complement of verbs expressing doxastic attitudes, while they receive an objective reading in the complement of profferings. The split between the two classes is primarily based on Epistemic Containment effects: these are claimed to be uniformly present in the complement of doxastics and systematically absent in the complement of proffering predicates. The contrast is illustrated in (41) (Anad & Hacquard's (17)).[9]

(41) a. #Holmes believed that every guest might be the murderer.
b. Holmes {assumed, implied} that every guest might be the murderer.

The authors furthermore propose to analyze these differences as resulting from the type of propositional content associated with these attitudes: doxastic attitude predicates report beliefs, while profferings are reports of discourse moves which attempt to settle an issue. The objective reading of the complement of proffering predicates is then attributed to the

(i) Isn't it raining according to John?

[9] The semi-factive doxastic *know* does not appear to pattern with *believe* as regards Epistemic Containment. We return to this matter below.

evaluation of the proposition in the projected common ground of the discourse move, where the issue has been adopted by all participants.

Note that the objective reading of the complement concerns a non-actual common ground. It is the objective of the discourse move to move the participants to acceptance of this non-actual common ground. A proffering verb may therefore be considered a kind of modalized factive, where the modality is a teleological stance associated with the discourse move.

Let us now check whether Anand & Hacquard's observations regarding subjective epistemic modals in the complement of doxastic and proffering predicates are mirrored by outside negation. Consider first proffering attitudes. The examples in (42) suggest that the external argument of a proffering verb cannot function as the attitude holder for outside negation in its polar complement. Note that the past tense in these examples disqualifies the speaker from acting as an attitude holder in this context.[10]

(42) *[Context: Neither John nor the speaker had any evidence regarding Mary's liking of spinach before last night. But having had dinner with her last night, they now know that she loves it.]*
   a. *Yesterday morning John demonstrated if/whether Mary didn't like spinach, too.
   b. *Yesterday morning John argued if/whether Mary didn't like spinach, too.

Things do not improve much if the examples are changed to the present tense, so that the speaker becomes a potential attitude holder. The examples in (43) assume that neither John nor the speaker has any anterior knowledge about Mary's liking of spinach.

(43) a. *John is demonstrating if/whether Mary doesn't like spinach, too.
   b. *John is arguing if/whether Mary doesn't like spinach, too.

This outcome is quite remarkable and deserves some discussion. Although the examples in (42) and (43) can be analyzed as reporting a discourse move that attempts to settle an issue, the complements in these examples are not propositions that can be put forward for inclusion in the common ground. In other words, these examples do not appear to have any modalized factive presupposition and therefore the alternatives in the polar complements should be considered completely unsettled. One would have thought that these are perfect conditions for the expression of an epistemic bias by either the subject of the predicate or by the speaker, but nevertheless outside negation is completely impossible. These findings are mirrored by the relative unacceptability of subjective epistemic modals in such complements (see (44)) (and the relative acceptability of subjective epistemics under doxastics – see (45)).[11]

(44) a. *John is demonstrating if/whether Mary perhaps likes spinach.
   b. *John is arguing if/whether Mary perhaps likes spinach.

(45) a. John is wondering if/whether Mary perhaps likes spinach.
   b. John is asking if/whether Mary perhaps likes spinach.

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[10] Recall that subjective epistemic modality is indexical. This means that a speaker-oriented attitude must always pertain to the evaluation of a proposition whose modality is at issue at speech time.

[11] Note, furthermore, that subjective modals give rise to a pretty strong effect of Epistemic Containment when embedded under doxastics:

(i) ??John wondered if/whether every party guest might be the murderer.

These observations are potentially problematical for Anand & Hacquard's proposal, which is summarized in the quotation below (from Anand & Hacquard 2009: 46):

> "While [the various discourse moves] may differ in terms of what is said (*claim*, *imply*, *presuppose*), intention (*argue* vs. *claim*), or success of the move (*convince* vs. *suggest*), as a class they all describe attempts to place their complement proposition in the common ground. If *p* is in the common ground then it is mutually accepted (closed under acceptance by all discourse participants), and thus non-controversial, as all participants are aware that it is mutually accepted. We suggest, in line with von Fintel and Gillies (2007) and Stephenson (2007), that this non-controversy is the source of the objective stance we diagnosed for proffering attitudes; things feel objective in a discourse inasmuch as the participants accept it and are aware that the others accept it. Thus proffering attitudes report attempts to make their complements non-controversial, and hence objective."

