

# Interpreting DP-modifying modal adverbs

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- ◆ I argue that sentences like (1) are cases of epistemic modal adverbs modifying definite and indefinite DPs:

- (1)    a.    Mary hiked [<sub>DP</sub> possibly [<sub>DP</sub> the tallest mountain in Ireland ] ].  
                  True only if there exists something that Mary hiked.  
          b.    Mary is meeting with [<sub>DP</sub> probably [<sub>DP</sub> {a, the} nurse practitioner ] ].  
                  True only there exists someone that Mary is meeting with.

- ◆ I first develop a semantic account that captures two properties of modal-modified DPs:

**I:** Adverbs in (1) are truly DP-modifying. They have not undergone linear displacement.

- ◇ Sentences like (1a) exhibit existential import. Sentences like (2) with higher modals do not:

- (2)    Mary possibly hiked the tallest mountain in Ireland.

**II:** Modal-modified DPs behave like indefinite expressions even if they contain a definite determiner.

- ◇ Sentences like (1a) do not commit the speaker to the existence of an entity which is the unique referent of *possibly the tallest mountain in Ireland*.

- ◆ I then examine the evaluation of modal adverb-modified DPs in intensional contexts:

- (3)    a.    Mary thinks her son will marry possibly the tallest woman in Alaska.  
          b.    Mary wants her son to marry possibly the tallest woman in Alaska.

- ◆ Modal-modified DPs are interesting test cases because modals and DPs seem to have different locality restrictions on which intensional operators they can be evaluated relative to:

- ◇ **DPs:** Local and non-local (Fodor 1970, Percus 2000, Keshet 2011, Schwarz 2012, a.o.).

- ◇ **Modals on clausal spine:** Local only (Speas 2004, Stephenson 2007, Hacquard 2010).

- ◆ **Question:** When modals modify DPs, what intensional binders are available?

- ◇ Modals modifying DPs generally have the evaluative possibilities of DPs...

- \* ...but even when they modify DPs, epistemic modals still resist evaluation relative to certain operators (e.g. *want*), *pace* Anand and Hacquard (2013) for clausal modals.

# 1 Modal adverbs can adjoin to DP

- ◆ I argue in this section for the structures shown in (4):

- (4)
- a. Mary hiked [<sub>DP</sub> possibly [<sub>DP</sub> the tallest mountain in Ireland. ] ]
  - b. Mary drank [<sub>DP</sub> perhaps [<sub>DP</sub> {an, the} Chilean wine. ] ]
  - c. Mary is meeting with [<sub>DP</sub> probably [<sub>DP</sub> {a, the} nurse practitioner. ] ]

- ◆ I present two kinds of evidence for the label “DP-modifying modals”:

- ◇ Modal adverbs can take scope below the verb.
- ◇ Modal adverbs can take scope above the determiner.

## 1.1 Modals can scope under the verb

- ◆ The sentences in (4) crucially differ from sentences like (5):

- (5) Wisely, Mary skipped her sister’s party. → Mary skipped, wisely, her sister’s party.

- ◇ Although the adverb *wisely* is pronounced adjacent to the DP *her sister’s party* it does not actually modify DP.

- ◆ *Prosodic and syntactic differences between (4) and (5):*

- ◇ The modal adverbs in (4) are prosodically integrated into DP.
  - \* Adverb *wisely* in (5) pronounced with obligatory comma or parenthetical intonation.
- ◇ Modal adverbs in (4) form syntactic constituents with the adjacent DP (Ernst 1984).
  - \* Modal must travel with DP when it undergoes rightward movement (6a).
  - \* Prosodically integrated modals occur in positions reserved for DPs (6b).

- (6)
- a. Mary hiked, yesterday, possibly the tallest mountain in Ireland.
  - b. Mary is meeting with probably a nurse practitioner.

- ◆ *Scope of the adverb in (4) vs. (5):*

- ◇ Existential import is exhibited when modal-modified DPs are in non-opaque object positions.
- ◇ The context in (7) supports the existential import exhibited by the (a) sentence.
  - \* Sentences with higher adjoined modals (b, c) are also verified in this context.

- (7) Mary visited Ireland last week and she hiked Carrauntoohil. You don’t know whether Carrauntoohil or Beenkeragh is the tallest mountain in Ireland. You say,
- a. Mary hiked possibly the tallest mountain in Ireland. *DP-modifying*  
True only if here exists something that Mary hiked.
  - b. Mary possibly hiked the tallest mountain in Ireland. *VP-modifying*
  - c. Mary hiked, possibly, the tallest mountain in Ireland. *VP-modifying, displaced*

◇ The (a) sentence because infelicitous in context (8), where the speaker is uncertain whether there exists something that Mary hiked.

\* Sentences with higher adjoined modals (b, c) are still verified in this context.

(8) Mary visited Ireland last week and planned to hike Carrauntoohil, which you know to be the tallest mountain in Ireland. You know that the weather was bad, however, so it's possible that Mary did not go hiking. You say,

a. #Mary hiked possibly the tallest mountain in Ireland. *DP-modifying*

True only if there exists something that Mary hiked.

b. Mary possibly hiked the tallest mountain in Ireland. *VP-modifying*

c. Mary hiked, possibly, the tallest mountain in Ireland. *VP-modifying, displaced*

### *Interim summary:*

- ◆ When modals take scope above the verb ((7b,c), (8b,c)) the modal binds the world variable of the verb.
    - ◇ The event of the type described occurred in some of the speaker's epistemic alternatives and (potentially) not in others.
  - ◆ Syntactic and prosodic evidence suggested constituency of the modal and DP in (a) sentences.
    - ◇ The modals in (7a), (8a) introduce uncertainty only for the identity of the DP.
      - \* Was what Mary hiked the tallest mountain in Ireland or not?
- ⇒ Existential import explained if the modal takes scope below the verb. ⇐

### **Aside: Existential import as a diagnostic of modal position**

- ◆ Existential import diagnoses instances of modals modifying DPs in non-opaque object positions.
    - ◇ This diagnostic distinguishes between DP-modifying (a) and Collins Conjunction readings (b) (9), discussed by Collins (1988), Schein (1997), Vicente (2013), a.o.
      - \* The Collins Conjunction structure lacks existential import for second conjunct.
- (9) Mary hiked Mt. Tom and possibly the tallest mountain in Ireland last year.
- a. **DP-modifying:** Mary definitely hiked two things: Mt. Tom and something which may be the tallest mountain in Ireland.
  - b. **Collins Conjunction:** Mary definitely hiked Mt. Tom. She may have also hiked the tallest mountain in Ireland.

