Knowing and believing things: what DP-complements can tell us about the argument structure and composition of (factive) attitudes

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Abstract

In the Hintikkan tradition, attitude verbs are viewed as relations between individuals and propositions, with differences among verbs understood in terms of the type of *accessibility relation*. Previous work on *know* and *believe* with SMALL CAPS CONTENT DPs (e.g. *Mary knows/believes the rumour that p*) have analysed *know DP* vs. *know CP* as polysemy. In this paper, I show that polysemy runs into conceptual and empirical problems, and propose instead a new derivational approach to *know*-verbs, which avoids polysemy. The proposed analysis links *know DP* and *know CP* to the same lexical root, which describes, broadly speaking, acquaintance. This analysis thus provides an explicit and compositional morpho-semantic link between *know DP* and *know CP* that accounts for the interpretation of DP-complements as objects of acquaintance, and further captures the idea (e.g. Kratzer 2002, a.o.) that knowledge, and factivity more broadly, is tied to acquaintance with a situation, the *res*. I also examine the syntax, semantics, and pragmatics of a different and less extensively studied type of DP-complement (Djärv's 2019 SOURCE DP, as in *Mary believes/*knows Anna that p*), and compare them with Content DPs. I show that whereas Content DPs and CPs both combine with verbs like *believe* as direct objects (via saturation of a propositional argument slot), Source DPs compose as indirect objects (via a type of attitudinal applicative head). Building on previous insights from Uegaki (2016), I explain the incompatibility of Source DPs with *know*-verbs in terms of a contrast with respect to question-embedding. The core insight of the current proposal is the idea that verbs like *know* and *believe* differ fundamentally at the level of argument structure and internal morpho-semantic composition, and thus combine with DPs via different routes; contrary to uniform approaches to *know* and *believe*. Whereas *believe*-verbs describe relations to intentional content, and require external licensing mechanisms to combine with DPs, *know*-verbs describe complex relations, fundamentally anchored in the attitude holder's acquaintance with (abstract or concrete) individuals in the world, and thus make reference to individuals as part of their argument structure. The current proposal also builds on and adds to previous work about connections between factivity, DP-complementation, and question-embedding.

1 Introduction

In the Hintikkan tradition, attitude verbs are standardly analysed as relations between individuals (so-called *attitude holders*) and propositions. That is, they quantify over worlds: if Mary believes that Lisa won, then all of Mary's belief-worlds are worlds in which Lisa won, as shown in (1).

(1) a. $[\![believe]\!]^w = [\lambda p_{<st>}.[\lambda x_e.DOX_x^w \subseteq p]]$, where
$DOX_x^w = \{w': w' \text{ conforms to what x believes in w}\}$
   b. $[\![(that) \text{ Lisa won}]\!]^w = \{w': \text{ Lisa won in } w'\}$
   c. $[\![Mary \text{ believes that Lisa won}]\!]^w = 1$ in w iff $DOX_{mary}^w \subseteq \{w': \text{ Lisa won in } w'\}$

On this approach, the primary semantic difference between *believe* (1), and the stronger alternative *know* (2), is in the type of *accessibility relation* that determines the set of worlds quantified over: DOX vs. EPIST. They differ additionally in that *know*, like other factives, is taken to presuppose that p is true in w; in line with the philosophical perspective on knowledge as 'justified true belief'.[1]

(2) a. $[\![know]\!]^w = [\lambda p_{<st>}[\lambda x_e: \underline{p(w)=1}.EPIST_x^w \subseteq p]]$, where:
$EPIST_x^w = \{w': w' \text{ conforms to what x knows in w}\}$
   b. $[\![(that) \text{ Lisa won}]\!]^w = \{w': \text{ Lisa won in } w'\}$
   c. $[\![Mary \text{ knows that Lisa won}]\!]^w = 1$ in w iff $EPIST_{mary}^w \subseteq \{w': \text{ Lisa won in } w'\}$
$\{\text{defined if Lisa won in w; otherwise } \#\}$

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[1] Though note that Gettier (1963) shows that while these conditions might be necessary, they don't seem to be sufficient.

In terms of the compositional semantics and the selectional properties of *know* and *believe*, this suggests that both types of verbs combine with propositions. Considering only cases where these verbs take declarative complements, this nicely captures the intuition that the main difference between (1-c) and (2-c) is that while both sentences imply that Mary takes p to be true, with *know*, unlike with *believe*, the *speaker* assumes that Mary has good reason to believe p, and also themselves takes p to be true.

A challenge for a uniform approach to the semantics of *know* and *believe* comes from their behaviour with DP complements.

1.1   Two empirical generalizations regarding *know DP* vs. *believe DP*

As has been observed by a number of authors since Prior (1971) and Vendler (1972) (e.g. Pietroski 2000; Ginzburg 1995; King 2002; Moltmann 2013; Uegaki 2016; Elliott 2016), verbs like *know* and *believe* differ in terms of their entailments, when they combine with CONTENT DPs like *the claim* or *the rumour*; i.e. nominals with propositional content (Higgins, 1973; Stowell, 1981; Grimshaw, 1990; Moulton, 2009). With such DPs, *know* and *believe* differ in terms of whether they entail the corresponding verb+CP sentence, as illustrated in (3). I will refer to this contrast as Generalization 1.

(3)   *Generalization 1: Entailment contrast*
     a.   Mary believes [$_{DP}$ the rumour that [$_P$ Lisa won]].   ⊨ Mary believes that p
     b.   Mary knows [$_{DP}$ the rumour that [$_P$ Lisa won]].   ⊭ Mary knows that p

Moreover, as noted by Djärv (2019), the entailment contrast tracks a separate contrast with respect to DP-complementation. *Believe*, unlike *know*, allows for what Djärv refers to as a SOURCE DP. Unlike Content DPs, these DPs are interpreted as the source of the propositional information provided the embedded clause — which, as shown in (4-b) may be either explicitly or contextually given. This contrast, which I refer to as Generalization 2, is illustrated in (4).[2]

(4)   *Generalization 2: Source contrast* (Djärv, 2019, 209–210)
     a.   I believe the referee (that Lisa won).
     b.   I know the referee (*that Lisa won).

Thus, as Djärv (2019) points out, in the case of *know*, Generalizations 1 and 2 reduce to one generalization, whereas in the case of *believe*, Generalizations 1 and 2 come apart. With *know*, both abstract individuals like *the rumour* and regular individuals like *the referee* are interpreted as an object of acquaintance. Crucially, the epistemic meaning that we get with CPs (2) disappears. With *believe*, on the other hand, the interpretation of the DP varies depending on the type of individual: Content DPs are interpreted as 'containers' of propositional information, whereas regular individuals are interpreted as sources of information. In both cases is the doxastic interpretation that we get with CPs (1) is preserved.

The main goal of this paper is to provide an explanation for the difference between *know* and *believe* in this respect. Specifically, I aim to address the following questions, raised by Generalizations 1 and 2:

(5)   *Analytical puzzles presented by Generalizations 1 and 2*
     a.   Why are *know DP* sentences interpreted as descriptions of acquaintance relations, with both abstract Content DPs and regular individuals like *Anna*?
     b.   Why does the interpretation of DPs with *believe* vary depending on the type of DP, such that Content DPs are (typically) interpreted as containers of propositional content whereas regular individuals like *Anna* are interpreted as sources of information?
     c.   Why do *believe DP* sentences, unlike *know CP* sentences, always preserve the doxastic meaning present with CP complements?

Previous work on the ambiguity of *know* has tended to analyse *know DP* vs. *know CP* in terms of polysemy; such that *know* —unlike *believe*— is ambiguous between an epistemic verb *know*$_{EPIST}$, which selects for propositional complements, and an acquaintance predicate *know*$_{AQ}$, which selects for individuals. In this paper, however, I point to a number of challenges for polysemy-based approaches, proposing

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[2]A brief note on Source DPs: some English speakers report finding heavier NPs clunky in Source-positions. However, most speakers I've consulted allow for both proper names and common nouns, given appropriate context. (i) is from COCA (Davies, 2008-), and seems fully natural to all speakers I've consulted.

