Meaning-Driven Combinatorial Restrictions and ‘imagine whether’

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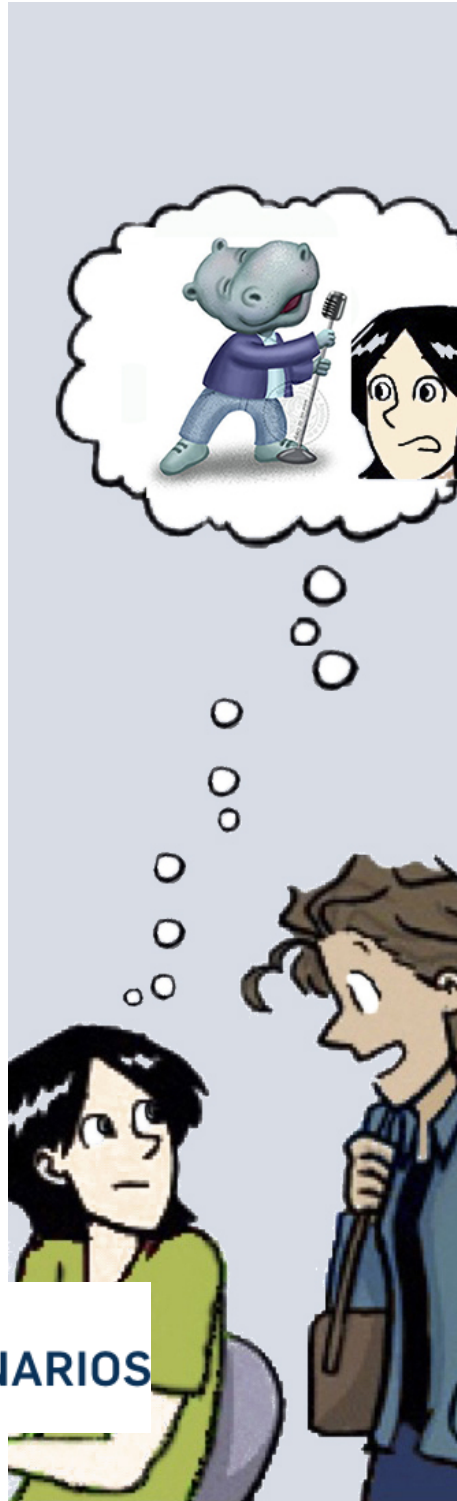

RUHR UNIVERSITÄT BOCHUM
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FOR 2812 CONSTRUCTING SCENARIOS OF THE PAST

Meaning-Driven Combinatorial Restrictions (MDCRs)

Source: Romero, Uegaki, & Roelofsen's DFG/AHRC project

Combinatorial [≈ (syntactic,) semantic **selectional**] **restrictions:**
Constraints on what complements a verb can take:

(†) John kicks
- a. ✓ Mary / a squirrel — e
- b. # that Mary likes chocolate — $\langle s, t\rangle$
- c. # whether Mary likes chocolate — $\langle\langle s, t\rangle, t\rangle$

(‡) John thinks
- a. ✓ that Mary likes chocolate — $\langle s, t\rangle$
- b. # whether Mary likes chocolate — $\langle\langle s, t\rangle, t\rangle$
- c. # Mary / a squirrel — e

Meaning-driven: Provide genuinely semantic explanations for these constraints! (Theiler et al., 2018)

Domain & Phenomenon

Plan for today: Extend work on MDCRs to 'event-directed' [≠ propositional] representational attitude verbs:

1. perception verbs: *see*, *hear*, *feel*
2. attention and memory verbs: *remember*, *notice*
3. counterfactual attitude verbs: *imagine*, *dream*

Phenomenon: Members of 3 typically reject *whether*-clauses:

(1) a. John remembers whether a woman was dancing. ✓
b. John imagined whether a woman was dancing. #

(judgement from D'Ambrosio and Stoljar, 2021)

➥ **Question:** What lies behind the difference b/w 'remember whether' and 'imagine whether'? – Is there a semantic explanation?

