Proceedings of SALT 29: 665–685, 2019

I can't believe it's not lexical: Deriving distributed veridicality*

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Abstract Given the assumption that selection is a strictly local relationship between a head and its complement, we expect the ability of a head to take a particular argument to be insensitive to linguistic material above that head. The verb *believe* poses a puzzle under this view: while *believe* ordinarily only permits declarative clausal complements, interrogative complements are allowed when believe occurs under clausal negation and *can* or *will*, and a veridical reading becomes available. I argue that this provides evidence that *believe* is not simply a standard Hintikkan representational belief verb, but rather is fundamentally question-embedding,and that the verb's lexical semantics, including an excluded middle presupposition, interact with the modal and negation to derive the veridicality of *can't believe*. I additionally conclude that veridicality need not be lexical: the right mix of semantic ingredients can conspire to yield a veridical interpretation, even if those ingredients are distributed across multiple lexical items.

Keywords: veridicality, question-embedding, doxastic verbs, belief

1 Introduction

The English clausal-embedding verb *believe* ordinarily permits declarative complements and bans interrogative complements:

(1) a. Susan believes that Ehrenrang was obliterated by the meteor.
b. *Susan believes which town was obliterated by the meteor.

This asymmetry is historically explained as resulting from s(emantic)-selection (Grimshaw 1979; Pesetsky 1982, 1991): *believe* selects propositions (type $\langle s,t\rangle$), not questions (type $\langle\langle s,t\rangle,t\rangle$), so it can only compose with clausal complements which are proposition-denoting, i.e., declaratives but not interrogatives.

* This work has benefited immensely from advice from debate and discussions with Pranav Anand, Donka Farkas, and Jim McCloskey, as well as conversations with Maayan Abenina-Adar, Kajsa Djärv, Deniz Özyıldız, Floris Roelofsen, Benjamin Spector, and Nadine Theiler, and audiences at UCSC, UC Berkeley, and SALT 29. Errors are, believably, all my own.

However, when *believe* occurs under a combination of *can* or *will* and negation[1], interrogative complements are licit–which neither negation nor modals easily achieve on their own:

(2) Susan {can't/*can/*doesn't} believe which town was obliterated by the meteor.

Assuming that selection is strictly local, these observations are puzzling. If a head is capable of selecting complements of a particular type in some context, it should (at least in principle) be able to select those kinds of complements freely, regardless of what material is above it. We must ask why, then, *believe* permits interrogative complements only in certain contexts.

Further complicating the picture is that while *wh*-interrogatives are acceptable complements of *can't believe*, polar interrogatives are not (Lahiri 2002; Egré 2008):

(3) *Susan {can't/won't} believe whether Ehrenrang was obliterated by the meteor.

Finally, and perhaps most strikingly, *can't believe* is **veridical** with declarative complements: it gives rise to the inference that its complement is true, starkly unlike *believe* on its own or under only negation:

(4) a. Mary can't believe that it's raining.
∴ It's raining.
b. Mary (doesn't) believe(s) that it's raining.
⁄∴ It's raining.

It is not obvious why the addition of a modal and negation should yield veridical interpretations for *believe*. Other close semantic kin of *believe*, such as *think*, In this paper, I will propose a **compositional** solution to these puzzles.

Specifically, I will argue that the apparent sensitivity of *believe*'s selectional restrictions to linguistic context is attributed not to selection itself, but rather a complex interaction between its component parts. The first is that, following Theiler, Roelofsen & Aloni (2018), *believe* lexically selects for questions (that is, sets of sets of worlds), contra a Hintikkan (1962)-style view in which it selects for propositions. Instead of *believe q* being ruled out for selectional reasons, it is generally unacceptable because in most circumstances it systematically produces trivial meanings (cf. Mayr 2017, 2019; Theiler et al. 2018). The veridicality of *can't believe*, then, is derived compositionally from a conspiratorial interaction between an excluded middle presupposition (Bartsch 1973; Gajewski 2007) an agent-oriented

1 I call this construction *can't believe* throughout.

modal, and negation. We need not package veridicality (or perhaps even factivity) with the lexical entries of particular clausal-embedding predicates; it may arise given the right combination of semantic ingredients spread out across multiple lexical items.

The paper is structured as follows: §2 provides reasons why *can't believe* should be understood compositionally, §3 sharpens the range of possible meanings that *can't believe* may have, §4 provides the compositional analysis, §5 discusses possible alternatives to that analysis, and §6 concludes.

2 Why treat *can't believe* as compositional?

Given that *can't believe* is so different from *believe* on its own, we might be tempted to treat *can't believe* as some kind of atomic predicate, rather than derive its meaning compositionally. I believe a compositional account to be preferable for at least two reasons. First, a similar pattern is observed in other languages. In the examples given below, the interpretation of *can't believe* is roughly the same as in the English paraphrase: [2]

(5) Je ne peux pas croire qui a gagné la course.
I NEG can NEG believe who has won the race
'I can't believe who won the race.' (French)

(6) Ik kan niet geloven wie de race gewonnen heeft.
I can not believe who the race won has
'I can't believe who won the race.' (Dutch)

(7) Ma ei suuda uskuda(=gi), kes on võitnud valimised.
I NEG can.NEG believe.INF(=even) who is won election
'I can't (even) believe who won the election.' (Estonian)

(8) Džon ne može po-viriti, v te, ščo Mariya vigrala gonku.
John NEG can PERF-believe in that that Maria win.PAST race.ACC
'John can't believe that Maria won the race.' (Ukrainian; Anelia Kudin, p.c.)