(i)   Sometimes the patient doesn't believe the doctor that he's sick, until the doctor gives it a name.

instead a derivational approach whereby *know DP* and *know CP* share the same morpho-semantic core, a lexical root which describes, roughly speaking, an acquaintance relation between individuals. Crucially, DP complements saturate the object-of-acquaintance slot of this root; resulting in an acquaintance predicate (*know DP*) and effectively also blocking the derivation of the epistemic meaning (*know CP*), which is built on-top of this root in a morpho-semantically more complex structure, where the object-of-acquaintance slot of the root is saturated by a situation pronoun, contributing the *res*. Besides capturing the behaviour of *know*-verbs with respect to DPs vs. CPs, this account thus also provides a formal compositional implementation of the idea (e.g. in Kratzer 2002, a.o.) that knowledge and factivity are linked to acquaintance with a fact. Specifically, this proposal provides a derivational and conceptual link between the presence of factivity with CP-complements and the interpretation of DPs as objects of acquaintance.

Whereas *know*-verbs combine with individuals as part of their argument structure, I will argue that verbs like *believe* select for propositions, and therefore can only combine with DPs as direct objects of the verb, either via type-shifting (as proposed in Uegaki 2016 for Content DPs) or via an external licensing head in a type of attitudinal applicative construction (proposed here for Source DPs, building on previous insights by Djärv 2019). Specifically, I show that in terms of their argument structure, Source DPs are (optional) indirect objects, licensed by a type of attitudinal applicative head (cf. Cuervo 2003; Pylkkänen 2008). Semantically, I show that Source DP sentences share key aspects of their meaning with assertion reports (cf. Anand & Hacquard 2009). However, rather than being part of the truth-conditional meaning of the sentence, Source DPs are interpreted as part of the sentence's not-*at issue* content (similarly to 'affected arguments'; e.g. Bosse, Bruening, & Yamada 2012). Crucially, like other applicative heads, the head introducing the Source DP preserves the relation between the verb and the clause, thus guaranteeing that a sentence like (4-a) *I believe the referee that Lisa won* will entail that I believe that Lisa won, just like a sentence like *I baked the referee a cake* will entail that I baked a cake.

To explain why these two options for combining with DPs are not available to verbs like *know*, I follow Uegaki (2016), who argues that verbs like *know* underlyingly select for questions, whereas verbs like *believe* select for propositions, and that the compositional mechanism that allows *believe*-verbs to combine with Content DPs is only defined for proposition-selecting verbs, and thus not compatible with verbs like *know*. I show that the same holds for Source DPs. Previous work has also observed a connection between factivity (or veridicality) and question-embedding (e.g. Egré 2008; Spector & Egré 2015; Uegaki 2015; Uegaki & Sudo 2017; Theiler et al. 2018; Steinert-Threlkeld 2019). Uegaki (2016) further links question-embedding to the interpretation of Content DP. The current proposal adds to the empirical and analytical picture by offering a compositional link between the acquaintance-interpretation with DPs and factivity with CPs, which also makes predictions for the link between factivity and question-embedding (see also Section 4.5 for discussion of the non-factive veridical verb *prove*).

Thus, the core of this proposal is that verbs like *know* and *believe* differ fundamentally at the level of argument structure and internal composition, and thus combine with DPs via different routes; contrary to uniform approaches. Whereas *believe*-verbs describe relations to intentional content and require external licensing mechanisms to combine with DPs, *know*-verbs describe complex relations, fundamentally anchored in the attitude holder's acquaintance with (abstract or concrete) individuals in the world.

Before moving on, note that the contrasts in (3) and (4) are not due to some lexical quirk of *believe* vs. *know*, but represents a more general split between two classes of verbs, which for descriptive purposes, I will refer to simply as *know*-verbs and *believe*-verbs. As has previously been noted, *know* is representative of a fairly large class of epistemic verbs. *Believe*, on the other hand, appears to represent a much smaller class of non-factive doxastic predicates, including also verbs like *trust* and *doubt*. (6)–(7) illustrate:

(6)　*Generalization 1 across verbs* (based on Uegaki 2016; Elliott 2016; Djärv 2019)
　　a.　Mary {believes, trusts, doubted} the rumor that Lisa won.
　　　　⊨ Mary {believes, trusts, doubted} that Lisa won.
　　b.　Mary {knows, discovered, noticed} the rumor that Lisa won.
　　　　⊯ Mary {knows, discovered, noticed} that Lisa won.

(7)　*Generalization 2 across verbs* (based on Djärv 2019, 208–211)
　　a.　I trust him (that he will do the best for me).[3]
　　b.　Do you have any reason to doubt him (that it was on that night that [it] happened)?[4]
　　c.　Mary {knows, discovered, noticed} (*you) that Lisa won.

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[3]Original example from Free Children's Ministry Resources; `equipu.kids4truth.com`
[4]Original example from Independent Counsel Solomon L. Wisenberg in a transcript of the Clinton Grand Jury Testimony, in Kuntz, Phil (ed). The Evidence: The Starr Report, p. 375

As we shall see in Section 2.2, Uegaki (2016) characterize the two classes in terms of a contrast with respect to question-embedding. Adding to the empirical picture, I show that the split also tracks factivity. In Section 4.1, I discuss the extent to which non-factive verbs like *explain*, which have previously been proposed to pattern like *know* with respect to Content DPs, should be analysed on par with factive *know*-verbs in terms of their argument structure and semantic composition.

1.2 Outline of paper

This paper is structured as follows: In Section 2, I discuss previous approaches to the entailment-contrast (Generalization 1); focusing in Section 2.2 on Uegaki's (2016) proposal. This section spells out the key assumptions which my proposal adopts from Uegaki (2016) regarding Content DPs and the link to question-embedding. However, previous approaches, including Uegaki's, have tended to appeal to polysemy in order to account for the interpretation of *know DP* vs. *know CP*. In Section 2.3, I point to a number of empirical and conceptual issues for polysemy-based approaches. Section 3 examines and provides new observations about the interpretation and argument-structure of Source (vs. Content) DP sentences in English and German. In Section 3.1, I look at the morpho-syntax of Source DPs and Content DPs; showing that Source DPs pattern like indirect objects, whereas Content DPs, like CPs, pattern like direct objects of *believe*-verbs. In Section 3.2, I examine the meaning of Source DP sentences, showing that they behave semantically like assertion reports. In Section 3.3, I show that this assertion (source) inference is not-*at issue*. Section 4 presents the current proposal for CP and DP-complementation of *know* and *believe*-verbs. In Section 4.1, I spell out a novel proposal for the derivation of *know DP/CP* sentences, and in Section 4.2, I offer a novel analysis of Source DP sentences. In Section 4.3, I show how these proposals, combined with Uegaki's (2016) analysis of Content DPs, is able to derive both Generalization 1 and 2; thus answering the questions in (5). Section 4.4 resolves an issue regarding a morpho-syntactic contrast between languages like English and German raised in Section 3.1, and Section 4.5 discusses three potential counter-examples to the link between DP-complementation and question-embedding. Finally, in Section 5, I compare the current proposal with two alternative approaches to CP and DP complementation with *know* and *believe*, offering arguments in favour of the current proposal. Section 6 concludes.

2 Background: Generalization 1 (Entailment)

2.1 *Know CP/DP* as polysemy?

Above we saw that with DP-complements, *know*-verbs are interpreted as describing some type of acquaintance relation to an individual. A natural way to capture this observation would be to say that *know*-verbs are ambiguous between a propositional verb and an acquaintance verb. This idea, illustrated in (8), has been proposed for instance by King (2002); Moltmann (2013), and Uegaki (2016).