## 1.2 Modals can scope above determiner

- ◆ I argued above that modal adverbs can take scope below verbs.
  - ◇ However, it does not necessarily follow that modal adverbs take scope above the DP as a whole.
- ◆ For sentences like (10), we might imagine the modal modifying only the superlative AP. Leftward movement of the adverb past D produces the attested word order.<sup>1</sup>

(10) Mary ate possibly the best pizza in New York.  
        $\approx$  Mary ate [<sub>DP</sub> the [<sub>NP</sub> [<sub>AP</sub> possibly best [<sub>NP</sub> pizza in New York] ] ] ]

- ◆ Modal adverbs must be allowed to modify adjectives anyway (Cinque 2010).<sup>2</sup>

(11) They brought the [ probably carnivorous ] plant to class.

⇒ **However, a structure like (10) is not adequate for all of the cases we are considering** ⇐

- ◆ Example (12) shows that modal modification is possible even in the absence of adjectival material:

(12) You know that Mary felt unwell today and went to the health center. She wasn't sure if she'd be seeing a doctor or a nurse. I ask you where Mary is. You say,  
       Mary is meeting with possibly a nurse practitioner at the health center.

- ◆ Further evidence for a DP-modifying structure comes from examples like (13):

(13) You went to a wine tasting yesterday. You arrived late and missed the descriptions of the three wines and only got to try one of the samples on the table. You know there was to be one Chilean, one Californian, and one Argentinian wine. I ask which you had. You guess and say to me,  
       I drank possibly the Chilean wine.

⇒ In  $w_o$ , all three wines at the tasting qualify as *possibly the Chilean wine*. ⇐  
 ⇒ Each wine qualifies as *the Chilean wine* in a different epistemic alternative. ⇐

- ◆ This state of affairs is illustrated by the toy model in (14):

(14)  $\text{EPI-ACC}(w_o) = \{ w_1, w_2, w_3 \}$        $w_1 \rightarrow \text{sample } a$        $w_2 \rightarrow \text{sample } b$        $w_3 \rightarrow \text{sample } c$

- ◆ If the definite determiner were taking scope over the modal in (13), the requirement of uniqueness would not be met in the context.
  - ◇ We would incorrectly predict DPs like *possibly the Chilean wine* to be infelicitous in contexts like (13).<sup>3</sup>

<sup>1</sup>I assume a structure of superlatives where the superlative degree head composes with the adjective to the exclusion of the NP (Jackendoff 1977, Bhatt and Pancheva 2004, Matushansky 2008).

<sup>2</sup>Some languages (such as German) may only allow AP modification by modal adverbs. See appendix for discussion.

<sup>3</sup>We can contrast the truth conditions of sentences like (14) with those of sentences like (i):

(i) I drank the possibly Chilean wine.

Here, word order suggests that the definite determiner indeed scopes over the modal. This sentence is only verified if the context contains a unique thing which is possibly *Chilean wine*.

### Proposed structure:

- (15) I drank possibly the Chilean wine.  
 $\approx$  I drank [DP possibly [DP the [NP [AP Chilean] [NP wine] ] ] ]

#### Aside:

- ◆ Definite determiners still impose their semantic requirements within **individual epistemic alternatives**.
  - ◇ **Existence:** In each epistemic alternative, one of the samples must actually be Chilean wine...
 

(16) You went to a wine tasting advertising wines from the New World yesterday. You arrived late and missed the descriptions of the different wines. You aren't sure if there is even a Chilean wine there. You say,  
 I drank possibly the Chilean wine.
  - ◇ **Uniqueness:** But within each alternative, only **one** of the samples must actually be Chilean wine.
 

(17) You went to a wine tasting yesterday. You arrived late and missed the descriptions of the three wines and only got to try one of the samples on the table. You know there were to be **two** Chilean wines, one Californian wine, and one Argentinian wine. You say,  
 #I drank possibly the Chilean wine.
- ◆ While uniqueness is required **within** each accessible world, it does not hold across the context as a whole.<sup>4</sup>

### 1.3 Modal-modified DPs are indefinite expressions of type $\langle \text{est} \rangle$

- ◆ Given the earlier toy model (repeated in (18a)), a modal-modified DP denotes a set of individuals (18b):

- (18) a.  $\text{EPI-ACC}(w_o) = \{ w_1, w_2, w_3 \}$        $w_1 \rightarrow \text{sample } a$        $w_2 \rightarrow \text{sample } b$        $w_3 \rightarrow \text{sample } c$   
 b.  $\llbracket \text{possibly the Chilean wine} \rrbracket^{w_o} = \{ \text{sample } a, \text{sample } b, \text{sample } c \}$

- ◆ By dint of the modal taking scope over the determiner, modal-modified DPs behave like semantically indefinite expressions of type  $\langle \text{est} \rangle$ , **regardless of whether the original DP is indefinite or definite**.
  - ◇ Intuitive support for the proposal comes from paraphrases of modal-modified DPs via indefinites.<sup>5</sup>

- (19) I drank possibly the Chilean wine.  
 $\approx$  I drank something which was possibly the Chilean wine.

- ◆ Additional evidence comes from the ability of modal-modified DPs to occur in object positions of intensional transitive (referentially opaque) verbs like *resemble*.
  - ◇ *Resemble* argued to take objects of type  $\langle \text{est} \rangle$  (Zimmermann 1993):

- (20)  $\llbracket \text{resemble}_{\text{property}} \rrbracket = \lambda P_{\text{est}} \lambda x \lambda w. \text{resemble}(P)(x)(w)$

<sup>5</sup>See also Grosu (2007) for similar observations made about Transparent Free Relatives (e.g. ‘Mary saw what looked to be a student’), a construction which I suggest in the appendix could be related to modal-modified DPs.