2 In some languages, including Turkish, Setswana, Malay, Hungarian, and Hebrew, a similar construction to *can't believe* is licensed with negation + *believe*, without an overt modal:

(i) Nereye kadar yüzmüşşün ki inanmtyorum.
where extent swam.2SG COMP believe.NEG.PRES.1SG
'I can't (lit. don't) believe how far you swam!' (Turkish; Michaelis 2001: 1043)

I leave the interesting question of how these languages might differ from languages like English as a question which merits much further investigation.

If *can't believe* in English is idiomatic, then we would presumably be forced to stipulate the same idiomaticity in other languages, and we would be left with no explanation of the cross-linguistic similarity. On the other hand, if the behavior of *can't believe* could be explained compositionally, then we would expect similar patterns to the English one to show up in other languages.

A second, though perhaps less compelling reason, is that certain meaning-preserving lexical substitutions in *can't believe* are also veridical and license interrogative complements:

(9) a. It's **unbelievable** who's lecturing us about fake news.[3]
b. My appetite fled as I sat rigidly in my seat, **unable to believe** who was next to me.[4]
c. Everyone who was present that night was **incapable of believing** why UEFA allocated this stadium for a European Cup final.

These facts suggest that *can't believe* is unlikely to be an English-specific idiom, but rather poses a compositional problem that reflects a deeper property of *believe* and its equivalents in other languages which warrants a non-stipulative explanation.

3 Core properties of *can't believe*

3.1 Veridicality inferences

Perhaps the most striking property of *can't believe* is that it is *veridical* with respect to its complement: it generates an inference that that complement is true. A speaker who utters (10), for example, is almost certainly understood to be committed to today being Tuesday.

(10) I can't believe that today is only Tuesday.

What makes this surprising, however, is this meaning is decidedly counterintuitive when one considers the meaning of the subparts of *can't believe*: on its face, (10) is an assertion that it is impossible for the speaker to believe that today is Tuesday. Intuitively, *can't believe* highlights a 'tension' between a speaker's belief in some proposition p despite their extreme surprise at p's truth (cf. Sæbø 2007). But if this is the case, where does the inference that the speaker believes it to be Tuesday come from? In this section, I will explore the extent to which veridicality is and is not available with *can't believe* with both declarative and interrogative complements.

3 http://www.wibc.com/blogs/tony-katz/morning-news/its-unbelievable-whos-lecturing-us-about-fake-news

4 http://thechronicleherald.ca/artslife/1523575-david-cassidy-club-med-and-me-%E2%80%98c%E2%80%99mon-get-happy%E2%80%99

3.1.1 With declarative complements

One way a veridical inference might be generated is presuppositionally. This appears to be the case for factive verbs like *know*, which do tend to presuppose the truth of their complements (Kiparsky & Kiparsky 1970: *et seq.*). We can be reasonably sure that these are presuppositions because they project:

(11) John doesn't know that we're planning a surprise party for him.
Presupposed: We're planning a surprise party for John

Out of the blue *can't believe* is generally veridical, whether with first- or third-person subjects[5]:

(12) I/Susan can't believe that it's raining.
∴ It's raining.

However, there are some contexts in which *can't believe p* does not seem to carry a veridical inference, but rather emphasize the impossibility of the attitude holder believing *p*.

(13) No matter how hard the prosecutor tries to convince him, John can't believe that Mary is the murderer. He was with her on the other side of the town at the time of the crime.

Given that *can't believe p* can be used non-veridically, it also stands to reason that *can't believe* is perhaps not best characterized as factive, since examples like (13) would involve violating this factive presupposition.

Nevertheless, while *can't believe p* may not always be veridical, the picture that emerges is one in which the veridicality inference may be overridden only in highly specific contexts.[6]

3.1.2 Interrogative complements

Guerzoni & Sharvit (2007: G&S) propose two distinct notions of 'factivity' for predicates which embed questions, depending on from whose perspective the complement is true. A predicate *v* is **speaker-factive** iff *x v q* presupposes that the speaker knows the true answer to *q*, and *v* **subject-factive** iff *x v q* presupposes that *x* knows the true answer to *q*.

5 Here second-person subjects are excluded because it is generally infelicitous to make assertions about what addressees do or do not believe.

6 I sidestep the interesting and almost certainly important question of the role prosody may play in cases where the veridical inference is canceled.

While we saw from examples like (13) that factivity is altogether perhaps a bit too strong a notion for *can't believe*, it's worth considering whether *can't believe* is subject- or speaker-veridical. G&S and Guerzoni (2007) argue that emotive factives like *surprise*, which bear an intuitive semantic similarity to *can't believe*, are speaker-factive on the basis of examples like (14), which they argue are infelicitous if the speaker does not know who passed the exam, as in (14). At first brush, the same seems to be true for *can't believe* (15).

(14) It will surprise Bill who passed the exam.

(15) Bill won't believe who passed the exam.

However, the infelicity of uttering (14) or (15) if the speaker does not know who passed the exam does not seem to be semantic. While uttering (15) out of the blue is likely to generate the inference that speaker is aware of who passed, this requirement can disappear in the right context. Romero (2015) challenges Guerzoni's claim for *surprise*, and her example extends quite naturally to *can't believe*:

(16) A: Hi John, do you know who was at the party?
B: No, but I can tell you Bill couldn't believe who was there. (cf. Romero 2015: (74))

Subject-factivity, on the other hand, seems indefeasible for *can't believe* with an interrogative complement. Following up a *can't believe q* assertion with an explicit denial of subject knowledge of the answer to *q* is incoherent:

(17) Lorraine can't believe which country is holding the World Cup. #In fact, she has no idea where it will be.