(8) Polysemy of *know* (to be rejected):
    a. $[\![\text{know}_{EPIST}]\!]^w = [\lambda p_{<st>}.[\lambda x_e: \underline{p(w)=1}.\text{EPIST}_x^w \subseteq p]]$ Hintikkan attitude: *know CP*
    b. $[\![\text{know}_{AQ}]\!]^w = [\lambda y_e.[\lambda x_e.\underline{\text{acquainted}_w(x)(y)}]]$ Acquaintance verb: *know DP*

Intuitive support for this idea comes from the fact that languages like German, French, and Swedish use different forms for these two meanings:

(9) a. Sara vet   att Lisa vann.
        Sara knows that Lisa won
        Sara knows that Lisa won.   Epistemic *know* (Ger. *wissen*, Fr. *savoir*)
    b. Sara känner Lisa.
        Sara knows Lisa
        Sarah knows Lisa.   Aquaintance-*know* (Ger. *kennen*, Fr. *connaitre*)

However, as Uegaki (2016) points out, appealing to polysemy is not in itself enough to account for Generalization 1, the entailment contrast. Section 2.2 presents the problem and Uegaki's solution.

2.2 The connection to question-embedding (Uegaki, 2016)

To account for Generalization 1, the entailment contrast in (3), Uegaki (2016) adopts the assumption that *know* is ambiguous between an epistemic attitude verb and an acquaintance predicate. However, he shows that polysemy alone is not enough to account for Generalization 1. The reason for this is that if we assume: (a) that the DP-to-CP entailment with *believe*-verbs is derived *compositionally* (i.e. that some general compositional mechanism enables Content DPs to combine with *believe* and give rise to the entailment); and (b) that *know* and *believe*-verbs are of the same semantic type, as on the Hintikkan picture, then we incorrectly predict that both *know* and *believe* verbs should be able to combine with DPs and compositionally give rise to the entailment.

Uegaki's (2016) solution is to reject the second assumption, that *know* and *believe*-verbs are of the same semantic type.[5] This is motivated by Uegaki's (2016) observation that the entailment contrast (Generalization 1) tracks a different contrast in terms of question-embedding (Karttunen 1977a, *et seq*): whereas *know*-verbs embed both declarative and interrogative complements, *believe*-verbs are exclusively declarative embedding. I refer to this contrast, illustrated in (10), as Generalization 3.[6]

(10)   *Generalization 3: Selection contrast* (Uegaki, 2016, 623)
    a.   Mary knows/discovered {that Lisa came / who came} to the party.
    b.   Mary believes/trusts {that Lisa came / *who came} to the party.

Uegaki (2016) argues that both Generalization 1 and 3 can be accounted for if we assume that epistemic, CP-selecting *know*-verbs select for questions (type $\langle st,t \rangle$), whereas *believe*-verbs select for propositions (type $\langle st \rangle$), and that *know*-verbs are polysemous between an epistemic question-selecting verb and an acquaintance-predicate, as shown in (11).

(11)   Lexical entries (Uegaki, 2016, 631-641)
    a. $[\![\text{believe}]\!]^w = [\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p]]$
    b. $[\![\text{know}_{EPIST}]\!]^w = [\lambda Q_{<st,t>}.[\lambda x_e.\exists p \in Q[p(w)=1 \wedge \text{DOX}_x^w \subseteq p]]$
    c. $[\![\text{know}_{AQ}]\!]^w = [\lambda y_e.[\lambda x_e.\text{acquainted}(x)(y)(w)]]$

In terms of Generalization 3, Uegaki (2016) accounts for it via the assumption that it is possible to shift propositions p into the singleton sets that contain them, {p}; i.e. to questions with only one alternative. This is achieved by the type-shifter ID in (12).[7,8]

(12) $[\![\text{ID}]\!]^w = [\lambda p_{<st>}.[\lambda q_{<st>}.q=p]]$ p-to-Q type shifter (Uegaki, 2016, 632)

This allows *know*-verbs to combine with declaratives as singleton proposition sets, but leaves *believe*-verbs without a way to combine with questions, thus straightforwardly deriving Generalization 3 (13)–(14).[9]

(13)   Uegaki's (2016) solution to Generalization 3: Declarative CPs
    a. $[\![\text{Mary believes that Lisa won}]\!]^w=1$ in w iff $\text{DOX}_m^w \subseteq \{w': \text{won}(lisa)(w')\}$
    b. $[\![\text{Mary knows that Lisa won}]\!]^w=1$ in w iff $\exists p \in \{\lambda w'.\text{won}(lisa)(w')\}[\text{EPIST}_m^w \subseteq p]$

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[5] In Section 5.1, I discuss an alternative approach, from Elliott (2016), which takes the *lack of the entailment* to be the compositional default, and treats the presence of the entailment with *believe* as a lexical exception. As we shall see however, this proposal faces a number of empirical challenges.

[6] The link between Generalizations 1 and 3 has been challenged by Theiler et al. (2019), who note two potential counter-examples: *prove* and *hear*. In Section 4.5, I return to these cases along with another potential counter-example: *doubt*. I argue that these cases are not in fact problematic for the current account.

[7] The name ID is inspired by the analogous $\langle e,\langle et \rangle \rangle$ type-shifter IDENT from Partee (1986).

[8] Uegaki (2016) also argues that a type-shifter is available to allow epistemic *know* to combined with DPs as concealed questions, which are of type $\langle st,t \rangle$. This is a different reading from what we saw with the *know DP*-sentences in Section 1:

(i)   Mary knows the price of milk. ⤳ Mary knows what the price of milk is.

Thus, DPs that denote concealed questions must combine with $know_{EPIST}$ and not with $know_{AQ}$. For concreteness sake, I assume the analysis from Uegaki (2016) (based on Aloni 2008), whereby the CQ reading of the DP is derived via a CQ type shifter (type $\langle e,\langle st,t \rangle \rangle$). For discussion and details, see Uegaki (2016, p. 638) and Aloni & Roelofsen (2011).

[9] There are other proposals on the market addressing the observation that *believe* and *know*-verbs differ with respect to the availability of question-complements. On the classic approach (e.g. Karttunen 1977a; Groenendijk & Stokhof 1984; Lahiri et al. 2002, a.o.), responsive predicates (verbs like *know*) select for propositions, and these verbs combine with questions by question-to-proposition reduction. For a comparison of the current approach with such approaches, I refer the reader to detailed discussion in Uegaki (2016, Sec. 4.2). More recently, Theiler, Roelofsen, & Aloni (2019) have proposed a uniform approach to question and declarative embedding, couched in the framework of Inquisitive Semantics. Here I follow Uegaki's (2016) approach, leaving it an open question for future research whether Generalizations 1 and 2 would be compatible with an approach along the lines of Theiler et al. (2019).

(14)   Uegaki's (2016) solution to Generalization 3: Interrogative CPs
   a. $[\![$M. believes whether Lisa won$]\!]^w = \#$ ***Type-mismatch***
   b. $[\![$M. knows whether L. won$]\!]^w = 1$ in w iff $\exists p \epsilon \{\lambda w'.won(l)(w'), \lambda w'.\neg won(l)(w')\}[\text{EPIST}_m^w \subseteq p]]$

To account for Generalization 1, Uegaki (2016) proposes a general compositional mechanism which enables Content DPs to combine with *believe* and derives the entailment: the type-shifter CONT in (15).

(15) $[\![\text{CONT}]\!]^w(x) = \lambda w'.w' \epsilon \text{CONT}_w(x)$ Content retrieval type shifter (Uegaki, 2016, 634)
   $\left\{ \begin{array}{l} \textit{defined if } \text{CONT}_w(x) = \text{CONT}_{w'}(x) \\ \# \textit{ otherwise} \end{array} \right\}$

This type-shifter relies on the content function CONT from Kratzer (2006) and Moulton (2009) in (16), which extracts the intentional content, a proposition, from individuals like *the rumour* or *the claim*.