- ◆ The intended intensional interpretation is brought out by the following context:

- (21) I think that Dale is extremely stupid. I of course do not know who the possibly stupidest people in the world actually are, but think Dale could be part of such a set.  
Dale resembles possibly the stupidest man in the world.

- ◆ Sentence (21) has two hallmarks of intensional interpretations (Zimmermann 1993, a.o.):

1. *Failure of existential exportation:*

- ◇ There need not exist a particular individual whom Dale is being compared to.

2. *Non-preservation of truth value with extensionally equivalent expressions:*

- ◇ Even if the speaker believes that Ralph exhibits property of being *possibly the stupidest man in the world*, the sentence in (21) does not necessarily have the truth conditions of the sentence in (22):

- (22) Dale resembles Ralph.

## 2 Composition of modal adverbs with DPs

### Desiderata for an account of sentences like (23):

- (23) a. Mary hiked [DP possibly [DP the tallest mountain in Ireland.]]  
b. Mary is meeting with [DP probably [DP a nurse practitioner.]]

⇒ Allow modal adverbs to modify DPs, both definite and indefinite. ⇐

⇒ Allow modal-modified DPs to be of type  $\langle \text{est} \rangle$ . ⇐

- ◆ The account that I give below makes use of the type shifter IDENTIFY, an intensional relative Partee's (1986) IDENT.

- (24)  $[[\text{IDENTIFY}]] = \lambda \mathcal{X}_{se} \lambda z_e \lambda w' [z = \mathcal{X}(w')] \quad \langle \text{se}, \text{est} \rangle$

- ◆ This type shifter is used by Frana (2006, 2010) (also Schwager 2008) to give a unified account of Concealed Questions (CQs) containing definite and indefinite DPs, e.g. (25):

- (25) a. Mary knows the capital of Italy.  
b. Pat knows a shortcut to UMass. (Frana 2006, ex. (30))

- ◇ Prior to composition with a *de re*, property-selecting entry for *know* (Kratzer 1990, 2002), definite DP intensions (type  $\langle \text{se} \rangle$ ) are shifted into type  $\langle \text{est} \rangle$  expressions via IDENTIFY:

\* If the DP is already of type  $\langle \text{est} \rangle$ , IDENTIFY does not apply.

- (26) a. Mary knows [ IDENTIFY [DP the capital of Italy]].  
b.  $[[\text{IDENTIFY}]] = \lambda \mathcal{X}_{se} \lambda z_e \lambda w' [z = \mathcal{X}(w')] \quad \langle \text{se}, \text{est} \rangle$   
c.  $[[\text{IDENTIFY } \textit{the capital of Italy}]] = \lambda z_e \lambda w' [z = \iota x [\text{CAPITAL-OF-ITALY}(x, w')]] \quad \langle \text{e}, \text{st} \rangle$

- ◆ CQs present some of the same challenges as are brought up by modal adverb-modified DPs.
  - ◇ Both appear to be cases of DP intensions composing with typically proposition-selecting verbs, e.g. *know*.<sup>6</sup>
  - ◇ Both constructions permit both definite and indefinite DPs.

⇒ I adopt IDENTIFY for use in my account of modal-modified DPs ⇐

- ◆ Like for CQs, definite DP intensions are shifted by IDENTIFY into type  $\langle \text{est} \rangle$  properties:
  - ◇ As was the case for Concealed Questions, expressions already of type  $\langle \text{est} \rangle$  (e.g. *a nurse practitioner*) do not require type shifting.

$$\begin{aligned}
 (27) \quad & \text{a. } [\text{IDENTIFY } [\text{DP the tallest mountain in Ireland}]] \\
 & \text{b. } \llbracket \text{IDENTIFY} \rrbracket = \lambda \mathcal{X}_{se} \lambda z_e \lambda w' [z = \mathcal{X}(w')] \quad \langle \text{se}, \text{est} \rangle \\
 & \text{c. } \llbracket \text{IDENTIFY the tallest mountain in Ireland} \rrbracket = \lambda z_e \lambda w' [z = \iota x [\text{TMI}(x, w')]] \quad \langle \text{e}, \text{st} \rangle
 \end{aligned}$$

- ◆ Once we have a DP of type  $\langle \text{est} \rangle$ , there are several ways to compose the DP and the modal.
  - ◇ If we want to maintain a single type  $\langle \text{st}, \text{st} \rangle$  entry for modal adverbs (28), we have two choices:

$$(28) \quad \llbracket \text{possibly}_{\text{proposition}} \rrbracket = \lambda p_{st} \lambda w [\exists w'' \in \text{EPI-ACC}(w) [p(w'')]]$$

1: Assume a reduced relative clause structure. See appendix.

2: Function Composition:

$$\begin{aligned}
 (29) \quad & \text{a. Shifted DP: } f = \lambda z \lambda w' [z = \iota x [\text{TMI}(x, w')]] \quad \langle \text{e}, \text{st} \rangle \\
 & \text{b. Modal: } g = \lambda p_{st} \lambda w [\exists w'' \in \text{EPI-ACC}(w) [p(w'')]] \quad \langle \text{st}, \text{st} \rangle \\
 & \text{c. Output: } (g \circ f) \quad \langle \text{e}, \text{st} \rangle \\
 & \quad = \lambda y (\lambda p_{st} \lambda w [\exists w'' \in \text{EPI-ACC}(w) [p(w'')]]) (\lambda w' [y = \iota x [\text{TMI}(x, w')]]) \\
 & \quad = \lambda y_e \lambda w [\exists w'' \in \text{EPI-ACC}(w) [y = \iota x [\text{TMI}(x, w'')]]]
 \end{aligned}$$

- ◇ Conversely, we could admit flexible type modals, e.g. (30): a type  $\langle \text{est}, \text{est} \rangle$  entry:

$$\begin{aligned}
 (30) \quad & \text{a. } \llbracket \text{possibly}_{\text{property}} \rrbracket = \lambda P_{est} \lambda y_e \lambda w [\exists w'' \in \text{EPI-ACC}(w) [P(y, w'')]] \\
 & \text{b. } \llbracket \text{possibly}_{\text{property}} \rrbracket (\llbracket \text{IDENTIFY the tallest mountain in Ireland} \rrbracket) \\
 & \quad = \lambda P_{est} \lambda y_e \lambda w [\exists w'' \in \text{EPI-ACC}(w) [P(y, w'')]] \\
 & \quad \quad (\lambda z_e \lambda w' [z = \iota x [\text{TMI}(x, w')]]) \\
 & \quad = \lambda y_e \lambda w [\exists w'' \in \text{EPI-ACC}(w) [y = \iota x [\text{TMI}(x, w'')]]]
 \end{aligned}$$

⇒ Under both strategies, modal-modified DPs are type  $\langle \text{est} \rangle$ , as desired ⇐

<sup>6</sup>This issue doesn't apply to analyses of CQs as 'questions in disguise.' For arguments against such an analysis, see Heim 1979; Romero 2005; Nathan 2006; Frana 2006, 2010; *inter alia*.