No Easy Explanation

The difference b/w 'remember...' (✓) and 'imagine whether' (#) cannot be explained through the factivity/veridicality of the verb:

Option A (Hintikka, 1975): 'whether'-clauses only occur in the complements of factive V(erb)s:

V is factive if $\neg Vp \Rightarrow p$ (presupposition)

Option B (Egré, 2008): 'whether'-clauses only occur in the complements of veridical Vs: (White: 'generalization $\mathbb{V}$')

V is veridical if $Vp \Rightarrow p$ (entailment)

↩ **Reason:** 'remember' is not factive/veridical in the tradit'l sense

Preview: The seeming factivity of 'remember'-reports is due to the veridicality of the underlying experience

Factivity Variation in 'remember'-Reports

The factivity of 'remember' varies with the particular context:

- 'remember' triggers the expected factivity inference in (2):

(2) *Context:* During last week's picnic in the park, John saw a woman dancing.

a. John remembers that a woman was dancing.

$\overset{\text{presup}}{\Rightarrow}$ b. 'A woman was dancing (in @)'

- 'remember' does <u>not</u> trigger these inferences in (3):

(3) *Context:* After the picnic, John dozed off and dreamt of a hippo singing.

a. John remembers that a hippo was singing.

$\overset{\text{presup}}{\not\Rightarrow}$ b. 'A hippo was singing (in @)'

!! This only applies to experiential [= 'event-directed'] remembering !!

The Challenge from Factivity Variation

Since the factivity variation between (2) and (3) is contextually induced, it can<u>not</u> be captured by any of the usual strategies:

- assume 2 lexical entries for 'remember' (Hintikka, 1969)

$$[\![\text{remember}_1]\!]^{@} = \lambda p : \underline{p_{@}}.\, \lambda z.\, \textit{remember}'_{@}(z, p) \qquad \text{(factive)}$$
$$[\![\text{remember}_2]\!]^{@} = \lambda p.\, \lambda z.\, \textit{remember}'_{@}(z, p) \qquad \text{(non-factive)}$$

↩ **Idea:** (2a) John remembers$_1$ that a woman was dancing.
(3a) John remembers$_2$ that a hippo was singing.

- assume 2 uses of the complementizer 'that' (Kratzer, 2006)

$$[\![\text{that}_{\mathbf{F}}]\!] = \lambda p : \underline{p_{@}}.\, \lambda w.\, p_w \qquad [\![\text{that}_{\mathbf{T}}]\!] = \lambda p.\, \lambda w.\, p_w$$

↩ **Idea:** (2a) John remembers that$_{\mathbf{F}}$ a woman was dancing.
(3a) John remembers that$_{\mathbf{T}}$ a hippo was singing.

The Challenge from Factivity Variation (cont'd)

Note: The (in)validity of the factivity inference correlates with the (in)ability of 'remember' to embed 'whether'-clauses:

(4) J. remembers whether a woman was dancing. (✓ given (2))

(5) J. remembers whether a hippo was singing. (# given (3))

N.B.: Given the context from (2), (4) is still slightly odd.

↩ **?Reason:** 'that' > 'whether' is a two-value Horn scale

- Given Grice's maxim of quantity, a speaker's use of (4) triggers a pragmatic inference to the negation 'remembers that'
- But this clashes with the context from (2)!

Roadmap

1. Background: event-directed attitudes & attitudinal parasitism
2. Use ❶ to explain factivity variation in 'remember (that)'-reports (3) vs. (2)/(1a)
3. Use this explanation to account for the different acceptability of different occurrences of 'remember whether' (5) vs. (4)
4. Use the account from ❷–❸ to explain the deviance of 'imagine whether' (in most contexts) (1b)

Effective ingredients

attitudinal parasitism (❶);
the lex. semantics of 'remember' (❷), 'imagine' (❹), & 'whether' (❸)

Experiential Parasitism

The semantic complement of 'remember' [= the parasite attitude] in (2a)/(3a) take their content from an experience [= the host]

↩ **Support:** paraphrasability by reports that refer to this experience:

(6) John remembers that a woman was dancing. (2a)

≡ a. J. remembers a particular fact about a certain visual scene, viz. that a woman was dancing in this scene.