But calling it subject *factivity* is still a bit too strong. The subject need not be committed to the true answer itself, but simply be convinced of their own rightness, even if the speaker believes otherwise, as demonstrated in (18).

(18) *Two parents normally give their daughter presents for Christmas addressed from themselves, but this year, they decided to give her a bunch of gifts from 'Santa.' She did not expect that Santa would be bringing her gifts, but she readily accepts it. One parent says to the other:*
She can't believe who brought her so many gifts this year.

Based upon this evidence, I will characterize the presupposition associated with *can't believe q* as **subject-certainty**: the subject believes that they know the true answer to *q*.

3.2 Permissible interrogative complements

Veridical predicates across the board tend to allow both declarative and interrogative complements (Spector & Egré 2015), but do not themselves form a completely homogenous class.[7]

The so-called 'emotive factives' like *regret* and *surprise* differ from 'doxastic factives' like *know* in that only the emotive factives disallow polar interrogative complements:

(19) Shawna knows/*regrets whether it's raining.

Can't believe patterns like the emotive factives in this regard:

(20) *I can't believe whether it's raining.

Though a unified treatment of *can't believe* and emotive factives is outside the scope of this paper, I note here that mirative expressions like *be surprised* and *be amazed*, which seem to carry roughly similar meanings to *can't believe*, are also emotive factives. These similarities certainly invite further scrutiny.

3.3 The role of negation

Finally, I will note that sentential negation *per se* is not necessary to license a veridicality inference with *believe*. *Can believe* is compatible with interrogative complements in polar questions and with adversative adverbs.

(21) Can/would you believe which dessert Sherrod baked?

(22) I can *(hardly/scarcely/barely) believe what score I got on the midterm!

Like *can't believe*, however, neither of these constructions straightforwardly entail

7 Several authors treat interrogative complements of *can't believe* not as true interrogatives, but rather exclamatives (Elliott 1971, 1974; Grimshaw 1979). However, some clausal complements of *can't believe* show properties consistent with being interrogative and not exclamative, including containing multiple *wh*-words (i) or sluices (ii):

(i) Joan can't believe who confiscated who is how tall.

(ii) Someone brought a tarte tatin to the potluck, though I couldn't believe who.

While some complements of *can't believe* might be exclamative, I take the evidence above to indicate that at least some must be genuine interrogatives. See Huddleston (1993) for further arguments.

that there is a particular p that the subject believes.[8]

3.4 Summary

Can't believe displays a set of properties highly reminiscent of emotive factives: It is veridical with declarative complements, carries a speaker-certainty presupposition with interrogative complements, and disallows polar interrogative complements.

4 Analysis

Can't believe is evidently comprised of multiple contentful parts, which when combined, create a complex predicate whose properties (namely veridicality and the ability to embed interrogatives) is not easily predicted from the sum of its parts. That said, a close examination he properties of these individual components may provide a clue as to our original puzzles. The principal idea I will advance is twofold: *believe* lexically selects not for propositions but *sets* of propositions, and the intuitive tension of *can't believe* represents an apparent conflict between two types of content: a veridical presupposition and a modalized antiveridical assertion.

4.1 Selectional properties of the verb

We have established *believe* is freely compatible with declarative complements, but has only permits interrogative complements in a fairly constrained set of contexts.

The classical view of *believe* from doxastic logics inspired by Hintikka (1962) is that it is proposition-taking (and therefore declarative-embedding), having a lexical entry along the lines of (23).

(23) $[\![\text{believe}]\!]^w = \lambda p_{st} \lambda x. \text{DOX}_x^w \subseteq p$

This denotation, though perhaps a bit simplistic, captures a core intuition about what it means to *believe*: an individual 'believes' a proposition if that proposition is entailed by their doxastic state DOX, the set of worlds compatible with their beliefs.

However, the fact that under this view *believe* requires a propositional argument is problematic, since we know that *believe* can take interrogative complements, albeit only in a proper subset of linguistic contexts (i.e. under something like *can't* or *won't*) in which it may also take declaratives.

Adopting the assumption that propositions denote sets of worlds (type st) and interrogatives denote sets of propositions (type $\langle st,t \rangle$), by s-selection, predicates

8 It is, however, the case that (21) seems to be felicitous only if the speaker has a particular belief about which dessert Sherrod baked, and doesn't require the addressee to know what Sherrod baked. It is possible that this interrogative construction might motivate a distinct treatment from *can't believe*.

should be able to embed only one or the other. This is a problem more general than *believe*, as many other predicates (the so-called 'responsive predicates') can also embed both types of clauses, including *know* and *say*.

Prior work has typically utilized one of two strategies to solve this selectional problem without sacrificing the type-driven notion of s-selection. REDUCTIVE accounts aim to unify the meaning of declaratives and interrogatives either reducing interrogative meaning to declarative meaning (Karttunen 1977; Groenendijk & Stokhof 1982, 1984; Heim 1994; Lahiri 2002; Egré 2008; Spector & Egré 2015: a.o.) or vice versa (Uegaki 2016; Elliott, Klinedinst, Sudo & Uegaki 2017; Roberts 2018: a.o.). On the other hand, UNIFIED accounts treat declaratives and interrogatives as type-equivalent, so responsive predicates pose no problem at all, as in Inquisitive Semantics (Ciardelli, Groenendijk & Roelofsen 2013; Theiler et al. 2018).

In this section, I will demonstrate how a particular Unified account–namely, the Inquisitive Semantics treatment of Theiler et al. (2018)–can account for the selectional behavior of *can't believe*; in §5 I will discuss issues that the REDUCTIVE accounts face for accounting for the behavior of *can't believe*.