## 2.1 Composition of modal-modified DP with extensional transitive verbs

- ◆ How do type  $\langle \text{est} \rangle$  modal-modified DPs compose with verbs looking for type  $e$  arguments?

◇ Recall these are the verbs for which existential import is predicted and attested:

- (31) Mary is meeting possibly the nurse practitioner.  
True only if there exists someone with whom Mary is meeting.

- ◆ There are several ways that sentences like (31) could compose.<sup>7</sup>
- ◆ One way is to have the type  $\langle \text{est} \rangle$  modal-modified DP raise above the subject and create a type  $\langle \text{est} \rangle$  predicate via abstraction ((32a)).
  - ◇ The predicate and the modal-modified DP compose via Predicate Modification ((32b)).
  - ◇ Existential closure and evaluation relative to  $w_o$  produce (32c).

- (32) a.  $[ [ \text{possibly IDENTIFY the nurse practitioner} ] \lambda x. \text{Mary is meeting } x ]$
- b.  $\begin{aligned} \llbracket (32a) \rrbracket &= \lambda z \lambda w' [ \lambda y \lambda w [ \exists w'' \in \text{EPI-ACC}(w) [ y = \iota x [\text{nurse}(x, w'')] ] ] ] (z)(w') \ \& \quad \text{PM} \\ &\quad [ \lambda x \lambda w [ \text{meet}(\text{Mary})(x)(w) ] ] (z)(w') \\ &= \lambda z \lambda w' [ \exists w'' \in \text{EPI-ACC}(w') [ z = \iota x [\text{nurse}(x, w'')] ] ] \ \& \\ &\quad \text{meet}(\text{Mary})(z)(w') \end{aligned}$
- c.  $\exists z [ \exists w'' \in \text{EPI-ACC}(w_o) [ z = \iota x [\text{nurse}(x, w'')] ] ] \ \& \ \text{meet}(\text{Mary})(z)(w_o) \quad \text{EC}$
- d. *Paraphrase:* There exists an individual  $z$  such that in epistemic alternative worlds  $w''$  accessible from  $w_o$ ,  $z$  is the nurse practitioner in that world  $w''$ . Mary is meeting  $z$  in  $w_o$ .<sup>8</sup>

*We obtain both outcomes desired for composition with extensional transitive verbs:*

- ◆ **Existential import:** Truth conditions only verified if there exists some object  $z$  such that it was involved in the event.
- ◆ **Indefiniteness of modified DP:** Across the set of epistemic alternatives, there can be a different individual who qualifies as *the nurse practitioner* in each.

<sup>7</sup>Other related strategies include: shift the modal-modified DP into an existential quantifier; or, compose the verb and modal-modified DP via Restrict (Chung and Ladusaw 2001). Another alternative would be to treat modal-modified DPs as specific indefinites, having a type  $\langle \text{est}, e \rangle$  choice function compose with the modified DP and return some member of the set (Reinhart 1997, Kratzer 1998).

<sup>8</sup>For simpler presentation, I do not take Lewisian counterparts into account. The derivation could be modified to take them into consideration.



## 2.2 Composition with intensional transitive verbs

- ◆ I argued above that modal-modified DPs are of type  $\langle \text{est} \rangle$  because they can compose with verbs (*resemble*) with intensional transitive, property-selecting entries (Zimmermann 1993):<sup>9</sup>

- (33) a.  $\llbracket \text{resemble}_{\text{property}} \rrbracket = \lambda P_{\text{est}} \lambda x \lambda w. \text{resemble}(P)(x)(w)$   
 b. Dale resembles possibly the stupidest man in the world.

- ◆ Under a property-type interpretation of the DP, (33b) does not carry existential import.

◇ This is borne out by the truth conditions obtained:

- (34) a.  $\llbracket \text{Dale resembles possibly the stupidest man in the world} \rrbracket$   
 $= \llbracket \text{resemble} \rrbracket(\llbracket \text{possibly the stupidest man in the world} \rrbracket)(\llbracket \text{Dale} \rrbracket)$   
 $= \lambda P_{\text{est}} \lambda x \lambda w [\text{resemble}(P)(x)(w)]$   
 $\quad (\lambda y \lambda w [\exists w'' \in \text{EPI-ACC}(w) [y = \iota z [\text{SMIW}(z, w'')]])](\llbracket \text{Dale} \rrbracket)(w_o)$   
 $= \text{resemble}(\lambda y \lambda w [\exists w'' \in \text{EPI-ACC}(w) [y = \iota z [\text{SMIW}(z, w'')]])(\text{Dale})(w_o)$   
 b. *Paraphrase:* In  $w_o$ , Dale stands in a resemblance relationship to the property ‘being possibly the stupidest man in the world.’

### *Looking ahead:*

- ◆ Other verbs argued to take property-type objects include *look for* and *seek* (Zimmermann 1993, Schwarz 2006).
  - ◆ However, I will argue in sec. 3 that intensional interpretations are not available for modal-modified DPs in the object positions of these verbs.
- ⇒ **Question:** What accounts for the oddness of intensional interpretations of modal-modified DPs under *look for*? ⇐

## 3 DP-modifying modals in intensional contexts

- ◆ I argued above that modal adverbs can modify DPs.
- ◇ Modal-modified DPs are potentially interesting cases to examine with respect to their evaluation in intensional contexts.
- \* DPs and modals are standardly argued to have different evaluation possibilities.