But if the unacceptability of subjective epistemic modals in the complement of proffering verbs taking a declarative complement is due to the fact that the proposition in the complement has been accepted by all discourse participants, then why are subjective epistemic modals not possible in the complement of those verbs when the complement denotes polar alternatives (that is, a question)?

Let us now turn to doxastic predicates. Such predicates do not trigger any factive presupposition when combined with a declarative complement. They should therefore lack whatever property interfered with outside negation in (42) and (43). The outside negation variants of (1a,b), repeated here as (46), show that this is correct.

(46) a. John is wondering if/whether Mary doesn't like spinach too.
b. John is asking if/whether Mary doesn't like spinach too.

Similarly, the predicate *be not very clear* in (1e), repeated here as (47), which also has a doxastic flavor, permits an ONPQ as its subject.[12]

(47) a. Whether Mary doesn't like spinach too is not very clear to John.
b. #Whether every guest might be the murderer is not very clear to John.

We encounter a new complication when we consider *know* and *remember*, which are also doxastic predicates, but were shown in (1c,d) not to allow an outside negation reading of their polar complement (these facts are repeated below as (48a,b)). In line with this behaviour, these verbs do not trigger Epistemic Containment in their complement, as shown by the fact that the wide scope reading for the universal in (49a,b) seems quite accessible.

(48) a. *John knows if/whether Mary doesn't like spinach too.
b. *John remembers if/whether Mary doesn't like spinach too.

(49) a. Holmes knows that every guest might be the murderer.
b. Holmes remembers that every guest might be the murderer.

[12] As expected, this predicate also triggers Epistemic Containment:

(i) # Whether every guest might be the murderer is not very clear to John.

That *know* and *remember* are different from *believe* is also confirmed by the fact that the epistemic adverb *perhaps*, which strongly resists an objective reading, is fine in the complement of *believe* but not in the complement of either *know* or *remember*:

(50) a. John believes that perhaps Mary likes spinach.
b. ??John knows that perhaps Mary likes spinach.
c. ??John remembers that perhaps Mary likes spinach.

The behavior of *know* and *remember* actually fits quite well with the proposal put forward by Anand & Hacquard, since – being semi-factive – these verbs trigger the presupposition that the proposition in their complement is true and hence must be accommodated as part of the common ground. That is, the objective reading is associated with propositions that are either in the common ground or in a projected common ground.

However, as was the case with (42), the unacceptability of (48a,b) on the outside negation reading remains mysterious: the verbs in these examples do not combine with a proposition, so that no factive presupposition is triggered regarding either of the polar alternatives. These should therefore represent an unsettled issue and should be very compatible with the expression of a subjective epistemic bias (for example, by the speaker), contrary to fact.

The data reviewed so far suggest that factivity is the factor that ties together the predicates that do not permit a subjective epistemic (including outside negation) to be embedded in their complement. Although we do not yet know why that is, we should complete the data overview by checking whether non-factive but veridical predicates, such as *is right about* and *correctly predicted* pattern with proffering verbs and semi-factives. We should also check that non-veridical responsive verbs pattern with doxastics.

The facts in (51) indicate that veridical predicates do indeed pattern with factives. (The judgment for (51b) assumes that its complement is read as an ONPQ.)[13,14]

(51) a. *John correctly predicted that the bakery is perhaps just around the corner.
b. *John correctly predicted whether the bakery isn't just around the corner.

In line with this, such predicates also do not trigger Epistemic Containment in their complement:

(52) John correctly predicted that every party guest might be the murderer.

Non-veridical responsive predicates, by contrast, do seem to be able to embed subjective epistemics, as well as outside negation, as shown in (53).

(53) a. John conjectured that the bakery was perhaps just around the corner.
b. John conjectured (about) whether the bakery wasn't just around the corner.

This then leads us to expect that such verbs might also trigger Epistemic Containment, and that too appears to be the case:

(54) #John conjectured that every party guest might be the murderer.

[13] We are grateful to Yasu Sudo for bringing these data to our attention.

[14] Veridical predicates entail, but do not presuppose, that the attitude holder has the correct belief.