≡ b. John remembers that *the* woman whom he saw at the park was dancing in the park.

(7) John remembers that a hippo was singing. (3a)

≡ a. J. remembers a particular fact about a certain oneiric scene, viz. that a hippo was singing in this scene.

≡ b. John remembers that *the* hippo from his dream was singing in this dream.

Experiential vs. Doxastic Parasitism

Doxastic [= non-experiential] **parasitism** (with belief as host) is a well-documented phenomenon: (Karttunen, 1973; Heim, 1992)

(8) Mary { hopes that, is imagining what it would be like if} [the man whom she believes to be the murderer] is arrested. (Maier, 2017)

Examples of experiential parasitism:

(9) Ralph is imagining that [the man whom he sees sneaking around on the waterfront] is flying a kite in an alpine meadow. (Ninan, 2012)

(10) J. is imagining that [the woman who threatened him in his dream last night] is swimming in the sea. (Blumberg,'19)

'Hidden' Experiential Parasitism (Blumberg,'18; L & Werning,'21a)

Note: Reports of parasitic attitudes need not contain an explicit predicate for the host attitude/experience :

(11) *Context:* Ira has been dreaming of a tattooed woman (no particular one that he has come across in real life)

a. He is imagining that she has clear, untattooed skin.

$\not\equiv$ i. *de re:* There exists a tattooed woman of whom Ira is imagining that she has untattooed skin

$\not\equiv$ ii. *de dicto:* Ira is imagining an inconsistent fact, viz. that some woman simultaneously does and does not have tattoos

$\equiv$ b. *de hospite:* Ira is imagining [that the tattooed woman from his dream] has clear, untattooed skin

Semantics (LF) for Parasitic 'remember'-Reports

Strategy (Blumberg, 2018)**:** Use Percus' (2000) *Index Variables-approach* (with world-variables/-arguments in syntax)

Use distinct variables for:

- parasite/attitudinal alternatives (*imagine* [*remember*]): s_2
- host/experience alternatives (*dream* [*see*]): s_1

➥ LFs for the different readings in (11): (Blumberg, 2018)

(12) a. [a woman-in-@] [λt. Ira imagines -in-@ [λs_1 [λs_2. t has clear skin-in-s_2]]]

(*dicto*) b. Ira imagines -in-@ [λs_1 [λs_2. a woman-in- s_2 has clear skin-in- s_2]]

(*hospite*) c. Ira imagines -in-@ [λs_1 [λs_2. a woman-in- s_1 has clear skin-in- s_2]]

a paired proposition (type $\langle s, \langle s, t \rangle \rangle$)

Generalization *X* (Percus, 2000)**:** The world variable that a verb selects for must be co-indexed with the nearest lambda above it.

LFs for (Non-)Factive 'remember that'

(13) John remembers that *the* woman whom he saw at the park was dancing in the park. (see (6b))

a. J. remembers-in-@ $[\lambda s_1\ [\lambda s_2.$ a wmn-in-s_1 dances-in-$s_2]\ ]$

b. [sth.-in-@] $[\lambda t.$ John remembers-in-@ $[\lambda s_1\ [\lambda s_2.\ t$ is a wmn-in-s_1 & dances-in-$s_2]\ ]\ ]$

(14) John remembers that *the* hippo from his dream was singing in this dream. (see (7b))

a. J. remembers-in-@ $[\lambda s_1\ [\lambda s_2.$ a hippo-in-s_1 sings-in-$s_2]\ ]$

Note: The interpretation of 'woman' and 'dance' in (13a) at different alternatives (forced by Generaliz'n X) is counterintuitive!