For Theiler et al., the denotation of declarative and interrogative clauses alike is a downward-closed set of propositions (henceforth, type T). For *believe* in particular, they propose a semantics which is broadly Hintikkan in nature: it predicates that the subject's doxastic state is a *member* of the set denoted by the complement of *believe*.

(24) $[\![\text{believe}]\!]^w = \lambda P_T \lambda x_e . \text{DOX}_x^w \in P$ (Theiler et al. 2018: 7)

This account is intuitively appealing because it permits *believe* to take interrogative complements without any type-shfiting. It also provides an explanation for why these complements are ordinarily unacceptable, explained below.

4.1.1 Whence subject-veridicality?

Though *believe* is not obligatorily veridical, it **is** a neg-raising verb (Zuber 1982): $\neg$*believe* p is typically interpreted to mean *believe* $\neg p$.

(25) John doesn't believe that it is raining.
∴ John believes that it is not raining.

This inference can be cashed out as a 'excluded middle' presupposition: *believe* presupposes that the subject believes either p or $\neg p$ (Bartsch 1973; Gajewski 2002).

Theiler et al. propose a similar presupposition augmented for Inquisitive Semantics. Because $\neg$ applies only to propositions, they must innovate a higher-order negation $\neg_!$:

(26) $\neg_! P := \{p | \forall q \in P : p \cap q = \emptyset\}$

Whereas $\neg p$ is defined as the set of all not-p worlds not, $\neg_! P$ is defined as the set of all sets of worlds which are not in any members of P. An important consequence of this definition is that $\neg_!$ applied to an interrogative clause yields the empty set under the assumption that interrogative clauses denote partitions over a set of worlds:

(27) $[\![\text{who won the election}]\!] = \{\{\text{A won}\}, \{\text{B won}\}, \ldots \{\text{Z won}\}\}$

With this in mind, consider Theiler et al.'s denotation for *believe* with an Inquisitive excluded middle presupposition (underlined):

(28) $[\![\text{believe}]\!]^w = \lambda P_T \lambda x : \underline{\text{DOX}_x^w \in P \vee \text{DOX}_x^w \in \neg_! P}.\ \text{DOX}_x^w \in P$ (Theiler et al. 2018: 7)

When P is interrogative, the EM presupposition reduces to $\text{DOX}_x^w \in P$, and the presupposed content of *believe P* becomes identical to its asserted content; i.e., the presupposition is completely trivial. I argue produces a systematic trivality, and is therefore unacceptable, inspired by Gajewski's (2002) L-Analyticity:[9]

(29) **B**AN ON **A**SSERTING **T**RIVIALITIE**S** (BATS)
For an utterance u, if u contains a clausal constituent with presupposed content ρ and at-issue content α, u is ungrammatical if $\rho \subseteq \alpha$ or $\rho \cap \alpha = \emptyset$.

Because *x believe q* involves an assertion which is obviated by the presupposition, it is systematically trivial and therefore predicted by BATS to be ungrammatical. Similarly, in the case of *don't believe*, the presupposed content systematically *contradicts* the asserted content, again producing ungrammaticality.

Thus, with an Inquisitive modification of fairly standard semantics for *believe*, we can understand why *believe* is generally allergic to interrogative complements, while still not ruling out *believe q* for reasons of selection.

4.2 The modal

It's not the case that any modal will license this use of *believe*. For instance, we cannot substitute *must*, *have to*, or *should* for *can* and yield acceptability:

9 Theiler et al. explain this fact using L-Analyticity itself:

(i) L-ANALYTICITY
An LF constituent α of type t is *L-analytic* iff the logical skeleton of α receives the same denotation under every variable assignment. (Gajewski 2002: 28)

Although this is intuitively quite similar, I present the modified version above because L-Analyticity makes the unwelcome prediction that if *believe q* is L-Analytic, then any operators above *believe q* won't be able to produce a grammatical sentence, which is inadequate for the data here.

(30) *I {must not/don't have to/shouldn't} believe who came to the party.

In addition to *can*, *will* + negation also similarly licenses this use of *believe*, e.g. in 'clickbait' headlines:

(31) You'll never believe what J.J. Abrams wrote before Star Wars.

What is special about *can* and *will*? They both have uses that require their complement took effort to achieve (Karttunen 1971; Bhatt 1999). In a nutshell, *x can VP* indicates that in the worlds where *x* has the same essential characteristic as in the actual world and applies their abilities to the fullest, *x* brings VP about.

Drawing from Kratzer (1981); Kaufmann (2012); Castroviejo & Oltra-Massuet (2018), I assume here that the modal *can* existentially quantifies over the best worlds in a modal base f_{dispo} describing the subject's intrinsic qualities ('disposition') in w relative to an ordering source g_{AB} defined as follows:

(32) $[\![\text{can}]\!]^w = \lambda R_{\langle s,eT\rangle}\lambda x_e\colon \exists u_s.u \in \text{BEST}(f_{dispo}(w)(x), g_{AB}).[R(u)(x)]$

a. f_{dispo} is a function from $\langle w,x\rangle$ pairs into a set of propositions that describe the inner make-up (i.e. individual characteristics) of x in w. $\cap f_{dispo}$ is the proposition containing exactly those worlds where x has the same inner make-up as in w.

b. g_{AB} is a function from $\langle w,x\rangle$ pairs into a set of propositions that describes states of affairs where x 'applies their strength of body, character or intellect'.

c. BEST is a function which takes modal base, ordering source pairs $\langle f, g\rangle$ and returns the set of worlds $w \in \cap f$ such that for all $w' \in \cap f$, $w \leq_g w'$. (See Portner 2009)

In short: *x can R* means that there is some best world compatible with *x*'s intrinsic characteristics in *w* where *x* exerts the extent of their abilities and brings *R* about. In the following section, I will delineate how this modal can compose with *believe*, and how it can help us understand the full range of interpretations of *can't believe*.