4.2 Embedding matters

Recall that the proposal by Anand & Hacquard is based on the intuition that "proffering verbs induce objectivity of their complements because the complements are intended to become part of the common ground" (Anand & Hacquard 2009: 48). In other words, the expression of a subjective epistemic attitude by speaker A towards a proposition should be inappropriate once a discourse move causes that proposition to be tendered as part of a projected common ground of a group of speakers that includes A.

We think that this take on conversational moves overstates their actual impact, since a discourse participant may well wish to qualify the status of the tendered proposition on the basis of their personal beliefs, even if they accept it as true.[15] The discourse in (55) illustrates such a case.

(55) *[Context: John has had dinner with his new girlfriend Mary in posh vegetarian restaurant where every course features at least a few leave of spinach. He reports on his evening out to Fred, who has known Mary for some time. He concludes by saying "I'm implying that Mary likes spinach." To this Fred replies ...]*
Well, It is also my personal belief that Mary likes spinach, so I do not need to be convinced of that.

This is a first indication that the objective reading for a proposition in the complement of proffering verbs is only forced on that proposition in that particular structural environment. We should therefore check whether the unacceptability ONPQs under proffering verbs, and semi-factive and veridical predicates also only arises under embedding. An example of unacceptable embedding of an ONPQ appears below.

(56) *John knows if/whether the bakery isn't just around the corner.

Consider next the dialogue in (57). Here, unlike in (56), the factive verb *know* is embedded in the conversational context. But a continuation in this context with an ONPQ built on the question embedded under *know* is just fine.

(57) *[Context: I am in the car with Mary, driving through an area of London that she knows much better than I do. We are looking for a particular bakery that is supposed to be somewhere around there. At some point Mary says "I know whether the bakery is around the next corner. Do you?" And I answer ...]*
Yes, ISn't it around the next corner?

And, just to be sure, the acceptability of the ONPQ in (57) is completely on a par with that of the ONPQ in (58), where the context contains the non-factive verb *wonder* rather than *know*:

(58) *[Context: I am in the car with Mary, looking for a particular bakery that is supposed to be somewhere around there. At some point Mary says "I'm wondering whether the bakery is around the next corner." And I continue ...]*
Yes, ISn't it around the next corner?

[15] This point echoes von Fintel and Gillies (2007), who point out that "... solipsistic readings for the modals – readings on which the modals quantify over the evidence available to the speaker at the time of utterance – are virtually always available".

Taken together, the data in this section indicate that the factor responsible for the ban on subjective epistemics and outside negation in certain environments must be grammatically represented, since it only affects the acceptability of these phenomena *in embedded environments*.

4.3 Towards an alternative analysis

Let us assume that the factive or veridical import of a predicate is encoded through the presence of an operator that scopes over the embedded proposition. We furthermore assume that this operator is present whether the complement of the predicate is semantically a proposition or a set of polar alternatives (see Spector and Égré 2015 for a related proposal). If the latter, it attaches below the question operator and thereby encodes that the answer to the embedded polar question should be taken to be true. This does not, of course, result in a factive presupposition (or a veridical entailment), since the complement of, say, *know* when it selects a question is not a proposition (but a set containing two factive polar alternatives). However, it does have the effect (i) of encoding that the subject stands in the relation expressed by *know* to a true proposition and (ii) of triggering existence presuppositions for indefinites in the polar complement of *know*, and for predicting that such presuppositions are absent in the complement of non-factive predicates like *wonder*:

(59) a. John is wondering whether Mary owns a unicorn.
>/> Unicorns exist.
b. ?John knows whether Mary owns a unicorn.
>> Unicorns exist.

The relative unacceptability of (59b) is due to the fact that, although John can know that Mary does not own a unicorn (since unicorns do not exist), he cannot know that Mary owns a unicorn (since that presupposes the existence of unicorns).

We analyze proffering predicates and veridical predicates analogously. Recall that Anand & Hacquard analyze proffering predicates as encoding a kind of modalized factivity: the complement is treated as a fact in the projected common ground. This approach is supported by the fact that these predicates pattern with true factives in triggering existence presuppositions for indefinites in their complement. That veridical predicates should do so, too, is of course expected.