Semantics for Declarative 'remember (that)'

Note: The interpretation of 'woman' and 'dance' in (13a) at different alternatives (forced by Generaliz'n X) is counterintuitive!

➥ **Solution:** Set '$R^{\langle s,\langle s,t\rangle\rangle}(s_1, s_1)$' resp. '$R(s_2, s_2)$' in the semantics for 'remember':

Semantics for declarative 'remember'

$$[\![\text{remember}]\!]^{@}$$
$$= \lambda R\, \lambda z.\ \mathit{remember}_{@}(z, \lambda s_2 : \underbrace{\mathit{exp}_{w_@}(z, \lambda s_1 . R(s_1, s_1))}_{\text{presupposed experience [host]}} . R(s_2, s_2))$$

$\mathit{exp}_{w_@}(z, p)$:= 'in the world, $w_@$, of which @ is a part, the agent z had an experience with content p'

Semantics for 'remember' + 'that'

My semantics for 'remember' enables the compositional interpretation of (14a) and (13b):

(15) $[\![\text{John remembers-in-@ } [\lambda s_1\ [\lambda s_2 .\ \text{a hippo-in-}s_1\ \text{sings-in-}s_2]\ ]\ ]\!]$

$\equiv [\![\ \text{remember}\ ]\!]^{@}([\![\text{John}]\!], \lambda s_1\ \lambda s_2\ (\exists x)[hippo_{s_1}(x) \wedge sing_{s_2}(x)])$

$= remember_{@}(john, \lambda s_2 : \underline{exp_{w_@}(john, \lambda s_1\ \exists y.\ hippo_{s_1}(y) \wedge sing_{s_1}(y)).\ \exists x.\ hippo_{s_2}(x) \wedge sing_{s_2}(x))}$

(16) $[\![[\text{a thing-in-@}]\,[\lambda t.\ \text{John remembers-in-@}\ [\lambda s_1\ [\lambda s_2 .\ t\ \text{is a woman-in-}s_1\ \text{dances-in-}s_2]\ ]\ ]]\!]$

$= (\exists x)\big[\,remember_{@}(john, \lambda s_2 : \underline{exp_{w_@}(john, \lambda s_1 .\ woman_{s_1}(x) \wedge dance_{s_1}(x))}.\ woman_{s_2}(x) \wedge dance_{s_2}(x))\big]$

Capturing Factivity Variation

(2) *Context:* ... John saw a woman dancing.

a. John remembers that a woman was dancing.

$\overset{\text{presup}}{\Rightarrow}$ b. 'A woman was dancing (in @)'

To capture the factivity inference in (2), we need one of the ff.:

(a) a **context** that identifies the particular mode of the experience (e.g. visual; + assumptions about the veridicality of this mode):

(2) At his picnic in the park, John saw a woman dancing.

(b) a linguistic specification of this mode (+ veridicality assumpt's):

(6) John remembers that *the* woman whom he saw at the park was dancing in the park.

(c) an assumption about the default veridicality of the experience

Capturing Factivity Variation (valid)

Assumption: Each of (a)–(c) further specifies *exp* through $\mathcal{V}$ [veridicality operator]: (see Jeong, 2020)

$$\mathcal{V}\left(exp_{w_@}(z,p)\right) := exp_{w_@}(z,p) \wedge p_@$$

➥ $\mathcal{V}$ adds a 'factivity conjunct', $p_@$, in the presupposition of s_2; It validates the inference on the presupposition's global int'n:

(17) $(\exists x)\left[remember_@(john, \lambda s_2\colon \underline{\mathcal{V}\left(exp_{w_@}(john, \lambda s_1 \ldots)\right).} \ldots)\right]$