<sup>9</sup>Verbs like *resemble* also have extensional (transparent) interpretations, (Zimmermann 1993, a.o.), as targeted by the context in (i). I assume that the composition occurs via the mechanisms outlined above for extensional verbs.

- (i) I am comparing Dale to Ralph because both of the men have are tall, have dark hair, and wear glasses. I believe Ralph to be quite possibly the stupidest man in the world. I don't have any feelings about Dale's intelligence.  
 Dale resembles possibly the stupidest man in the world. ( $\approx$  Dale resembles Ralph)

***A note on structures shown below:***

- ◆ I place null possible world (alternately, situation) pronouns on DPs to indicate possible and impossible indexings (Percus 2000, von Stechow 2007).
- ◆ Also following Percus (2000), sentences with clause-embedding intensional verbs (e.g., *thinks*, *wants*) contain two indexed  $\lambda$ 's:
  - ◇  $\lambda w_o$  : adjoined to the root clause (the default binder)
  - ◇  $\lambda w_1$  : adjoined to the embedded clause (binders introduced by e.g. *thinks* or *wants*)

- ◆ **DPs:** Can be evaluated relative to both local and non-local intensional binders (35) (Fodor 1970, Eng 1981, Bäuerle 1983, Percus 2000, Keshet 2011, Schwarz 2012, a.o.).

- ◇ Following Fodor's (1970) terminology, I refer to the DP as 'opaque' when locally evaluated and as 'transparent' when non-locally evaluated.

(35)  $\lambda w_o$  Mary thinks  $\lambda w_1$  my brother( $w_1/w_o$ ) is Canadian( $w_1/*w_o$ ). (Percus 2000)

- a. *Local/opaque* ( $w_1$ ): Mary's belief is that I have a Canadian brother.
- b. *Non-local/transparent* ( $w_o$ ): Mary holds a belief of the individual who is my actual brother (Dave) that Dave is a Canadian.

- ◆ **Modals:** Like other material along the clausal spine (e.g. *is Canadian* in (35)), they seem to be necessarily evaluated relative to the closest intensional binder.

- ◇ Hacquard (2006, 2010) cites examples like (36) in support of this generalization:

- \* In (36), *must* has to be evaluated with respect to *think* (Mary's beliefs), and not  $w_o$  (the speaker's beliefs) (Speas 2004, Stephenson 2007, Hacquard 2010).

(36)  $\lambda w_o$  Mary thinks  $\lambda w_1$  my brother must( $w_1/*w_o$ ) have won the game.

- a. *Local/opaque* ( $w_1$ ): Given Mary's beliefs about the world in  $w_1$ , in all of her epistemic alternatives my brother won the game.
- b. \**Non-local/transparent* ( $w_o$ ): Mary thinks that in all epistemic alternatives compatible with my (the speaker's) beliefs in  $w_o$ , my brother won the game.

*Questions addressed below:*

- ◆ What is the effect of modifying a DP with material (namely modal adverbs) normally adjoined to the clausal spine?
  - ◇ Does the presence of a modal restrict possible interpretations of the modified DP as a whole?

*What I argue below:*

- ◆ Modal-modified DPs retain characteristics independently identified for both DPs **and** for modals along the clausal spine.
  - ◇ Like DPs, modal-modified DPs in principle allow opaque and transparent interpretations...
  - ◇ ...but modals block opaque interpretations when the local intensional binder is incompatible.
    - \* A similar incompatibility is observed to occur between certain modal auxiliaries and intensional binders by Anand and Hacquard (2013).

### 3.1 Modal-modified DPs can receive transparent and opaque interpretations

- ◆ In the context in (37), the modal-modified DP receives an **opaque** interpretation.
    - ◇ The entirety of the modal-modified DP is evaluated relative to Mary's beliefs, the local binder ( $\lambda w_1$ ).
      - \* The speaker's beliefs are not relevant to determination of the epistemic alternatives quantified over by *possibly*.
- (37) Mary had pizza from Arise. Mary believes that Arise's pizza is among the most expensive in Amherst. I am from out of town and have no particular beliefs about the prices of local pizzas. I report Mary's belief, saying:
- a. Mary thinks she ate possibly the most expensive pizza in Amherst.
  - b.  $\lambda w_o$  Mary thinks  $\lambda w_1 \exists x$ [possibly the most expensive pizza in Amherst]( $w_1$ )( $x$ ) & Mary ate  $x$   
*Paraphrase:* Mary's belief is that there exists some  $x$  which is the most expensive pizza in Amherst in at least some of her epistemic alternatives, and she ate  $x$ .
- ◆ By contrast, a context like (38) licenses a **transparent** interpretation for the same modal-modified DP.
    - ◇ The modal-modified DP in (38) is evaluated relative to the speaker's beliefs, the matrix binder ( $\lambda w_o$ ).
- (38) Mary had pizza served from a box with the Arise logo on it. I know that Arise's pizza is among the most expensive in town. Mary is visiting and does not know anything about Arise having expensive pizza. Unknown to Mary, her pizza was actually from Athena's, which is the cheapest in town. I report Mary's belief, saying:
- a. Mary thinks she ate possibly the most expensive pizza in Amherst.
  - b.  $\lambda w_o$  Mary thinks  $\lambda w_1 \exists x$ [possibly the most expensive pizza in Amherst]( $w_o$ )( $x$ ) & Mary ate  $x$   
*Paraphrase:* There exists some  $x$  which is the most expensive pizza in Amherst in at least some of the speaker's epistemic alternatives. Mary thinks she ate  $x$ .

*Conclusion:*

**Locality restrictions that apply to modals along the clausal spine do not block transparent readings of DP-modifying modals.**

**Are modal-modified DPs moving into a local configuration with higher binders?**

- ♦ If they do, we might still claim that modals — whether on the clausal spine or in DP — must always stand in a local relationship with their intensional binder.
- ♦ Percus (2000) introduces world/situation variables in the syntax to account for transparent readings (discussed by Fodor 1970) that exists but which cannot be due to movement.
  - ◊ While Keshet’s (2011) split scope theory accounts for some of these readings, it still predicts that material in islands cannot receive a transparent interpretation.
    - \* Keshet notes the existence of unexpected (for his system) transparent interpretations of definite descriptions (2011: 275). Modal-modified DPs could be a particular case of this issue.
- ♦ However, it seems that DP-modifying modals can receive transparent interpretations even when in islands, including relative clauses (39a), complex DPs (39b), and *because* clauses (not given here).