(60) a. John believes that Mary owns a unicorn.
>/> Unicorns exist.
b. ??John implied that Mary owns a unicorn.
>> Unicorns exist.
c. *John correctly predicted that Mary owns a unicorn.
⊨ Unicorns exist.
d. *John regrets that Mary owns a unicorn.
>> Unicorns exist.

With these assumptions in place, the embedding restrictions on subjective epistemic modals (including outside negation) follow from the combined effect of selection for factivity, the SSEM, repeated in (61) below, and the CSS.[16]

(61) *Scope of Subjective Epistemic Modality (SSEM)*
A category carrying subjective epistemic modality must mark widest scope in its clause (by percolating its quantificational index).

Consider the potential representations for (50b) in (62). The verb *know* requires its complement to be in the scope of a factive operator. The SSEM requires the subjective modal adverb *perhaps* to have widest scope in its clause. Therefore, depending on which requirement takes precedence, either the predicate's selectional requirement is violated (see (62a)) or the SSEM (see (62b)). If the factive operator (Op_F) and the subjective epistemic take widest scope jointly, a violation of the CSS occurs ((see (62c)).

(62) a. *John knows [that [$_{:2}$ Op_F [$_{:2}$ Mary [$_{:2}$ perhaps$_2$ likes spinach]]]] (*selection)
b. *John knows [that [Op_F [$_{:2}$ Mary [$_{:2}$ perhaps$_2$ likes spinach]]]] (*SSEM)
c. *John knows [that [$_{:\mathbf{1,2}}$ $Op_{F\text{-}1}$ [$_{:2}$ Mary [$_{:2}$ perhaps$_2$ likes spinach]]]] (*CSS)

By hypothesis, the factive operator is also present when the verb selects a polar question:

(63) John knows [if/whether$_Q$ [Op_F Mary likes spinach]]

Therefore, if this complement includes a subjective epistemic modal, the same constellation of competing requirements will rule the structure out:

(64) a. *John knows [if/whether$_Q$ [$_{:2}$ Op_F [$_{:2}$ Mary [$_{:2}$ perhaps$_2$ likes spinach]]]] (*selection)
b. *John knows [if/whether$_Q$ [Op_F [$_{:2}$ Mary [$_{:2}$ perhaps$_2$ likes spinach]]]] (*SSEM)
c. *John knows [if/whether$_Q$ [$_{:\mathbf{1,2}}$ $Op_{F\text{-}1}$ [$_{:2}$ Mary [$_{:2}$ perhaps$_2$ likes spinach]]]] (*CSS)

If the complement contains outside negation, then – assuming that a factive operator cannot extend its scope across a question operator – either the SSEM or the selectional requirements of the embedding predicate will be violated:

(65) a. *John knows [$_{:1}$ if/whether$_Q$ [$_{:1}$ Op_F [$_{:1}$ Mary [$_{:1}$ doesn't$_1$ like spinach]]]] (*selection)
b. *John knows [if/whether$_Q$ [Op_F [$_{:1}$ Mary [$_{:1}$ doesn't$_1$ like spinach]]]] (*SSEM)

Given the assumption we have made about the presence of a factive operator in the complement of verbs of proffering and veridical predicates, this analysis will carry over to these predicates.

The absence of Epistemic Containment in the complement of predicates of proffering, and factive and veridical predicates follows from the incompatibility of the factive operator with a subjective epistemic modal. We illustrate this for a proffering verb in (66). On the objective reading of the modal in (66a), all is well: no index percolation occurs and the modal is interpreted as part of the proposition tendered for acceptance into the common ground. The

[16] The definition of the SSEM does not refer to the difference between subjective epistemic modal auxiliaries and adverbs, which mark scope over a proposition, and outside negation, which marks scope over polar alternatives. We assume that this difference falls out from the semantic selection requirements of these items.

QP outscopes the modal by the default scope rule (hence no containment effect). The subjective reading of the modal in (66b-d), is unavailable, because it gives rise to the constellation of competing demands also present in (62). (Note that the CSS violation in (66d) happens irrespective of whether the QP extends its scope.)