(16)   a. $\text{CONT}_w(x) = \{w': w'$ is compatible with the intentional content determined by x in w$\}$
   b. $[\![$the claim that Lisa won$]\!]^w = \iota x.claim_w(x) \ \& \ \text{CONT}_w(x) = \{w': won(\textit{lisa})(w')\}$

Applied to a contentful individual like *the claim that Lisa won*, (15) returns the intentional content of that individual, as shown in (17). The presupposition ensures that the attitude holder additionally believes that p is the content of the rumour or the claim; given the standard assumption that the presupposition of *believe*'s complement universally projects to the attitude holder's beliefs (Karttunen, 1974).

(17) $[\![\text{CONT}]\!]^w([\![$the claim that Lisa won$]\!]^w) = \lambda w'.won(\textit{lisa})(w')$
   $\left\{ \begin{array}{l} \textit{defined if } \text{CONT}_w([\![\text{the claim that Lisa won}]\!]) = \text{CONT}_{w'}([\![\text{the claim that Lisa won}]\!]) \\ \# \textit{ otherwise} \end{array} \right\}$

As shown in (18), this straightforwardly allows proposition-selecting *believe* (11-a) to combine directly with the Content DP, and also predicts that *believe Content DP* sentences will entail the corresponding *believe CP* sentences (13-a). At the level of truth-conditional content, these are equivalent.

(18)   Uegaki's (2016) solution to Generalization 1: *believe*
   $[\![$Mary believes the claim that Lisa won$]\!]^w = 1$ in w iff $\text{DOX}_m^w \subseteq \{w':won(\textit{lisa})(w')\}$
   $\left\{ \begin{array}{l} \textit{defined if } \text{DOX}_{mary}^w \subseteq \{w'|\lambda w''.won(\textit{lisa})(w'') = \text{CONT}(w')([\![\text{the claim that Lisa won}]\!])\} \\ \# \textit{ otherwise} \end{array} \right\}$

Given the assumption that *know*-verbs are ambiguous between a question-selecting attitude verb and an acquaintance relation between individuals, this analysis also guarantees that the only way for *know*-verbs to combine with a Content DP will be via the acquaintance-predicate in (11-c) (thus giving rise to an acquaintance-relation (19-b)). With the question-embedding predicate in (11-b), composition with (15) will result in a type-mismatch, as illustrated in (19-a).[10]

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[10]A reader may wonder whether it would be possible to nest the two types shifters, as in (i), and thus derive the entailment with *know*-verbs.

(i)   John knows$_{EPIST}$ [ID [CONT [the rumor that Mary left]]]. (Uegaki, 2016, 642)

To avoid this issue, Uegaki (2016, Sec. 3.2.3) presents two potential solutions, one in terms of an economy or blocking constraint on type shifting, and one in terms of a different assumption about the basic semantic type of declaratives. The first solution is to suggest that the nesting of CONT and ID as in (i) is blocked by the *CQ* type shifter ($\langle e, \langle st, t \rangle \rangle$) mentioned in footnote 8, which shifts entities to concealed questions. This blocking is couched in terms of a more general economy principle on type shifting operations, which states that: *A structure involving successive applications of multiple type-shifters α and β to the form φ i.e., $[\beta[\alpha \ \varphi]]$, is ruled out if there is a basic type-shifter γ such that the semantic type of $[\gamma \ \varphi]$ is the same as that of $[\beta[\alpha \ \varphi]]$* (Uegaki, 2016, 643, ex. (45)). Crucially, type-shifting is viewed as a last resort *repair strategy* to resolve type-mismatches, which is blind to the actual meaning of the type-shift. That is, given a type-mismatch, the grammar will simply choose the simplest type-shifting operation available. Thus, given that the *CQ* type shifter ($\langle e, \langle st, t \rangle \rangle$) achieves in one step what the nesting of CONT and ID would achieve in two steps, the application of first CONT and then ID to a Content DP, in order to derive a singleton question meaning, is ruled out. The other solution (which Uegaki attributes to a suggestion by Floris Roelofsen, pc), is to assume that declaratives are fundamentally singleton proposition sets, and that, in order to combine with proposition-selecting verbs like *believe*, they must be shifted to propositions. As Uegaki points out, this too would preserve the explanation in terms of a type-distinction, but avoids the potential problem of nesting.

 For current purposes, it is not crucial which of the solutions is adopted, given that this problem does not arise in the context of the current account for Generalization 2 (the source contrast) provided in Section 4.2. In what follows, I will continue to assume, with Uegaki (2016), that declarative complement clauses are fundamentally proposition denoting. Adding further to the explanation in terms of an economy principle, I would also like to suggest that the restriction on the nesting of CONT and ID might also be viewed in terms of avoiding 'look-ahead', in favour of a local economy of derivations. That is, in order to resolve the type-mismatch between *know*$_{EPIST}$ ($\langle \langle st, t \rangle, \langle et \rangle \rangle$) and a Content DP ($\langle e \rangle$) by step-wise

(19) Uegaki's (2016) solution to Generalization 1: *know*

    a. $[\![\text{know}_{EPIST}]\!]^w([\![\text{CONT}]\!]^w([\![\text{the claim that Lisa won}]\!]^w)) = \#$ ***Type-mismatch***

    b. $[\![\text{know}_{AQ}]\!]^w([\![\text{the claim that Lisa won}]\!]^w = 1$ in w iff $\text{acquainted}(x)(\iota x.\text{claim}_w(x) \ \& \ \text{CONT}_w(x) = \{w': \text{won}(lisa)(w')\})(w)$

Uegaki's (2016) proposal thus accounts for Generalizations 1 and 3 by appealing to three ingredients: (i) a selectional difference between clause-embedding *know* and *believe*-verbs (11); (ii) the two type-shifters in (12) and (15); and (iii) polysemy of *know*-verbs, as shown in (11).

I agree with the key point made by Uegaki (2016), that if we assume a uniform analysis of the semantics and selectional properties of CP-selecting *know* and *believe*, then it will be difficult to explain why they differ with respect to the entailment with Content DPs (Generalization 1).[11] That is, the interpretive contrast with DPs is in itself an argument for a non-uniform analysis of CP-selecting *know* vs. *believe*. Crucially, this argument only requires the assumption that the entailment is derived via some general compositional mechanism. Given that the entailment contrast occurs across verbs (and as we shall see in Section 3, with similar verbs across languages), and tracks both question-embedding and the availability of Source DPs, I take this assumption to be motivated.

In my analysis of Generalizations 1 and 2, and in addressing the puzzles in (5), I therefore adopt two of the three ingredients of Uegaki's (2016) analysis: (i) the assumption of a selectional difference between clause-embedding *know* and *believe*-verbs, and (ii) the two type-shifters in (12) and (15).[12] However, I reject the third assumption, that *know*-verbs are systematically polysemous. In the following section, I spell out the reasons for rejecting polysemy, and in Section 4.1, I propose instead a new decompositional analysis of *know*-verbs, whereby CP and DP-selecting *know*-verbs are derivationally related.

Additionally, it's clear that the above analysis doesn't say anything about Source DPs (Generalization 2), and why it should correlate with Generalizations 1 and 3. In Section 3.1, I examine the syntax and semantics of *believe DP* sentences in greater detail, and in Section 4.2, I provide an novel analysis of Source DPs (building on insights from Djärv's 2019 discussion of Source DPs in German).

2.3 Problems with polysemy of *know*-verbs (Djärv, 2019)

As argued by Djärv (2019), there are several problems with assuming that *know*-verbs are ambiguous between an epistemic, clause-embedding verb, and an acquaintance predicate, as in (8)/(11). First, while the contrast in (9), between *wissen/veta/savoir* and *kennen/känna/connaitre* in German, Swedish, and French, seems to support the claim that English *know* is polysemous, the interpretation of DPs as individuals doesn't just arise with *know*, but with essentially all factive clause-embedding verbs (e.g. *notice, discover, see, like, resent*). In order to generalize, a polysemy-based account would therefore have to posit systematic polysemy for *all* of these verbs. Besides *know*, however, I am not aware of any language that systematically distinguishes between CP- and DP-selecting *forms* of these verbs; thus undermining the argument from the formal distinction in (9).