(39) Mary heard a rumor that Alice kissed the chef from Arise Pizza and is now happy. Mary falsely believes that Arise pizza is very inexpensive. I, however, know that they make one of the most expensive pizzas in Amherst. I report Mary’s belief, saying:

- a. Mary thinks that Alice kissed the chef who makes possibly the most expensive in Amherst.
- b. Mary believes the rumor that Alice kissed the chef who makes possibly the most expensive pizza in Amherst.

⇒Movement cannot be the source of all instances of transparent interpretations.←

## 3.2 Missing opaque readings for DP-modifying modals

### 3.2.1 The data

- ♦ It is not just the case that modal-modified DPs **can** receive transparent interpretations when in the scope of an intensional operator.
  - ◊ Sometimes, they can **only** receive transparent interpretations.
- ♦ The absence of an opaque reading is particularly clear for modal-modified DP objects of *look for*.<sup>10</sup>

- (40) a.  $\lambda w_o$  Mary looked for  $\lambda w_1$  [possibly the most expensive restaurant in Hazel](\* $w_1$ ).
- b. Mary likes to search for very expensive restaurants wherever she goes to show off her wealth. She has just traveled to the small town of Hazel, Kentucky. It’s actually the case that Hazel is so small, there are no restaurants at all. I tell you about Mary’s search.  
# Mary looked for possibly the most expensive restaurant in Hazel.

- ◊ The target sentence in (40) seems to be infelicitous in the context because it necessarily exhibits existential import, which is lacking in this context.
  - \* The sentence is only felicitous if there is something in the **actual world** that Mary is searching for.

<sup>10</sup>I assume that *look for* and *seek* decomposes into a property-selecting verb and an intensional operator (Deal 2008).

◇ By contrast, a transparent interpretation (in which *look for* takes an entity as object) is possible for a comparable modal-modified DP:

- (41) a.  $\lambda w_o \exists x$  [possibly the most expensive restaurant in Boston](x)(w<sub>o</sub>) & Mary looked for x
- b. Mary has heard that Menton, a restaurant Boston, is not to be missed, so she looked for it on her last trip to Boston. I happen to know that Menton is among the most expensive restaurants in Boston. I tell you about Mary's search.  
Mary looked for possibly the most expensive restaurant in Boston.

◆ Opaque readings are also absent for modal-modified DPs in the object position of *seek*:

- (42) a.  $\lambda w_o$  John is seeking  $\lambda w_1$  [possibly a Triceratops bone](w<sub>1</sub>)
- b. John is an unscrupulous amateur fossil hunter whose desire is to convince others (and himself) that he's found a Triceratops bone. He doesn't care if the fossil he finds is actually from a Triceratops or not, however: any bone which seems to him like it might be a Triceratops (it's the right size, the skull has horns) will satisfy his goal. I tell you about his search.  
# John is seeking possibly a Triceratops bone.

⇒ An opaque reading is available if we go back to *think* ⇐

◇ The absence of an opaque reading for modal-modified DPs beneath *look for* and *seek* is underscored if we compare the above sentences above to (43), where the modal-modified DP is in the scope of *think*:

- (43) a. ✓ Mary thinks she found [possibly the most expensive restaurant in Boston].  
       $\approx \lambda w_o$  Mary thinks  $\lambda w_1 \exists x$ [possibly the most expensive restaurant in Boston](x)(w<sub>1</sub>)  
      & Mary found x
- b. ✓  $\lambda w_o$  John thinks  $\lambda w_1$  this fossil resembles [possibly a Triceratops bone](w<sub>1</sub>)

◇ Opaque readings also seems to be missing when modal-modified DPs occur in the scope of *want*.<sup>11</sup>

- (44) a.  $\lambda w_o$  Alice wants  $\lambda w_1 \exists x$ [possibly the tallest woman in Texas](x)(w<sub>1</sub>)  
      & her son will marry x in w<sub>1</sub>
- b. Alice thinks that extremely tall women and Texans make the best wives. Alice desires at some future time, on the basis of knowledge she has at that time, to be able to say, "My son is marrying possibly the tallest woman in Texas." We don't yet know who this woman will be; perhaps she has not yet even been born. I report this desire to you.  
# Alice wants her infant son to marry possibly the tallest woman in Texas.

<sup>11</sup>See appendix for discussion of a possible third reading (the 'split' reading) where DP — but not the modal apparently modifying it — can be evaluated relative to *want*, *look for*, and *seek*.

◇ Although pragmatically implausible, a transparent reading is clearly available for the same modal-modified DP:

- (45) a.  $\lambda w_o$  Alice wants  $\lambda w_1 \exists x$ [possibly the tallest woman in Texas](x)( $w_o$ )  
& her son will marry x in  $w_1$
- b. Alice wants her infant son to marry a woman who is (currently, in the actual world) possibly the tallest woman in Texas. I report this desire of Alice's to you.  
Alice wants her infant son to marry possibly the tallest woman in Texas.

◆ Another example making the same point:

- (46) Alice wants her son to marry possibly a librarian.  
*Cannot mean:* In all worlds in which Alice's desires are met, her son marries someone who is, given her beliefs in those worlds, possibly a librarian.

⇒ Once again, an opaque reading is possible under *think* ⇐

- (47) a. ✓ Alice thinks her son will marry [possibly the tallest woman in Texas].  
≈  $\lambda w_o$  Alice thinks  $\lambda w_1 \exists x$ [possibly the tallest woman in Texas](x)( $w_1$ )  
& her son will marry x in  $w_1$
- b. ✓ Alice thinks her son will marry [possibly a librarian].  
≈  $\lambda w_o$  Alice thinks  $\lambda w_1 \exists x$ [possibly a librarian](x)( $w_1$ )  
& her son will marry x in  $w_1$

◆ The absence of opaque readings is due to the presence of the modal adverb:

◇ If the modal is removed, an opaque reading of the DP is available under *want*:

- (48) Alice thinks that extremely tall women and Texans make the best wives. Alice wants at some future time (when her son marries) to say “My son is marrying the tallest woman in Texas.”  
Alice wants her infant son to marry the tallest woman in Texas.