(66) a. John implied [that [Op_F [[every guest] [might be the murderer]]]]
b. *John implied [that [$_{:2}$ Op_F [$_{:2}$[every guest] [$_{:2}$ might$_2$ be the murderer]]]] (*selection)
c. *John implied [that [$Op_{F\text{-}1}$ [$_{:2}$ [every guest] [$_{:2}$ might$_2$ be the murderer]]]] (*SSEM)
d. *John implied [that [**$_{:1,(2),3}$** $Op_{F\text{-}1}$ [$_{:(2),3}$ [every guest]$_2$ [might$_3$ be the murderer]]]] (*CSS)

As discussed in section 4.2, the ban on subjective epistemics is not present if the proposition tendered for acceptance into the common ground is not embedded under a proffering verb. Similarly, the ban on outside negation in the complement of factive predicates also only manifests itself under embedding. This follows from the present account if root assertions are never embedded under a factive operator. This seems entirely plausible, since there are also no factive assertives (as noted by Anand and Hacquard 2014).

Finally, we should ask why doxastics force a subjective reading of their complement. One might try to argue that this is a consequence of the fact that, all else being equal, modals favour a subjective reading. But there are good reasons to assume that it is in fact a matter of selection. The meaning of these verbs presupposes the existence of an event in the mind of the referent of their external argument that is concerned with the evaluation of a proposition (as in the case of *believe*) or of the relative plausibility of polar alternatives (as in the case of *wonder*). In the case of doxastics selecting polar alternatives, this lexically encoded attitude holder has exclusive access to the verbal complement for the purposes of epistemic bias: it is impossible to attribute any such bias to the speaker (the always available external attitude holder).[17]

4.4 Epistemic bias and semi-factivity

Verbs like *know* and *remember* are classed as semi-factives, because their factive presupposition is cancelled under negation (67b), epistemic downgrading (67c,d), and yes/no question formation (67e).

(67) a. John knows that Mary likes spinach. >>
Mary likes spinach
b. John does not know that Mary likes spinach. (He's only guessing.)
>/> Mary likes spinach.
c. It is possible that John knows that Mary likes spinach. (But then again, he may only be guessing.)
>/> Mary likes spinach

[17] One might assume that doxastics require their complement to be in the scope of a 'subjective' operator and that a doxastic predicate relates the indexical properties of this operator (Papafragou 2006) to the event in the mind of the referent of its external argument. This would come close to postulating an 'internal logophoric centre' in the sense of Bianchi 2003. While such ideas seem compatible with the proposal advanced here, the simpler implementation developed here seems adequate.

d. John might know that Mary likes spinach. (But then again, he may only be guessing.)
   >/> Mary likes spinach.
e. Does John know that Mary likes spinach. (Or is he only guessing?)
   >/> Mary likes spinach.

This leads us to expect that *know* will permit an ONPQ in environments in which its factivity is cancelled. The following examples show that this expectation is borne out:

(68) a. *John knows if/whether Mary doesn't like spinach (too).
b. John doesn't know if/whether Mary doesn't like spinach (too).
c. It is possible that John knows if/whether Mary doesn't like spinach (too).
d. John might know if/whether Mary doesn't like spinach (too).
e. Does John know if/whether Mary doesn't like spinach (too)?

Note that the epistemic bias in (68b-e) may be attributed to the speaker or some other discourse participant whose epistemic bias regarding Mary's liking of spinach is at issue. This can be illustrated with the following examples in the context provided:

(69) *[Narrator: Tonight Bill and Fred will be meeting their new flat mate Mary and they are out shopping for the meal that they will prepare for her. Bill is considering buying some spinach but neither he nor Fred know for sure whether Mary likes spinach. Fred thinks that everybody like spinach and so Mary should like it too, but Bill is less sure. Since Mary was recommended to them by Fred's friend John, Bill suggests that Fred give John a ring. Fred agrees that that is a good idea.]*
a. Fred: After all, it is possible that HE knows if/whether Mary doesn't like spinach.
b. Narrator: After all, it is possible that HE knows if/whether Mary doesn't like spinach.

In (69a), the epistemic bias is associated with Fred, who is also the speaker. In (69b), this bias can again be attributed to Fred, but the sentence is uttered by the narrator, who is outside the conversational context.