$\equiv (\exists x)\left[remember_@(john, \lambda s_2\colon \underline{exp_{w_@}(john, \lambda s_1.\, woman_{s_1}(x) \wedge dance_{s_1}(x))} \wedge (woman_@(x) \wedge dance_@(x)) \underline{.\, woman_{s_2}(x) \wedge dance_{s_2}(x)})\right]$

$\equiv (\exists x)\left[(woman_@(x) \wedge dance_@(x)) \wedge exp_{w_@}(john, \lambda s_1.\, woman_{s_1}(x) \wedge dance_{s_1}(x)) \wedge remember_@(john, \lambda s_2.\, woman_{s_2}(x) \wedge dance_{s_2}(x))\right]$

$\Rightarrow (\exists x)[\, woman_@(x) \wedge dance_@(x)\,] = [\![\text{A woman danced/was dancing}]\!]^@$

Capturing Factivity Variation (invalid)

Since it does not evidence any 'veridicality-inducing factors' (viz. context, linguistic specification, default veridicality assumption), the factivity inference is <u>not</u> valid in (3):

(3) *Context:* After the picnic, John dozed off and dreamt of a hippo singing.

a. John remembers that a hippo was singing.

$\overset{\text{presup}}{\not\Rightarrow}$ b. 'A hippo was singing (in @)'

(18) $[\![\text{J. remembers-in-@}\,[\lambda s_1\,[\lambda s_2.\ \text{a hippo-in-}s_1\ \text{sings-in-}s_2]]]\!]$ + Context

$$= \mathit{remember}_{@}(\mathit{john}, \lambda s_2 : \underline{\underline{(\mathit{exp}_{w_@}(\mathit{john}, \lambda s_1\, \exists y.\, \mathit{hippo}_{s_1}(y) \wedge \mathit{sing}_{s_1}(y)))}}.\ \exists x.\, \mathit{hippo}_{s_2}(x) \wedge \mathit{sing}_{s_2}(x))$$

$$\not\Rightarrow (\exists x)[\mathit{hippo}_{@}(x) \wedge \mathit{sing}_{@}(x)] \;=\; [\![\text{A hippo was singing}]\!]^{@}$$

Generalization to Interrogative 'remember (wh-)'

Note: Our target is 'remember <u>whether</u>', not 'remember that'

↩ **Solution:** Replace the semantic complement of *remember* by a paired <u>question</u> ($\langle\langle\langle s, \langle s, t\rangle\rangle, \boldsymbol{t}\rangle\rangle$)

(Unified) Semantics for interrogative 'remember'

$[\![\text{remember}_{\text{INQ}}]\!]^{@}$

$$= \lambda Q^{\langle\langle s,\langle s,t\rangle\rangle,t\rangle}\lambda z.\ \mathit{remember'}_{@}(z, \lambda p : \underline{\exists q.\ \mathit{exp}_{w_@}(z, q) \wedge (\forall s_1.\ Q(\lambda\langle s_3, s_4\rangle.\ s_4 = s_3 = s_1) \rightarrow q_{s_1})}.\ Q(\lambda\langle s, s_2\rangle.\ s_2 = s \wedge p_{s_2}))$$

Semantics for declarative 'remember'

$[\![\text{remember}]\!]^{@}$

$$= \lambda R^{\langle s,\langle s,t\rangle\rangle}\lambda z.\ \mathit{remember}_{@}(z, \lambda s_2 : \underline{\mathit{exp}_{w_@}(z, \lambda s_1.\ R(s_1, s_1))}.\ R(s_2, s_2))$$

Semantics for 'remember' + 'whether'

We assume that 'whether' has the ff. almost-standard semantics:
(*modulo* paired propositions and a 'decidability' presupposition)