4.3 Deriving the behavior of *can believe*

To see how our modal semantics interacts with *believe*, consider *can believe* with a declarative complement. An example is given below with an assumed LF.

(33) a. Beatrice can believe that Fran won the election.
b. LF: [B [can [believe [F won the election]]]]

An intuitive paraphrase of (33) might be something like, 'Beatrice finds it plausible

that Fran won the election'. It does not, however, require that Beatrice be committed to the truth of that complement. If we utilize the semantics given above here, we yield a meaning for (33) as follows:

(34) **Derivation of (33)**:

a. $[\![\text{F won the election}]\!]^w = P$

b. $[\![\text{believe F won the election}]\!]^w = \lambda x_e : \underline{\text{DOX}_x^w \in P \vee \text{DOX}_x^w \in \neg P}.\ \text{DOX}_x^w \in P$

c. $[\![\text{can believe F won the election}]\!]^w = \lambda x_e : \underline{\text{DOX}_x^w \in P \vee \text{DOX}_x^w \in \neg P}.\exists u \in \text{BEST}(f_{dispo}(w)(x), g_{AB}(w)(x)).[\text{DOX}_x^u \in P]$

d. $[\![\text{B can believe F won the election}]\!]^w = \underline{\text{DOX}_b^w \in P \vee \text{DOX}_b^w \in \neg P}.\exists u \in \text{BEST}(f_{dispo}(w)(b), g_{AB}(w)(b)).[\text{DOX}_b^u \in P]$

This more or less matches our intuitions: there is a world where Beatrice can apply her might and come to the conclusion that Fran won the election.

Can believe with an interrogative complement, as in (35), is unacceptable:

(35) a. *Beatrice can believe who won the election.

b. $[\![\text{B can believe who won the election}]\!]^w = \underline{\text{DOX}_b^w \in Q}.\exists u \in \text{BEST}(f_{dispo}(w)(b), g_{AB}(w)(b)).[\text{DOX}_b^u \in Q]$

Our current semantics does not predict (35) to be ungrammatical. Rather, it assigns it a meaning along the lines of "there is an ideal world in which Beatrice is opinionated about the election", which is not contradictory in the least.

However, *can believe q* utterances **are** licit in certain contexts, e.g., in response to *can't believe q* utterances:

(36) A: I can't believe who won the election!
B: $[\text{I}]_F$ can believe who won the election.

Thus, it seems desirable not to render *can't believe q* utterances ungrammatical wholesale. Nevertheless, out of the blue, (35) seems bad. Why? A possible explanation lies in the pragmatics of making an assertion like (35).

Here, the speaker presupposes subject-certainty about q–that Beatrice has an opinion about the outcome of the election–in w and asserts this certainty is possible in the worlds where Beatrice applies her abilities to the fullest. But this assertion is quite odd: it effectively communicates only that w is an ideal world with respect to Beatrice's ability to be opinionated about the election. The ideality of w for this purpose is only relevant in situations where we have some reason to doubt Beatrice's abilities in this regard.

Thus, *can believe q* is generally licit only in contexts where the 'believability' of the embedded question is somehow in question, which are specific pragmatic circumstances. If the validity of the election outcome is dubious, the acceptability of (35) improves:

(37) *Archibald, Beatrice, and Consuela are international observers for a contested election in a country with a history of government corruption. They stumble upon evidence that there was ballot-stuffing involved.*
A: Do you think the results are legitimate?
C: Beatrice can believe who won the election, but I find the huge margin of victory is awfully suspicious.

Given this, it would in fact be desirable not to rule out *can believe q* across the board, but rather understand its general unacceptability as arising from pragmatic oddity.

4.4 *Can't believe*

Finally, we want *can't believe* to be acceptable with both declarative and interrogative complements, as well as generate the appropriate veridicality inferences. First consider the declarative case:

(38) a. Beatrice can't believe that Fran won the election.
b. $[\![\neg\text{B can believe F won the election}]\!]^w = \overline{\text{DOX}_b^w \in P \vee \text{DOX}_b^w \in \neg P}.\nexists u \in \text{BEST}(f_{dispo}(w)(b), g_{AB}(w)(b)).[\text{DOX}_b^u \in P]$

Here, the speaker asserts that there is no ideal world in which Beatrice believes that Fran won the election. This is the core tension: Beatrice has a belief, but that belief is non-ideal.

What might give us pause here is that this denotation does not place any restrictions on Beatrice's beliefs in w, since there is no reduction of the EM presupposition. Why this is troublesome is that (38-a) is most naturally understood as indicating that Fran does indeed believe that Beatrice won.

To understand why this is the case, consider both possible beliefs that Beatrice could have about Fran's victory. If Beatrice *does* believe that Fran won, (38-a) gives rise to the inference that she did not expect that outcome:

(39) Beatrice (still) can't believe that Fran won the election. Fran never stood a chance, yet there she was on CSPAN taking the oath of office.

On the other hand, if Beatrice *doesn't* believe that Fran won, (38-a) can be used to emphasize the sheer impossibility of that belief:

(40) Beatrice can't believe that Fran won the election. She inspected every ballot herself and knows that Fran lost.