It is notable that although it seems possible to attribute the epistemic bias to the matrix subject *John* in (68b,e), this is not possible with examples involving epistemic downgrade. This is not surprising, given that having an epistemic bias regarding *p* is conditional on a [¬positive] evidential bias regarding *p*. In (68b,e), it is not predicated of John that he has knowledge regarding Mary's liking of spinach. Therefore, in the absence of an evidential bias, he is free to entertain an epistemic bias. (Note that this again shows that the attitude holder for outside negation does not have to be the speaker.) On the other hand, if it is predicated of John that he *has* knowledge regarding Mary's liking of spinach, as it is in (68c,d), then he cannot simultaneously entertain an epistemic bias with respect to one of these alternatives. This is because an evidential bias supporting the positive answer is incompatible with ONPQ, while an evidential bias favouring the negative answer calls for an INPQ.[18]

[18] As discussed earlier in connection with (12), the expression of a positive epistemic bias is also possible in a context that provides evidence for the positive answer, as long as that evidence is not compelling enough to force one to accept that answer. The following examples confirm that, also in this kind of context, the acceptability of ONPQs is in line with these expectations.

(i) *[Context: Last week John told me that he was going to New York for a day on Friday. But when Mary shows me his diary, it indicates that John had meetings in London all day that day. I say …]*

Finally, given the indexical properties of subjective epistemic bias, we should also expect (68a) to improve if the polar alternatives concern an issue whose outcome can only be determined in the future. As the acceptability of (70) shows, this prediction is borne out.

(70) John will know tomorrow evening if/whether Mary doesn't like spinach (too).

While the presupposition of semi-factives is cancelled in various environments, we do not expect that to be the case for the entailment of veridical predicates. These should therefore remain incompatible with outside negation under manipulations that affect factivity. This is correct:

(71) a. *John is correctly predicting if/whether the bakery isn't around the corner.
b. *John might be correctly predicting if/whether the bakery isn't around the corner.
c. *Is John correctly predicting if/whether the bakery isn't around the corner.
d. *John will correctly predict tomorrow if/whether the bakery isn't around the corner.

As shown in (72), verbs of proffering pattern with veridicals in this respect. This suggests that the modalized factivity of these verbs is akin to the strong factivity of verbs like *regret*, or alternatively that these verbs encode modalized veridicality. We leave this matter for future exploration.

(72) a. *John is not demonstrating if/whether Mary doesn't like spinach, too.
b. *John might demonstrate if/whether Mary doesn't like spinach, too.
c. *Is John demonstrating if/whether Mary doesn't like spinach, too?
d. *John will demonstrate tomorrow if/whether Mary doesn't like spinach, too.

Finally, the unacceptability of modals under bouletics is maintained under negation, epistemic downgrade and yes/no question formation:

(73) a. *John {hopes, wishes, commanded} that the Earth might be flat.
b. *John does/did not {hope, wish, command} that the Earth might be flat.
c. *John perhaps {hopes, wishes, commanded} that the Earth might be flat.
d. *Does/did John {hope, wish, command} that the Earth might be flat?

The same is true of the unacceptability of outside negation:

(74) a. *John cares if/whether Mary doesn't like spinach, too.
b. *John does not care if/whether Mary doesn't like spinach, too.
c. *John perhaps cares if/whether Mary doesn't like spinach, too.
d. *Does John care if/whether Mary doesn't like spinach, too?

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a. I'm wondering if John wasn't in New York on Friday (after all), because I saw him wearing an NYU t-shirt on the tube this morning.
b. Well, Fred, who unfortunately isn't here, might well know if John wasn't in New York on Friday (after all), because he met him last night.

It is not clear why this should be so.[19] Note that the issue is not confined to subjective epistemics. Bouletics do not permit any epistemic in their complement, whether subjective or objective.

4.5 Dutch *wel*

The data in this section provide further support for our claim that the properties exhibited by outside negation cluster around the fact that it is a *subjective* epistemic category. We compare Dutch outside negation *niet* 'not' with Dutch *wel*, a particular variant of which is also restricted in its use to polar environments.[20] This variant of the particle signals the absence of personal beliefs that could support a positive epistemic bias regarding *p*. In fact, it is typically used to indicate a retreat from a previous positive epistemic bias regarding *p*. In other words, the attitude holder has lost confidence in the truth of *p*. Thus, *wel* has pretty much the opposite interpretive effect of *niet*, since use of the latter conveys a positive epistemic bias.[21]

The opposing effects of the use of *niet* and *wel* can be brought out with a context such as the one in (75), where the use of *niet* is completely unacceptable, while the use of *wel* is perfect. We do not believe that English has a word that means *wel*, but perhaps focus on the main verb comes closest to indicating a similar epistemic move, as shown in the translation of (75b).