Moreover, by appealing to polysemy, we fail to capture the strong intuition that the CP- and DP-taking versions of *know, notice, discover, see, love, resent*, etc. all share a semantic core. On the polysemy analysis of CP and DP-selecting *know* in (8)/(11), where the two are simply different lexical items, it is

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application of first CONT and then ID, the computational semantics, at the point where CONT ($\langle e,st\rangle$) is applied to the DP, would need to know that further application of ID ($\langle\langle st\rangle,\langle st,t\rangle\rangle$) will eventually resolve the type-mismatch. That is, the grammar would need to have access to more global information than is available at that particular point in the derivation.

[11] The same issue would also arise in the context of Source DPs (Generalization 2): if *believe*-verbs are compatible with Source DPs, and *believe* and CP-selecting *know*-verbs differed only with respect to the type of accessibility-relation, as per the Hintikkan approach in (1)–(2), then it's hard to explain why CP-selecting *know* is not compatible with Source DPs.

[12] An alternative to using the type-shifter in (15) can be found in Djärv (2019, Sec. 4.5), who takes the content function in (16-a) to be part of the lexical meaning of verbs like *believe* (but not *know*), as shown in (i-a). On this view, *believe*-verbs describe states of believing the propositional content of contentful individuals. While this proposal also straightforwardly derives the entailment of *believe*+Content DPs, it complicates the semantic types of clausal complements, which Djärv (2019) suggests are shifted from propositions to contentful individuals via a C-head, as shown in (i-b)–(i-c):

(i)   Djärv (2019, 248-9)

    a. $[\![\text{believe}_{x_c}]\!]^w = \lambda x_c.\lambda s_l.\text{belief}(s)(\text{CONT}(x)(w_s))$

    b. $[\![\text{C}^o_{cont}]\!]^w = \lambda p_{<st>}.\iota x_c.\text{CONT}(x_c)(w) = p$

    c. $[\![\text{CP}]\!]^w = \iota x_c.\text{CONT}(x_c)(w) = p$ cf. $[\![\text{the claim that p}]\!]^w = \iota x_c.\text{CONT}(x_c)(w) = p \ \& \ \text{claim}(x_c)(w)$

The main question for this proposal is about the link to question-embedding: should the analysis of declaratives as contentful individuals be extended to clausal complements of verbs like *know*? This is what Djärv (2019) proposes, but if so, where does that leave the relation between declarative and question-complements of such verbs?

not clear what derives this intuition. In fact, on such an analysis, we might expect (20) to behave more like (21), which can only be acceptable as a joke or word-play.

(20)   a.   I love many things: I love my family and I love that I have so many great friends.
       b.   Today I noticed two disturbing things: I noticed an ominous sign on the wall and I noticed that my neighbour's car had been broken into.

(21)   a.   #Today I did a lot of firing: I fired a hunting rifle and I fired my manager.
       b.   #I can tell you two things about pupils: they tend to dilate in bright light and they are never able to sit still.

Finally, Swedish data actually speaks *against* polysemy: in complex forms, *känna* (by hypothesis $know_{AQ}$ (8-b)) can combine with questions, as shown in (22). This would be difficult to account for on the above analysis where there is no derivational link between $know_{AQ}$ ($\langle$e,et$\rangle$) and $know_{EPIST}$ ($\langle\langle$st,t$\rangle$,$\langle$et$\rangle\rangle$).[13]

(22)   a.   Jag känner till [$_{DP}$ Anna]
            I   know   to   Anna
            I'm aware of Anna.
       b.   Jag känner till [$_Q$ vem som gjorde vad].
            I   know   to   who that did   what
            I'm aware of who did what.

I therefore reject the polysemy analysis and propose instead (in Section 4.1) a decompositional analysis of *know*-verbs, whereby the DP and CP-selecting forms of these verbs are derivationally related via the same lexical root. Before turning to the analysis of *know CP/DP*, however, I return to the question of how to analyse Source DPs and how they differ from Content DPs.

3   New data: *believe* (Source vs. Content) DP

In this section, I look in more detail at the structure and interpretation of *believe DP* sentences. I start in Section 3.1 by looking at the semantic and syntactic differences between Content DPs and Source DPs; showing that while Content DPs combine with *believe* by saturating its propositional argument slot (in line with the semantic analysis from Uegaki 2016), Source DPs behave like a type of unselected, externally licensed argument. In Sections 3.3 and 3.2, I further examine the meaning of Source DPs; showing that Source DPs are interpreted similarly to reported assertions (Section 3.2), and that this inference is not-*at issue* (Section 3.3).

3.1   LFs of Source DP and Content DP sentences

As we saw in Section 1, when *believe*-verbs combine with Content DPs like *the claim* or *the rumour*, they entail the corresponding verb+CP sentence (Generalization 1). In the previous section, we saw that Uegaki (2016) accounts for this by type-shifting Content DPs to propositions, thereby allowing Content DPs to combine with *believe* by saturating its propositional argument slot.

Turning now to Source DPs, Djärv (2019) observes that in English, Source DPs and Content DPs cannot co-occur, as shown in (23):

(23)   Djärv (2019, p. 235)
       *I believe you the claim that Mary is a genius.

This might lead us to think that the two DPs saturate, and therefore compete for, the same argument slot of *believe*,[14] and that the interpretation of the DP depends on other factors (e.g. pragmatic factors like plausibility).

However, Djärv (2019) shows based on German data that this cannot be the right explanation: in German, as shown in (24), the two types of DPs *can* co-occur:[15]

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[13]The presence of multiple *wh*-elements in (22-b) ensures that the complement is interpreted as a question of type $\langle$st,t$\rangle$, and not as a free relative of type *e* (e.g. Dayal 2016).

[14]This has in fact been proposed by Roberts (2020), who gives a similar analysis of *believe* to Djärv (2019) (see fn. 12), but proposes that both Source DPs and Content DPs saturate the type e argument slot of *believe*; see Section 5.2.

[15]Thanks to Florian Schwarz, pc., for this observation.

(24) German (Djärv, 2019, 235)

Ich glaube ihr die Behauptung, dass Maria ein Genie war.
I believe her.DAT the.ACC claim that Maria a genius was

*I believe the claim, that she told me, that Maria was a genius.*

One possibility, in view of this contrast, is to suggest that Source DP sentences in German and English are derived in different ways. However, as we shall see in the remainder of this section, there is good evidence in favour of a uniform approach to Source and Content DPs in German and English, both in terms of their semantics and argument structure. Furthermore, Source DPs and Content DPs in both English and German behave differently from one another in terms of their morpho-syntactic properties; thus showing us that the two DPs do not occupy the same argument slot. Specifically, I will show that the argument structure of *believe*, in both German and English, is parallel to that of optionally ditransitive verbs like *bake*, illustrated in (25).

(25) a. *Mary baked a cake.* b. *Mary baked Anna a cake.* (after Pylkkänen 2008)
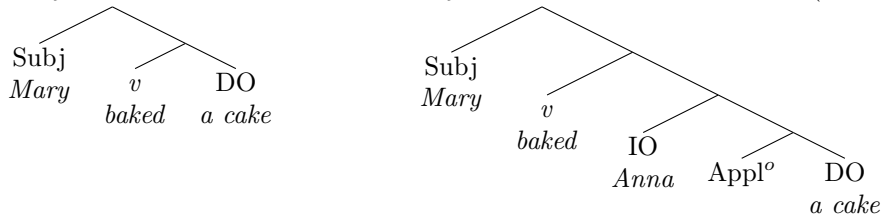
We shall see that (in both languages) Source DPs pattern like *indirect objects* of *believe*-verbs, whereas Content DPs and CPs both pattern like *direct objects*. In short, the data speaks strongly *against* a uniform analysis of Source DPs and Content DPs, and also strongly *in favour* of a uniform treatment of English and German *believe CP/DP* sentences.[16] The proposed LFs of *believe CP/DP* sentences is given in (26) (using F^o as a place-holder for the head that will be proposed in (81) in Section 4.2).