Semantics for 'whether'

$$[\![\text{whether}]\!] = \lambda R^{\langle s,\langle s,t\rangle\rangle} : \underbrace{(R(w_@, w_@) \vee \neg R(w_@, w_@))}_{\text{'decidability' presupposition}} .$$
$$\lambda S^{\langle s,\langle s,t\rangle\rangle}. ((\forall\langle s_1, s_2\rangle. S(s_1, s_2) \rightarrow R(s_1, s_2)) \vee (\forall\langle s_1, s_2\rangle. S(s_1, s_2) \rightarrow \neg R(s_1, s_2)))$$

N.B.: The downward-closure of sets of paired propositions captures the intuitive semantic inclusion relations (see Ciardelli et al., 2017)

➥ Since the decidability presupposition is <u>not</u> satisfied in the 'John dreaming'-context from (3), [\![whether]\!] blocks the interpretation of (5):

(5) John remembers whether a hippo was singing. (# given (3))

1st Attempt at 'imagine whether'

$$[\![\text{whether}]\!] = \lambda R^{\langle s,\langle s,t\rangle\rangle}\colon \underline{(R(w_@, w_@) \vee \neg R(w_@, w_@))}.\ \ldots$$

Conjecture 1 (wrong): The difference b/w 'remember whether' (✓) and 'imagine whether' (#) is due to the inability of 'imagine' to be parasitic on **veridical** experiences

↩ **BUT** the behavior of 'imagine' excludes this:

(9) Ralph is imagining that [the man whom he sees sneaking around on the waterfront] is flying a kite in an alpine meadow. (Ninan, 2012)

(19) John is imagining that [the woman whom he saw during last week's picnic in the park] is bungee-jumping (in his imagination). (L & Werning, 2021b)

2nd Attempt at 'imagine whether'

$$[\![\text{whether}]\!] = \lambda R^{\langle s,\langle s,t\rangle\rangle}\colon \underline{(R(w_@, w_@) \vee \neg R(w_@, w_@))}.\ \ldots$$

Conjecture 2 (wrong): The difference b/w 'remember ...' (✓) and 'imagine whether' (#) is due to the inability of 'imagine' to interpret all constituents at **the same** alternative

➥ **BUT** the behavior of 'imagine' also excludes *this*:

(20) Inger imagines that a fairy is flying above. (experiential)

a. Inger is imagining that [a fairy in her imagined visual scene] is flying above (in this scene).

b. Inger imagines-in-@ $\underbrace{[\lambda s_2.\ [\lambda s_1}$ a fairy-in-s_1 flies-above-in-s_1]]

!! inversed order of λs over attitude- and *exp*-alternatives

Semantics for 'imagine whether'

Note: Our semantics for 'whether' combines both restrictions (<u>veridical</u> experience, <u>same alternative</u> for all constituents):

$$[\![\text{whether}]\!] = \lambda R^{\langle s,\langle s,t\rangle\rangle}\colon \underline{(R(w_@, w_@) \vee \neg R(w_@, w_@))}.\ \ldots$$

↩ To allow for 'imagine' to violate these restrictions, we assume:

(Unified) Semantics for interrogative 'imagine'

$$[\![\text{imagine}_{\text{INQ}}]\!]^@ = \lambda Q^{\langle\langle s,\langle s,t\rangle\rangle,t\rangle}\lambda z.\ \textit{imagine'}_@(z, \lambda p\colon \underline{\exists q.\ \textit{exp}_{w_@}(z,q) \wedge \underline{(\forall s_1.\ Q(\lambda\langle s_3, s_4\rangle.\ s_3 = s_1) \rightarrow q_{s_1})}}.\ Q(\lambda\langle s, s_2\rangle.\ p_{s_2}))$$

$$[\![\text{remember}_{\text{INQ}}]\!]^@ = \lambda Q\,\lambda z.\ \textit{remember'}_@(z, \lambda p\colon \underline{\exists q.\ \textit{exp}_{w_@}(z,q) \wedge \underline{(\forall s_1.\ Q(\lambda\langle s_3, s_4\rangle.\ s_4 = s_3 = s_1) \rightarrow q_{s_1})}}.\ Q(\lambda\langle s, s_2\rangle.\ s_2 = s \wedge p_{s_2}))$$