In both of these situations, Beatrice believing that Fran won is 'non-ideal':

- In (39), Fran's victory is shocking/unexpected.
- In (40), Fran's victory is false, and therefore incompatible with B's abilities in w

Because the EM presupposition does not reduce, (38-a) is utterable whether Beatrice truly believes Fran won or not.

Turning at last to interrogative complements, the results are quite similar, with the notable exception that the EM presupposition reduces:

(41) a. Beatrice can't believe who won the election.

b. $[\![\neg$B can believe who won the election$]\!]^w = \underline{\text{DOX}_b^w \in Q}.\nexists u \in \text{BEST}($ $f_{dispo}(w)(b), g_{AB}(w)(b)).[\text{DOX}_b^u \in Q]$

Here, speaker certainty is again presupposed by virtue of this reduction. As discussed in §3, this is precisely what we want: an utterance of *can't believe* q is simply impossible if the subject of *believe* is unopinionated about q. However, the meaning of (41) is not systematically trivial.

The core insight here is that the subject is presupposed to be opinionated about q in the actual world, while simultaneously asserted that in no ideal world are they opinionated about q. Thus, they are making a statement that the actual world is non-ideal.

4.4.1 What is an 'ideal belief'?

When an agent is faced with a piece of new information, how do they update their beliefs? Whether they do and how depends on two primary factors: their existing beliefs and the quality of evidence. Anyone who is trying to figure out whether to believe a new proposition p is going to have to square it with what they already think is true.

Belief update is an extremely fundamental component of linguistic communication, and generally goes off without a hitch. However, rational agents are still discriminating creatures: they will not believe any old proposition that comes their way. For instance, there is no reason to believe propositions for which there is insufficient evidence, nor can one rationally believe two propositions that they know to be mutually exclusive.

I propose that, generally speaking, when deciding whether to integrate a proposition into their beliefs, agents consider (at least) whether its adoption a) would result in an inconsistent belief state, b) has compelling evidence to support it, and c) would require other existing beliefs to be discarded. We can formalize this as a set of maxims that all rational agents aim to adhere to when updating their beliefs, as in (42).[10]

(42) **Maxims of belief revision**

1. MAXIM OF CONSISTENCY: Do not have an inconsistent belief state (i.e., do not believe propositions p and q such that $p \cap q = \emptyset$). (Alchourrón, Gärdenfors & Makinson 1985)
2. MAXIM OF EVIDENTIALITY: Believe that for which there is extremely good evidence. (Doyle 1979: et seq.)
3. MAXIM OF CONSERVATION: Do not revise existing beliefs. (Gärdenfors & Makinson 1988)

Unfortunately, the world sometimes fails to comport according to our beliefs, and we cannot always obey all these maxims. Suppose that I have lived my entire life in a windowless room, and based upon everything I know about the world, I have a firm belief that the sky is orange. I step outside and I am stunned to see with my own eyes that the sky is *blue!* This poses a direct challenge to my beliefs, so I should perform some kind of belief revision.

I could simply add *the sky is blue* to my beliefs, but (let's assume) that *the sky is blue* and *the sky is orange* cannot be true at the same time. Given the assumption of rationality, it seems unlikely that agents would ever entertain belief states they consider inconsistent: that is to say, the Maxim of Consistency is inviolable. Adding a contradictory belief to my doxastic state does not seem like a particularly good choice.

Another option is to violate the Maxim of Evidentiality and reject believing that the sky is blue and go on believing that it is orange. But to do so would require me not to believe my own eyes, which also seems fairly irrational: we want to follow extremely good evidence where it leads. I could gin up post-hoc rationalizations for my sensory experience (my eyes are playing tricks on me, etc.), but this stubborn refusal to accept manifest reality is also not particularly rational.

My only choice, then, is to give up of some my existing beliefs. I could adopt the belief that the sky is blue with no further problems by giving up my belief that

10 There are many ways of cashing out this intuition formally, e.g. as a set of ranked Optimality-Theoretic constraints. I do not make the claim that this is an exclusive list of all that an agent considers when performing belief updates, just the minimum set of maxims to illustrate what a non-ideal belief of the relevant sort might consist of.

the sky is orange. Of course, to do so violates Conservation, but I have no choice: I either have to be irrational and heinously violate one of the other Maxims, or I have to discard my long-held believe that the sky is orange. I would be licensed to utter (43) in this context:

(43) I can't believe what color the sky is.

Given that *can't believe q* carries a presupposition of speaker certainty, we now have a way of understanding the pragmatic factors which govern its use. Can't believe q, then, is only uttered felicitously when the subject of *believe* cannot follow all the maxims, but nevertheless believes some particular answer to q. In effect, the only maxim they can give up is Conservation, yielding an effect of 'surprise'.

5 Some alternative accounts

The analysis proposed here crucially relies on a semantics for *believe* in which it selects sets of sets of worlds, and both declarative and interrogative clauses denote objects of such a type. I briefly consider here whether other approaches to the meaning of *believe* or *can't believe* as a whole could be extended to cover the empirical data considered in this paper. A full-throated attempt at such an analysis is unfortunately outside the scope of this paper, but I briefly discuss here some of the major empirical hurdles that such accounts might face.