(26) **Proposed LFs for *believe CP/DP* sentences**

a. Clauses & Content DPs b. Source DPs
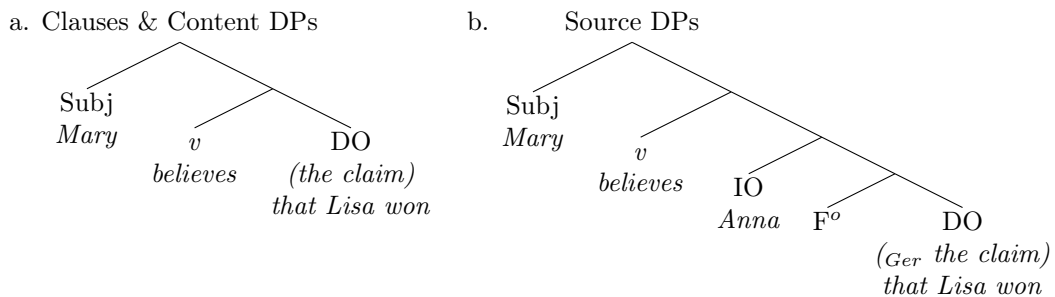
Here, I will discuss two types of morpho-syntactic evidence for this proposal: Case on Source vs. Content DPs and extraction possibilities. First, however, let us establish that German behaves like English with respect to Generalizations 1 and 2. As shown in (27)–(28), *believe*, but not *know*, triggers the DP-to-CP entailment with Content DPs and permit Source DPs.

(27) Generalization 1: German

 a. Er glaubt die Behauptung, dass Hans Maria das Buch gab.
    He believes the.ACC claim that Hans Maria the book gave
    He believes the claim that Hans gave Maria the book.
    ⊨ He believes that Hans gave Maria the book.
 b. Er kennt/*weiß die Behauptung, dass Hans Maria das Buch gab.
    He knows$_{AQ}$/knows$_{EPIST}$ the.ACC claim that Hans Maria the book gave
    He knows the claim that Hans gave Maria the book.
    ⊭ He knows that Hans gave Maria the book.

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[16]Up to a degree; which I will argue is case-licensing; see discussion in Section 4.4.

(28) Generalization 2: German (Djärv, 2019, 235)

    a. Ich glaube ihr,   dass Hans Maria das Buch gab.
       I   believe her.DAT that Hans Maria the book gave
       I believe her that Hans gave Maria the book.

    b. *Ich weiß/kenne   ihr/sie,   dass Hans Maria das Buch gab.
       I   know$_{AQ}$/know$_{EPIST}$ her.DAT/ACC, that Hans Maria the book gave
       I know from her that Hans gave Maria the book.

    1. Case on Source vs. Content DPs. As we saw in (24) and (27)/(28), Source DPs in German are marked with Dative case, and Content DPs with Accusative. This is true also in cases where they do not co-occur, and when the proposition is contextually provided, as shown in (29-c).

(29) German (Djärv, 2019, 235)

    a. Ich glaube ihr/*sie,   dass Maria ein Genie war.
       I   believe her.DAT/ACC that Maria a   genius was
       I believe her that Maria was a genius.

    b. Ich glaube die/#der   Behauptung, dass Maria ein Genie war.
       I   believe the.ACC/DAT claim   that Maria a   genius was
       I believe the claim that Maria was a genius.[17]

    c. Ich glaube ihr/*sie.
       I   believe her.DAT/ACC
       I believe her.

Importantly, this is not the default. As shown in (30), DP-complements of *know*-verbs are marked with Accusative.

(30) German

    a. Ich kenne sie/*ihr.
       I   know her.ACC/DAT
       I know her.

    b. Ich habe sie/*ihr   bemerkt/entdeckt.
       I   have her.ACC/DAT noticed/discovered.
       I noticed/discovered her.

The case-marking pattern that we find with Source DPs is the same pattern that we find with optionally transitive verbs like *bake* and *steal*. As shown in (31-b), German allows both Goal and Source Applicatives. In either case, indirect objects, like Source DPs, are marked with Dative, and direct objects, like Content DPs, are marked with Accusative.

(31) German

    a. Sie   gab ihr   den   Schlüssel.
       she.NOM gave her.DAT the.ACC key
       She gave the key to her.   ✓Goal Applicative

    b. Sie   stahl ihr   den   Schlüssel.
       she.NOM stole her.DAT the.ACC key
       She stole the key from her.   ✓Source Applicative

English, on the other hand, has only Goal Applicatives (32).

(32)   a. She gave her the key. (≈ *She gave the key to her.*)   ✓Goal Applicative
      b. *She stole her the key. (≈ *She stole the key from her.*)   ✗Source Applicative

    Djärv (2019) uses this observation to argue that the co-occurrence contrast in (23)–(24) follows from Source DPs in German being licensed by a regular Source Applicative head, illustrated in (33-b).

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[17]Note that in (29-a), the Accusative form is marked *, whereas in (29-b), the Dative form is marked #. This represents the fact that certain kinds of Content DPs may also function as Source argument, namely so-called Repository-of-Information nominals like *report* (see Anand & Hacquard 2009). I return to this point in Section 3.2.

(33)   Pylkkänen (2008, 45)
   a. $\llbracket \text{Appl}^o_{goal} \rrbracket = \lambda\text{x}.\lambda\text{y}.\lambda\text{f}_{<e,vt>}.\lambda\text{e}.\text{f}(\text{e},\text{x})$ & to-the-possession(x,y)   Goal Applicative
   b. $\llbracket \text{Appl}^o_{source} \rrbracket = \lambda\text{x}.\lambda\text{y}.\lambda\text{f}_{<e,vt>}.\lambda\text{e}.\text{f}(\text{e},\text{x})$ & from-the-possession(x,y)   Source Applicative

Djärv 2019 argues that since the Appl^o head assigns Dative to the Source DP, the head associated with *believe* is free to license the Content DP with Accusative, thus capturing the fact that the two types of DPs can co-occur in German (24). In English, on the other hand, which does not have Source Appl^o, there is only *one* case-assigning head present in the syntax, namely that associated with *believe*. Hence (on the assumption that DPs need to be case-licensed in the syntax[18]), English allows only one DP (23): a Source DP or a Content DP, but not both. (Djärv, however, does not provide an explanation for how Source DPs are licensed and compose with *believe*-verbs in English.)

I will adopt the core of Djärv's (2019) insight, but argue that the above explanation is only partially correct. I agree with Djärv that Source DPs involve the same type of syntactic and argument-structural configuration as regular applicatives, as shown in (26). However, as I will show next, this analysis turns out to be motivated for *both* German and English. (In Sections 3.2–3.3, I will also show that Source DP sentences are semantically and pragmatically different from standard (*bake/steal*) applicatives; thus also motivating a different semantic analysis from that in (33-b).)

2. Extraction possibilities. Here I show that Source DPs in both German and English behave like indirect objects of verbs like *bake* and *steal* with respect to extraction in passives, whereas Content DPs behave like direct objects. In German, as shown in (34), it is only possible to promote direct objects in passives, and not indirect objects.