'remember whether' (✓) vs. 'imagine whether' (#)

$$[\![\text{whether}]\!] = \lambda R^{\langle s,\langle s,t\rangle\rangle}\colon \underline{(R(w_@, w_@) \vee \neg R(w_@, w_@))}.\ \ldots$$

- ➥ Since the decidability presupposition <u>is</u> satisfied in the 'John seeing'-context from (2), [[whether]] admits the interpretation of (1a)
- ➥ Since the decidability presupposition is <u>NOT</u> satisfied in the 'John dreaming'-context from (3), [[whether]] blocks the interpretation of (1b)

Phenomenon (limited anti-rogativity of *imagine*):

Members of 3 typically reject *whether*-clauses:

(1) a. John remembers whether a woman was dancing. ✓

b. John imagined whether a hippo was singing. #

Upshot

My analysis assumes that 'imagine whether' (#) is not syntactically, but **semantically** deviant. This deviance is based on:

- the referential dependence of the matrix attitude on an underlying (veridical or counterfactual) experience
  ➥ Experiential parasitism (L & Werning, 2021a)
- the possibility of interpreting the complement's different constituents at the matrix- or the experience-alternatives (see Blumberg, 2019)

The semantic deviance arises since

- 'whether'-complements require that their constituents are all interpreted at the same 'veridical experience'-alternative

!! This is the case for most (!) uses of 'remember', but only for few exceptional uses of 'imagine'

Outlook

Observation: Sometimes, 'imagine whether' seems fine (as attested by White & Rawlins' *MegaAttitude* dataset)

Specifically: 'imagine whether' is (better) acceptable in contexts which impose some kind of reality constraint:
(example due to Peterson, 2017)

(21) I am imagining whether the new sofa will fit into my living room. (✓)

Plan for **Future work:**

- Provide a detailed explanation of such cases
- Show how this explanation supports my account!

Thanks to *PhD Comics* for the characters!

Blumberg, K. (2018). Counterfactual attitudes and the relational analysis. *Mind 127*(506), 521–546.

Blumberg, K. (2019). *Desire, Imagination, and the Many-Layered Mind*. Ph. D. thesis, NYU.

Ciardelli, I., F. Roelofsen, and N. Theiler (2017). Composing alternatives. *Linguistics & Philosophy 40*(1), 1–36.

D'Ambrosio, J. and D. Stoljar (2021). Vendler's puzzle about imagination. *Synthese*.

Egré, P. (2008). Question-embedding and factivity. Ms.

Heim, I. (1992). Presupposition projection and the semantics of attitude verbs. *J. Sem. 9*(3), 183–221.

Hintikka, J. (1969). Semantics for propositional attitudes. In *Models for Modalities*.

Hintikka, J. (1975). Different constructions in terms of the basic epistemological verbs. In *The Intentions of Intensionality*, pp. 1–25. Kluwer.

Jeong, S. (2020). The effect of prosody on veridicality inferences in Korean. In M. Sakamoto et al. (Ed.), *New Frontiers in Artificial Intelligence. JSAI-isAI 2020*, pp. 133–147. Springer.

Karttunen, L. (1973). Presuppositions of compound sentences. *Linguistic Inquiry 4*(2), 169–193.

Kratzer, A. (2006). Decomposing attitude verbs. Manuscript.

Maier, E. (2017). Referential dependencies between conflicting attitudes. *Journal of Philosophical Logic 46*(2), 141–167.

Ninan, D. (2012). Counterfactual attitudes and multi-centered worlds. *Semantics and Pragmatics 5*(5), 1–57.

Percus, O. (2000). Constraints on some other variables in syntax. *Nat. Lang. Sem. 8*, 173–229.

Theiler, N., F. Roelofsen, and M. Aloni (2018). A uniform semantics for declarative and interrogative complements. *Journal of Semantics 35*(3), 409–466.