5.1 *Believe* as quantifying over propositions

Spector & Egré (2015), following Lahiri (2002), propose that veridical predicates compose with questions via existential quantification over propositions. This is, fundamentally, a reductive account: the meaning of *believe q* is reduced to some *believe p*. A potential benefit, though, is that this gives *believe* a treatment analogous to modals, and possibly unificatory with other responsive predicates. A toy lexical entry for *believe* in such a view might resemble the following: [11]

(44) $[\![\text{believe Q}]\!] = \lambda x.\exists P \in Q(\text{x believe P})$

If we treat declaratives as denoting singleton sets of propositions (as done by e.g. Uegaki 2016), then the declarative-embedding properties of *believe* are preserved. This approach quickly runs into problems, as there is no reason why *believe* shouldn't always be compatible with embedded interrogatives, absent a concept of inquisitive

11 I abstract away here from whether *believe* is selecting for propositions or questions. This general schematic is compatible with a semantics where it selects for questions, or one where propositional arguments are type-shifted into singleton-set questions.

negation as in the Theiler et al. (2018) approach. In other words, this line of inquiry appears not to offer immediately obvious advantages over that of this paper.

A more plausible alternative, however, might be that *believe* **universally** quantifies over propositions:

(45) $[\![\text{believe Q}]\!] = \lambda x.\forall P \in Q$ (x believe P)

This will get us the anti-rogativity of *believe*, since if Q is interrogative, *believe* Q is always a contradiction, as people cannot *believe* multiple answers to the same question.

At the end of the day, however, reductive accounts (and indeed, all accounts which do not have a way of deriving subject-certainty presuppositions) struggle with *can't believe's* veridicality with interrogative complements–it would need to be stipulated into the semantics of *believe*, which is problematic given that *believe* can also of course ordinarily be negated. While Theiler et al. (2018) derive this presupposition inherently from their treatment of negation and clausal meaning, other accoutns face the burden of obtaining this presupposition some other way.

5.2 *Can't believe* as hyperbole

A purely compositional analysis (as the one proposed here), runs into its share of problems. For one, while *unbelievable* exhibits similar properties to *can't believe*, *not believable* does not:

(46) a. It's unbelievable who won the race.
b. ??It's not believable who won the race.

This is not easily accounted for under the current proposal if *not believe* and *unbelievable* are composed of identical semantic ingredients.

One possible explanation for this observation is that there is some degree of non-compositionality involved; maybe some lexical items can combine veridically with *believe*, but not others. For instance, perhaps *can't* in *can't believe* is receiving an interpretation in context which is not strictly the sum of the semantic values of its parts. After all, there are other hyperbolic uses of *can't–can't wait* is used in contexts where it is not strictly true. A person who utters (47) may not be referring to their physical inability to wait until tomorrow (indeed, unless they can time travel, they don't have much of a choice), but merely their anticipation and excitement.

(47) I can't wait until tomorrow!

Similarly, a team which is *unbeatable* is probably still so even if they lose 5% of the games they play. But if it is indeed the case *can't believe* is not interpreted fully

compositionally, we would need to determine to what extent (if any) compositional interpretation *is* involved, and whether this noncompositional interpretation is derived from particular lexical items, pragmatically, or some other way.

While this line of thinking is potentially fruitful, it ultimately faces some of the same limitations as a fully idiomatic account. For one, the cross-linguistic robustness of *can't believe* as a construction with particular properties would still raise the question of whether the use of *can't* in a hyperbolic way is also systematically possible across languages, and if so, why. Above all, a non-compositional approach must still grapple with the question of what type of complement *believe* selects and why interrogatives are not often embeddable under *believe* in the absence of particular modal and negation combinations.

6 Conclusion

This paper aims to make two main contributions. The first is an argment that that *believe* underlyingly selects interrogative complements, because it can take interrogative complements under certain circumstances. Following Theiler et al. (2018) I attribute the fact that *believe q* is nevertheless usually unacceptable from the fact that it systematically results in trivial (and therefore unacceptable) meanings, except in particular semantic contexts.

The second contribution concerns the *can't believe* construction. I observed that *can't believe* is (close to) veridical with interrogative complements, which I attributed to projection of an excluded middle presupposition of *believe* that reduces to subject-certainty when *believe*'s complement is interrogative. The intuitive characterization of *can't believe* as 'surprise'-denoting arises from a conflict between a speaker-certainty presupposition and an impossibility-of-speaker-certainty assertion.

This account suggests that some attitude predicates display more permissive selectional behavior in certain linguistic contexts, an observation which has been made in recent literature for predicates like *be certain* and *hope* (Mayr 2019; White 2019). This is indicative that we might want to consider clausal selection not only as a restriction on complements imposed by particular lexical predicates, but rather a bilateral compatibility relation between a predicate and its broader linguistic context, including its complement.

The arguments in this paper also open a number of exciting possible avenues for future research. For instance, given the similarity between *can't believe* and emotive factives like *be surprised*, it is empirically desirable to determine whether the two can be treated uniformly. Finally, if veridicality can be at least partly decomposable, as suggested, this approach may shed light on how it arises more generally.

References

Alchourrón, Carlos E., Peter Gärdenfors & David Makinson. 1985. On the logic of theory change: Partial meet contraction and revision functions. *Journal of Symbolic Logic* 50. 510–530.

Bartsch, Renate. 1973. 'Negative transportation' gibt es nicht. *Linguistiche Berichte* 27(7). 1–7.

Bhatt, Rajesh. 1999. Ability modals and their actuality entailments. In Kimary N. Shahin, Susan Blake & Eun-Sook Kim (eds.), *The 17th West Coast Conference on Formal Linguistics (WCCFL)*, 74–87. Stanford, CA: CSLI Publications.

Castroviejo, Elena & Isabel Oltra-Massuet. 2018. Generic and action-dependent abilities in Spanish 'Be capable'. *Glossa: a journal of general linguistics* 3(1). 131.

Ciardelli, Ivano, Jeroen Groenendijk & Floris Roelofsen. 2013. Inquisitive semantics: A new notion of meaning. *Language and Linguistics Compass* 7(9). 459–476.