(75) *[Context: I have a new friend, Mary, coming over for dinner. I did not know anything about what foods she likes when I went shopping and went for spinach on a whim, thinking that most people like spinach. When Mary arrives and walks into the kitchen, I suddenly lose confidence in my choice and say ...]*

a. #Hou je niet van spinazie?
hold you not of spinach
'Don't you like spinach?' (I believe that you do)

b. Hou je wel van spinazie?
hold you prt of spinach
'Do you LIKE spinach?' (I thought that perhaps you did, but now I don't know.)

It does not seem too much of a stretch to regard *wel* as marking an objective attitude; that is to say an epistemically neutral attitude based on evaluation of evidence in the public domain (none in the example above).

Recall that we analyzed the unacceptability of *niet* in the complement of veridical predicates as a grammatical phenomenon: a factive operator and a subjective operator compete for widest scope and are therefore incompatible with each other. The proposed analysis of *wel* therefore predicts that it should be at home in a veridical environment, since its interpretation does not involve any subjective bias. The following data show that this prediction is borne out.

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[19] But see Anand & Hacquard (2013) for a take on the issue.

[20] Like other such particles, *wel* cannot bear stress (Elffers 1997).

[21] Note that this use of *wel* is restricted to polar environments, just like that of *niet*. When the modal particle *wel* occurs in a declarative clause its meaning contribution is to indicate the absence of personal beliefs that could support a *negative* epistemic bias regarding *p*. So a sentence like *Jan zal wel komen* means "John will come, as far as I know".

(76) a. Jan vraagt zich af of Marie wel/niet komt.
John ask self PRT if Mary PRT/not comes
'John is wondering whether Mary is(n't) coming.'
b. Jan weet of Marie wel/*niet komt.
John knows if Mary PRT/not comes
'John knows if Mary is(*n't) coming.'
c. Het maakt Jan niet uit of Marie wel/*niet komt.
John makes John not out if Mary PRT/not comes
'John doesn't care if Mary is(*n't) coming.'
d. Of Marie wel/niet komt is Jan niet helemaal duidelijk.
Whether Mary PRT/not comes is John not quite clear
'Whether Mary isn't coming is(n't) clear to John.'
e. Of Marie wel/*niet komt is irrelevant voor Jan.
Whether Mary PRT/not comes is irrelevant for John
'Whether Mary is(*n't) coming is irrelevant to John.'

We also expect that *wel* should not give rise to scope freezing effects, which indeed it does not do:[22]

(77) Jan vroeg zich af of
John asked self PRT whether
a. ?wel tenminste één student ieder artikel gelezen had.
PRT at-least one student every article read had
(∃>∀;∀>∃)
b. tenminste één student wel ieder artikel gelezen had.
at-least one student PRT every article read had
(∃>∀;∀>∃)
c. tenminste één student ieder artikel wel gelezen had.
at-least one student every article PRT read had
(∃>∀;∀>∃)

The data in this section provide further support for our claim that the properties exhibited by outside negation cluster around the fact that it is a subjective epistemic category.

5 Conclusion

This paper has explored similarities between sentences containing 'outside negation' and sentences containing subjective epistemic modals. Both resist embedding under semi-factives, veridical predicates and predicates of proffering, trigger Epistemic Containment, and exhibit further peculiar scope-freezing effects. We have argued that these phenomena can be given a unified treatment in terms of the scopal properties of subjective epistemic attitudes. The obligatory very wide scope of such epistemics is incompatible with the selectional properties of proffering, veridical and semi-factive predicates, which is expressed through a factive operator in both declarative and polar complements of such verbs. We argued that outside negation differs from other subjective epistemic categories in that it must obligatorily

[22] The particle *wel* seems a little less comfortable in the very high position – above the subject – occupied by outside negation in (77a).

take scope over the question operator. The proposed account relies on a theory of scope extension in which scope shift is encoded through percolation of scope indices constrained by a minimality condition. Therefore, to the extent that the account presented here is successful, it provides support for this particular view of scope-taking.

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