(34)   German
   a.   Sie   stahl ihm   den   Schlüssel.
        she.NOM stole him.DAT the.ACC key
        She stole the key from him.
   b.   Der   Schlüssel wurde ihm   gestohlen.
        the.NOM key   was   him.DAT stolen
        The key was stolen from him.   ✓Promote direct object
   c.   *Er   wurde den   Schlüssel gestohlen.
        he.NOM was   the.ACC key   stolen
        He had the key stolen from him.   ✗Promote indirect object

In *believe DP* sentences, Content DP and CPs (35-a) pattern with direct objects (34-b) in terms of extraction, whereas Source DPs (35-b) pattern with indirect objects (34-c).

(35)   German
   a.   (Die   Behauptung,) dass Maria ein Genie war, wurde ihm geglaubt.
        (The.NOM claim,)   that Maria a   genius was, was   him believed
        (The claim that he made,) that Maria was a genius, was believed. ✓Promote Content DP
   b.   *Er   wurde geglaubt (die Behauptung), dass Maria ein Genie war.
        he.NOM was   believed (the claim),   that Maria a   genius was
        He was believed when he claimed that Maria was a genius.   ✗Promote Source DP

As shown in (36), many varieties of English show the opposite pattern for double object constructions. Here, the *indirect*, but not the *direct* object can be promoted.

(36)   a.   I baked him a cake.
       b.   *A cake was baked him.   ✗Promote direct object
       c.   He was baked a cake.   ✓Promote indirect object

Of course, as we have seen, English does not allow Source DPs and Content DPs to co-occur. Nevertheless, we find that in a structure with a Source DP and a CP, the CP cannot be promoted in a passive (37-a), similarly to the direct object in (36-b). The Source DP, however, *can* be promoted, as shown in (37-b),

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[18]Note that there is disagreement about the connection between morphological case and argument licensing, with some authors arguing that the two are entirely independent (e.g., Marantz 1991; Sigurðsson 2012). Here, I follow Vergnaud 2008; Chomsky & Lasnik 1977; Pesetsky & Torrego 2004; Legate 2008; Deal 2009; Rezac 2013, among others, in assuming that DPs do need licensing via abstract case assignment in the syntax.

like the indirect object in (36-c).[19]

(37) a. *That Maria is a genius was (generally/widely) believed him.   ✗Promote CP
     b. He was generally believed that Maria was a genius.   ✓Promote Source DP

Crucially, without a Source DP, both CPs and Content DPs can be promoted in passives, showing us that the restriction in (37-a) is not due to a general restriction on moving clauses or objects of *believe*.

(38) a. That Maria is a genius was (generally/widely) believed.   ✓Promote CP
     b. The claim that Maria is a genius was (generally/widely) believed. ✓Promote Content DP

The same is true for direct objects of verbs like *bake*, when there is no indirect object present (39):

(39) A cake was baked.   ✓Promote direct object

This is in in contrast to (36-b), where there is an indirect object present in the syntax; thus showing that we get exactly the same pattern in sentences with *believe* and in regular double object constructions.

Taken together, these observations would be difficult to account for on an account whereby Source DPs and Content DPs in English saturate the same type e argument slot of *believe*. Rather, both the German and English data discussed here follow immediately if we assume that CPs and Content DPs are direct objects of *believe*, whereas Source DPs are indirect objects. On the current view (e.g. Pylkkänen 2008, and others), this implies that they are introduced by an external head, rather than being a core argument of the verb, as shown in (25)–(26) and (33). As for the co-occurrence contrast of Source and Content DPs in English (23) vs. German (24), I propose in Section 4.4 that this contrast follows from a parametric difference in whether the head introducing the Source DP assigns case or not; a difference which I link to the availability of Source Datives (31-b) in the language more broadly. (Thus, the current proposal does posit a link between the co-occurrence contrast and the presence of Source Applicatives. However, this link is less direct than that proposed by Djärv 2019.)

Before concluding this section, further motivation for the claim that Source DPs (unlike clausal complements of *believe*-verbs) are externally licensed, comes from the observation that in both English and German, *I believe you* implies the belief of some contextually salient proposition. *I believe that p*, on the other hand, does not imply the existence of some contextually available source of the p-information. This is shown in (40)–(41):

(40) Djärv (2019, p. 243)
     a. I believe Mary.   ↝ ∃ p_C s.t. Mary is the source of p_C
     b. I believe that [$_P$ it's raining].   ↝̸ ∃ x_C s.t. x_C is the source of p

(41) German
     a. Ich glaube Maria.
        I   believe Maria
        I believe Maria.   ↝ ∃ p_C s.t. Mary is the source of p_C
     b. Ich glaube, dass Lisa gewonnen hat.
        I   believe, that Lisa won   has
        I believe that Lisa won.   ↝̸ ∃ x_C s.t. x_C is the source of p

This is what we expect if sentences like *I believe you* are interpreted in a similar fashion to sentences like *I baked a cake*, which also do not entail that the cake was baked *for* someone.

In the following two sub-sections, I examine the interpretation of Source DP sentences. Section 3.2 looks at the semantics and Section 3.3 at the discourse status of these sentences.

3.2   Semantics: Source DP sentences refer to an assertion event

In this section, I examine in more detail the meaning of Source DP sentences, asking what it means to be a 'source of information' in the context of these sentences. To this end, I consider two *prima facie* plausible alternatives, given in (42):

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[19]Note that the ability to promote the Source DP in a passive sentence is also an argument that Source DPs are arguments, and not adjuncts; cf. *I had to stop due to the weather./*The weather was stopped due to.* or *Mary ran a mile./*A mile was ran.*)

(42)   Interpretation (informally) of *x believes y that p*
   a.   **Hypothesis 1:** y caused x to believe p.   **(to be rejected)**
   b.   **Hypothesis 2:** there was an assertion event s.t. x proposed to make p common ground.

Additionally, as we have seen, Source DP sentences also give rise to the inference that the attitude holder believes p. To tease apart these two hypotheses, I rely on two diagnostics from Anand & Hacquard (2009) [A&H]: the interpretation of epistemic modals and restrictions on inanimate DPs.

1. Interpretation of epistemic modals. The first diagnostic relies on Tancredi's (2007) modified version of von Fintel & Iatridou's (2003) Epistemic Containment Principle [ECP]. In it's original form, the principle states that quantifiers cannot bind their traces across an epistemic modal. In the modified version, the generalization is that quantifiers cannot bind their traces across a *subjectively interpreted* epistemic modal. Objectively interpreted epistemic modals obviate the ECP. This is illustrated in (43). The idea is that the sentence with the subjectively interpreted modal (43-a) is degraded, because the only interpretation available is the not very plausible one that 'it is possible that all guests are the murderer' (*might > every*). The sentence with the objectively interpreted modal (43-b), on the other hand, is fine, because the more plausible interpretation that 'for each guest x, it is possible that x is the murder' (*every > might*) is available.

(43)   Runner & Moulton (2017, 15); based on Anand & Hacquard (2009, ex. (15)–(16))
   a.   #(Subjectively speaking), every guest might be the murder.
        #It is possible that all guests are the murderer.   *might > every*
        *For each guest x, it is possible that x is the murder.   **every > might*
   b.   Objectively speaking, every guest might be the murder.
        # It is possible that all guests are the murderer.   *might > every*
        For each guest x, it is possible that x is the murder.   *every > might*

A&H also observe that there is a contrast between doxastic attitudes and assertion-reports with respect to the ECP, as shown in (44).

(44)   Runner & Moulton (2017, 15); based on Anand & Hacquard (2009, ex. (17))
   a.   #Holmes believed that every guest might be the murderer. *might > every* / **every > might*
   b.   Holmes claimed that every guest might be the murderer.   *might >* every / *every > might*

A&H account for this by proposing that for doxastic attitudes, p (and thus the modal) is evaluated with respect to the attitude holder's subjective belief state. For assertion reports, on the other hand (unlike in matrix assertions; cf. (43-a)), p is evaluated with respect to a projected common ground, where p is part of the general consensus, thus yielding an objective stance. An informal version of their proposal for belief vs. assertion reports is given in (45); for more detail, see their Section 3.3.