Doyle, Jon. 1979. A truth maintenance system. *Artificial Intelligence* 12(2). 231–272.

Egré, Paul. 2008. Question-Embedding and Factivity. *Grazer Philosophische Studien* 77(1). 85–125.

Elliott, Dale E. 1971. *The grammar of emotive and exclamatory sentences in English*: Ohio State University PhD dissertation.

Elliott, Dale E. 1974. Toward a Grammar of Exclamations. *Foundations of Language* 11(2). 231–246.

Elliott, Patrick D., Nathan Klinedinst, Yasutada Sudo & Wataru Uegaki. 2017. Predicates of relevance and theories of question embedding. *Journal of Semantics* 34(3). 547–554.

Gajewski, Jon. 2002. L-analyticity and natural language. Ms., MIT.

Gajewski, Jon. 2007. Neg-raising and polarity. *Linguistics and Philosophy* 30(3). 289–328.

Grimshaw, Jane. 1979. Complement selection and the lexicon. *Linguistic Inquiry* 10(2). 279–326.

Groenendijk, Jeroen & Martin Stokhof. 1982. Semantic analysis of wh-complements. *Linguistics and Philosophy* 5. 117–233.

Groenendijk, Jeroen & Martin Stokhof. 1984. *Studies on the Semantics of Questions and the Pragmatics of Answers*: University of Amsterdam PhD dissertation.

Guerzoni, Elena. 2007. Weak exhausitivity and 'whether': A pragmatic approach. In *Proceedings of SALT 17*, 112–129. Washington, DC: LSA.

Guerzoni, Elena & Yael Sharvit. 2007. A question of strength: on NPIs in interrogative clauses. *Linguistics and Philosophy* 30(3). 361–391.

Gärdenfors, Peter & David Makinson. 1988. Revisions of knowledge systems using epistemic entrenchment. *Second Conference on Theoretical Aspects of*

Reasoning about Knowledge 83–95.
Heim, Irene. 1994. Interrogative semantics and Karttunen's semantics for *know*. In R. Buchalla & A. Mittwoch (eds.), *The Ninth Annual Conference and the Workshop on Discourse of the Israel Association for Theoretical Linguistics*, Academon, Jerusalem.
Hintikka, Jaakko. 1962. *Knowledge and Belief.* Cornell University Press.
Huddleston, Rodney. 1993. Remarks on the construction, "You won't believe who Ed has married". *Lingua* 91. 175–184.
Karttunen, Lauri. 1971. Implicative verbs. *Language* 47(2). 340–358.
Karttunen, Lauri. 1977. Syntax and semantics of questions. *Linguistics and Philosophy* 1(1). 3–44.
Kaufmann, Magdalena. 2012. *Interpreting Imperatives* (Studies in Linguistics and Philosophy). Dordrect, London: Springer.
Kiparsky, Paul & Carol Kiparsky. 1970. Fact. In M. Bierwisch & K.E. Heidolph (eds.), *Progress in linguistics: A collection of papers*, 143–173. The Hague & Paris: Moton.
Kratzer, Angelika. 1981. The notional category of modality. In Hans-Jürgen Eikmeyer & Hannes Rieser (eds.), *Words, Worlds, and Context: New Approaches in Word Semantics*, 38–74. Berlin: de Gruyter.
Lahiri, Utpal. 2002. *Questions and Answers in Embedded Contexts*. Oxford Studies in Theoretical Linguistics.
Mayr, Clemens. 2017. Predicting polar question embedding. In *Sinn und Bedeutung 21*, 1–18.
Mayr, Clemens. 2019. Triviality and interrogative embedding: context-sensitivity, factivity, and neg-raising. *Natural Language Semantics* 27(3). 227–278.
Michaelis, Laura. 2001. Exclamative constructions. In Martin Haspelmath, Ekkehard König, Wulf Oesterreicher & Wolfgang Raible (eds.), *Language Universal and Language Typology: An International Handbook*, 1038–1050. Berlin: Walter de Gruyter.
Pesetsky, David. 1982. *Paths and Categories*: Massachusetts Institute of Technology PhD dissertation.
Pesetsky, David. 1991. Zero syntax: vol. 2: Infinitives. Ms., MIT.
Portner, Paul. 2009. *Modality*. Oxford Studies in Theoretical Linguistics.
Roberts, Tom. 2018. Responsive predicates are question-embedding: Evidence from Estonian. In Uli Sauerland & Stephanie Solt (eds.), *Sinn und Bedeutung 22*, 271–288.
Romero, Maribel. 2015. Surprise-predicates, strong exhaustivity, and alternative questions. *Semantics and Linguistic Theory 25* 225–245.
Spector, Benjamin & Paul Egré. 2015. A uniform semantics for embedded interrogatives: *an* answer, not necessarily *the* answer. *Synthese* 192(6). 1729–1784.

Sæbø, Kjell Johan. 2007. A whether forecast. In B. ten Cate & H. Zeevat (eds.), *Logic, Language, and Computation*, 189–199. Berlin: Springer.
Theiler, Nadine, Floris Roelofsen & Maria Aloni. 2018. A uniform semantics for declarative and interrogative complements. *Journal of Semantics* 35(3).
Uegaki, Wataru. 2016. Content Nouns and the Semantics of Question-Embedding. *Journal of Semantics* 33(4). 623–660.
White, Aaron Steven. 2019. Nothing's wrong with believing (or hoping) whether. Ms., University of Rochester.
Zuber, Richard. 1982. Semantic restrictions on certain complementizers. In *The 12th International Congress of Linguists, Tokyo*, 434–436.

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