◆ By comparison, a sentence like that from (44b) (repeated here), is odd in this type of context:

- (44b) # Alice wants her infant son to marry possibly the tallest woman in Texas.

**Aside for further work:**

◆ Opaque readings are still available if a modal adjective, rather than adverb, is used:

- (49) a. Alice wants her son to marry a **possible** librarian.  
b. Alice wants her son to marry to marry the tallest woman **possible**.

◆ What explains this difference between modal adverbs and adjectives?

### 3.2.2 Explaining the missing opaque readings

⇒ **Proposal: Mismatched intensional expressions block opaque readings** ⇐

- ◆ All of the modals that we have seen to modify DPs are epistemic.
- ◆ Opaque interpretation only available when intensional operator is *thinks*.
  - ◇ Under verbs like *want*, *look for*, and *seek* — all of which plausibly quantify over desire worlds — opaque interpretations disappear.
- ◆ In order for an (epistemic) modal-modified DP to be evaluated relative to a local binder, that binder must have a (somehow) ‘matching’ modal character.

#### ◆ Do we see a similar ‘mismatch’ effect for modals along the clausal spine? Yes.

- ◇ Anand and Hacquard (2013) report the following contrast for epistemic modal auxiliaries under *think* vs. *want*:

\* They report that in (50b), *have to* cannot be evaluated relative to the epistemic state of John himself.

- (50) a. John thinks that Paul has to be innocent.  
b. \*John wants Paul to have to be the murderer.

- ◆ Modals on the clausal spine do not have the same flexibility with respect to intensional operators as is available to modals modifying DP.
  - ◇ As such, modals on the clausal spine are simply infelicitous when the closest intensional operator of an epistemic modals on the clausal spine is a desiderative predicate, infelicity results.
- ◆ By contrast, for modal-modified DPs if a local binder is not suitable, then a non-local binder (transparent interpretation) is defaulted to.

#### ◆ Why do the intensional operators *want* and *look for* fail to license opaque interpretations for modal-modified DPs? Several possibilities.

- ◇ Anand and Hacquard (2013):
  - \* Verbs like *think* as **representational attitudes** (Bolinger 1968).<sup>12</sup> Verbs like *want* are non-representational attitudes with a comparative semantics incompatible with epistemic modals in their scope (Heim 1992, Villalta 2008).
- ◇ Other discussion of mismatching between intensional expressions:
  - \* Portner (1997), Farkas (1992), Kratzer (2013).

<sup>12</sup>See Anand and Hacquard (2009) for a version of this proposal in terms of Stalnaker’s (1984) attitudes of acceptance.

## 4 Summing up

- ♦ I argued that:
    - ◊ Given existential import, we know that the modal adverbs in question do not take the verb in their scope.
    - ◊ Given the indefiniteness of the modified DP as a whole, we know that modal adverbs take scope over determiners.
- ⇒ Epistemic modal adverbs can modify DP ⇐**
- ♦ **I then asked:** What happens when the (conflicting) demands of modals and DPs in intensional environments come into contact?
  - ♦ **I argued:**
    - ◊ Modals that modify DPs generally have the same interpretive possibilities as DPs do (Fodor 1970, Enç 1981, Bäuerle 1983, Percus 2000, Keshet 2011, Schwarz 2012, a.o.).
      - \* This is a point of difference with modals along the clausal spine, which, like other material on the clausal spine, must be bound by the closest operator (Hacquard 2006, 2010).
    - ◊ Modals that modify DPs still retain semantic characteristics of modals more generally.
      - \* Regardless of whether they are in DP or along the clausal spine, epistemic modal adverbs cannot be evaluated relative to verbs like *want*.
- ⇒ Modification of DP by a modal does not (in principle) block transparent readings. ⇐**
- ⇒ But, placement of the modal within DP does not allow modals to exist in environments semantically incompatible with that modal more generally. ⇐**

## 5 Acknowledgements

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## 6 Appendix

### 6.1 Reduced relative clause analysis of modal-modified DPs

- ◆ In sec. 2, I outlined several ways that composition between DPs and modal adverbs might occur.
  - ◇ Another strategy not outlined above is to assume the reduced relative clausal structure mediates between the DP and the modal.
- ◆ This strategy will capitalize on apparent similarities between modal-modified DPs and Transparent Free Relatives (TFRs) as in (51):

- (51) a. John was attacked by  $[_{\text{TFR}}$  what seemed to be *the principal of the school*].  
 b. John is a  $[_{\text{TFR}}$  what Mary would call *unique*] individual. (adapt. Grosu 2003)

- ◆ Under Grosu’s (2003, 2007) analysis of TFRs, they are structurally comparable to free relatives.
  - ◇ TFRs are headed by bare *what* and contain an intensional operator.<sup>13</sup>
  - ◇ The TFR’s core semantic content is carried by the pivot (an entity (51a) or property (51b)).
    - \* When the pivot is a DP (e.g. (51a)), a specificational copula is present to convert the DP into a property. One possible entry for the specificational copula is in (52):<sup>14</sup>

$$(52) \quad \llbracket be_{SPEC} \rrbracket = \lambda \mathcal{X}_{se} \lambda z_e \lambda w' [z = \mathcal{X}(w')] \quad (\text{Romero 2005})$$

- ◆ Following a syntactic structure for reduced relatives proposed by Bhatt (2006), bare *what* is replaced by a null PRO, which is then abstracted over:

- (53)  $\lambda y$  [ possibly  $[_{\text{SC}}$  PRO<sub>y</sub> IDENTIFY *the tallest mountain in Ireland* ] ]  
 a.  $\llbracket \text{SC} \rrbracket = \llbracket \text{IDENTIFY } the \text{ tallest mountain in Ireland} \rrbracket ((\text{PRO}_y)$   
      $= [\lambda z_e \lambda w' [z = \iota x [\text{TMI}(x, w')]]] (\text{PRO}_y)$   
      $= \lambda w' [y = \iota x [\text{TMI}(x, w')]] \quad \langle \text{st} \rangle$   
 b.  $\llbracket possibly \rrbracket (\lambda w' [y = \iota x [\text{TMI}(x, w')]])$   
      $= \lambda w [\exists w'' \in \text{EPI-MB}(w) [y = \iota x [\text{TMI}(x, w'')]]] \quad \langle \text{st} \rangle$   
 c.  $\lambda y \lambda w [\exists w'' \in \text{EPI-MB}(w) [y = \iota x [\text{TMI}(x, w'')]]] \quad \langle \text{e, st} \rangle$

- ◆ For further comparison between modal-modified DPs and TFRs, see Bogal-Allbritten (2013).

### 6.2 The view from German

- ◆ I have argued that English permits epistemic modal adverbs to adjoin to DPs.
  - ◇ I.e., there is an adjunction site available for epistemic modals that is below the verb but above the determiner.
- ◆ Does the same position exist in other languages, e.g. German?<sup>15</sup>
  - ◇ I examined strings of the following forms: *det modal AP N*                      *modal det AP N*

<sup>13</sup>For an alternative treatment of TFRs, see van Riemsdijk (2000).

<sup>14</sup>The entry given here only differs from Romero’s (2005) entry for specificational *be* in terms of the order of its arguments. Higgins (1973) notes that order of composition is a general point of flexibility in specificational sentences.

<sup>15</sup>I thank Martin Walkow and Stefan Keine for all German judgments presented here.

- ◆ Both word orders are felicitous in the following context, where uncertainty is restricted to whether what Mary ate was the best pizza in Amherst or not.
- ◇ Recall these are the environments where both DP-modifying and higher-adjoined modal adverbs are felicitous in English.

- (54) Mary visited Amherst yesterday and ate at Arise Pizza. You can't remember if Arise has the best pizza in New Haven or if the title belongs to another restaurant. You say,
- Gestern hat Mary die {wohl/vielleicht/möglicherweise/eventuell} beste Pizza in yesterday has Mary the possibly best Pizza in Newhaven gegessen.  
New.Haven eaten.
  - Gestern hat Mary {wohl/vielleicht/möglicherweise/eventuell} die beste Pizza in yesterday has Mary possibly the best Pizza in Newhaven gegessen.  
New.Haven eaten.

- ◆ In contexts where the target sentence does not have to have existential import ((55)), however, only the (b) word order (*modal det AP N*) was accepted.

- (55) Mary visited Amherst yesterday. She had planned to eat at Arise Pizza, but she was very busy and you do not know whether she made it there or not. You say,
- # (54a)
  - (54b)

***Interim conclusions:***

- ◆ Given the existential import observed for (54a) and (55a), strings with the order *det modal AP N* must involve a modal within DP.
- ◇ ...but we **cannot** conclude that the order *modal det AP N* involves modal adjunction to DP, as it did in English.
- \* Given German V2 word order, the order *modal det AP N* is string ambiguous between DP-modifying and VP-modifying structures.

- ◆ **Question for future work:** Does German also have a DP-adjoining modals?
- ◇ I tried the following context and target sentence to determine whether a modal can occur in pre-DP position.
- \* **Assuming V2 holds for German**, the target sentence in (55b) would motivate the availability of DP-modifying modals:

- (56) Hans and his friends climbed different mountains. The mountain that Hans climbed was probably taller than the ones his friends climbed.
- Vielleicht den höchsten Berg hat Hans bestiegen.  
possibly the tallest mountain has Hans climbed  
(Intended: 'Hans climbed [ possibly the tallest mountain ]

- ◆ However, while a consultant judged the sentence to be felicitous in the context, he gave the following comment, suggesting that such examples **do not necessarily show us that adjunction of modals to DP is possible**.

(57) *Comment from consultant:* “The sentence is fine, [but it] requires a particular intonation, but is totally grammatical. Feels like multiple prefield filling...”

- ◆ Further work will test modal adverbs in environments discussed by Büring and Hartmann (2000).
  - ◇ Büring and Hartmann (2000) argue that strings like (57b) — but with *nur* in initial position, rather than *vielleicht* — are **not** cases of adjunction to DP, calling into question the generalization that V2 holds in German.

### 6.3 The split reading

- ◆ In addition to the opaque and transparent readings generally available for modal-modified DPs in intensional contexts, there is a ‘split’ reading, wherein the attitude holder (Alice) has a particular property in mind but the speaker is now uncertain what that property is:

(58) Context: You know that Alice has a very specific hope for the properties that the person that her (now infant) son will one day marry. She told you what property she wanted her son’s future wife to have. You now cannot recall the property. To the best of your recollection, it was something like ‘possibly the tallest woman in the state.’

Alice wants her son to marry possibly the tallest woman in the state.

#### *Caveat:*

- ◆ I doubt that the analysis of the split reading will look very similar to the analyses given for opaque and transparent readings of modal-modified DPs.
  - ◇ Recall that the cases of modal-modified DPs I focused on featured no prosodic break between the modal and the DP.
  - ◇ By contrast, the split reading in (57) is most easily accessible to my ear if a prosodic break occurs between the modal adverb and the DP.

- ◆ However, it may be interesting to compare the truth conditions of (58) with the truth conditions of the true (specific) transparent interpretations for the same string (e.g., (47)).
  - ◇ In the transparent reading, we are concerned with a particular **individual** who (given the speaker’s knowledge) may be the tallest woman in the state.
  - ◇ In the split reading, we are instead concerned with a particular **property**, which (given the speaker’s knowledge) may be the property of being the tallest woman in the state.

#### *Challenge posed by the split reading*

- ◆ The modal *possibly* is evaluated with respect to a different world than its (apparent) syntactic sister, the DP *the tallest woman in the state*.
  - ◇ The modal is evaluated relative to a higher intensional operator (the default matrix operator).
- ◆ I leave open the proper analysis of the split reading for the moment. A possible direction would be to give *possibly* a focus sensitive semantics. Focus sensitive adverbs (e.g. *only*, *even*) are another case of elements apparently having higher “scope” than its syntactic sister (Rooth 1992, a.m.o).