(45)   Anand & Hacquard (2009, ex. (28), (30))
   a.   John believes that it might be raining. *There is a belief state of John s.t.* [it is raining] *is compatible with his doxastic alternatives.*
   b.   John claimed that the Earth is flat. *There was a claiming event e by John proposing to make* [the Earth is flat] *common ground.*

Crucially, for our purposes, Runner & Moulton (2017, 15) observe that sentences with Source DPs, like assertion reports, obviate the ECP.

(46)   They believed Holmes that every guest might be the murderer. (Runner & Moulton, 2017, 15)
   a.   #believed H's' claim that it is possible that all guests are the murderer.   *might > every*
   b.   believed H's claim that for each guest x, it is possible that x is the murderer. *every > might*

Runner & Moulton (2017) (who are primarily concerned with *believe* in the context of non-finite complements) suggest that in these sentences, *believe* is interpreted assertively. I would like to suggest, however, that the obviation effect observed in (46) is not due to *believe* itself being interpreted assertively, but rather follows from the fact that Source DP sentences, in addition to making a statement about the attitude holder's private subjective beliefs, additionally state that there was an assertion event such that x proposed to make p common ground, as on Hypothesis 2 (42-b). The objective stance arises from this additional dimension of meaning, whereby p is evaluated with respect to a projected common ground; the conversational goal of the assertion-event introduced by the Source DP. Some support for this comes

from the fact that my consultants find the judgement in (46) to be less sharp than those in (43) and (44). On the hypothesis entertained here, this is not surprising, given that this sentence simultaneously describes a private doxastic state (*they believed p*) and an assertion event (*Holmes has asserted p*).[20]

In sum, the observation in (46) from Runner & Moulton (2017) shows us that Source DP sentences behave in a way that is characteristic of reported assertions; in line with Hypothesis 2. To further tease apart Hypothesis 1 and Hypothesis 2 in (42), I will use a second diagnostic from A&H, concerning restrictions on the type of inanimate DPs that are available as Source DPs.

2. Restrictions on inanimate DPs. The second diagnostic relies on restrictions on inanimate subjects. As I mentioned in fn. 17, in addition to functioning like regular Content DPs, DPs like *the report* are also able to function as Source DPs. A&H refers to inanimate subject DPs like *the report* as Repository-of-Information (RoI) subjects. Crucially, they observe that such RoI subjects are only available with certain kinds of clause-embedding predicates. Specifically, RoI subjects are available with predicates that describe an assertion or speech act event, like *argue, claim, imply*, and *suggest*, but not with verbs that describe a private belief state, like *believe, think*, or *know*. This contrast is illustrated in (47).

(47) Anand & Hacquard (2009, ex. (21))
    a. #The book {believes, thinks} that the Earth might be flat.
    b. The book {argues, implies} that the Earth might be flat.

According to A&H, this follows from the same semantic contrast between *claim* and *believe*-verbs that is responsible for the contrast with epistemic modals that we discussed above. Whereas a book or a report can be understood as the agent of an assertion event, a doxastic attitudes require a sentient subject, capable of beliefs. Crucially for our purposes, however, A&H additionally note that so-called non-discourse participants like *the timing* are possible only with certain kinds of speech act verbs: while they are generally available with verbs like *imply*, they are not possible with verbs like *argue*.

(48) Anand & Hacquard (2009, ex. (24))
    a. #The time of death argues that the butler is the murderer.
    b. The time of death implies that the butler is the murderer.

A&H suggest that sentences like (48-b) are not in fact interpreted assertively, but rather as involving a causative doxastic meaning with an implicit generically quantified over experiencer:

(49) Based on Anand & Hacquard (2009, ex. (26))
    The time of death implies that the butler is the murderer.
    $\approx$ GEN$_x$ time of death causes x to believe that the butler is the murderer   ($\approx$ H2 (42-a))

A&H propose that predicates like *imply* are ambiguous between a doxastic predicate with an implicit attitude holder and an assertive predicate, and that non discourse participant subjects like *the timing* bring out or activate the doxastic meaning.[21]

This observation allows us to tease apart Hypotheses 1 and 2 in (42). If Source DP sentences are interpreted as causative doxastics (as on Hypothesis 1; 'The Source DP caused x to believe p'), then we'd expect that inanimate DPs like *the timing/the time of death* should be available as Source DPs. If, on the other hand, Source DP sentences are interpreted on par with reported assertions (as on Hypothesis 2; 'The Source DP has asserted p'), then we'd expect that inanimate DPs like *the timing/the time of death* should *not* be available as Source DPs.

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[20]Among the five German (linguist and non-linguist) native speakers I consulted, only one of them agreed with the judgements in the 'basic' cases (43) and (44), and actually preferred the *might > every* reading in (46). Given that the judgement for (46) is already not entirely robust in English, together with the fact that the *basic* scope-judgements appear to not be clear in German, I'll leave it for future research to further investigate the nature of the ECP-facts in German.

[21]Independent support for this comes from the contrast in (i). On this view, (i) follows from the fact that with *the book*, these verbs are interpreted as assertives, and thus obviate the ECP, allowing for the *every > might* reading. With *the time of death*, these verbs are interpreted as causative doxastics as in (49)/(ii), and thus only allow the *might > every* reading.

(i) Anand & Hacquard (2009, ex. (25))
    a. The book {implies, suggests} that everyone might be the murderer.
    b. #The time of death {implies, suggests} that everyone might be the murderer.

(ii) Anand & Hacquard (2009, ex. (26))
    #The time of death suggests that everyone might be the murderer.
    GEN$_x$ time of death causes x to believe that everyone might be the murderer

As shown in (50)–(51), Source DPs are subject to the same restrictions on inanimate DPs as subjects of assertion predicates like *argue*. Whereas DPs like *the report* or *the article* can (at least with sufficient context) function as a sources of information, DPs like *the timing* are completely unavailable in source positions.[22]

(50)   a. I (definitely) believe this article (that Voice and *v* are different heads).
         b. #I (definitely) believe the time of the death (that the butler did it).

(51)   German
         a. Ich glaube dem   Bericht (schon), dass der Butler der Mörder ist.
             I   believe the.DAT report PART, that the butler the killer   is
             I believe the report that the butler is the killer.
         b. #Ich glaube dem   Timing/Zeitpunkt   (schon), dass der Butler der Mörder ist.
             I   believe the.DAT timing/point-in-time PART, that the butler the killer   is
             I believe the timing that the butler is the killer.

In this section I have shown that Source DPs behave similarly to subjects of verbs like *argue* and *claim*, i.e. verbs which describe assertion reports, as expected on Hypothesis 2 in (42), but not on Hypothesis 1. That is, Source DPs do not describe a 'cause to believe' event, but rather, an assertion event. Our conclusions about the meaning of Source DP sentences so far are summarized in (52).

(52)   Core components of meaning of Source DP sentences (pre-final version):
         a. The attitude holder believes p
         b. There was an assertion event s.t. x_{source} proposed to make p common ground.

Before concluding this section, I examine the discourse status of these two components of meaning.

3.3   Discourse Status: Source DPs are not *at-issue*

In this section, I look at whether the belief and the assertion inferences of Source DP sentences are part of the truth-conditional meaning of their sentences or not. The first test for this is *projection*.

As shown with the German and English Source DP sentences in (53)–(54), whereas the inference that the attitude holder believes p gets cancelled by negation or called into question in questions, these sentences still take it for granted that the referent of the DP is the source of the p-inference. That is, the source-inference *projects*, a behaviour typical of presuppositions.

(53)   Projection from negation
         a. I don't believe you that Mary is a genius.   English
         b. Ich   glaube dir   nicht, dass Maria ein Genie ist.
             I.NOM believe you.DAT not,   that Maria a   genius is
             I don't believe you that Maria is a genius.   German
             ⇸ I believe that Maria is a genius.
             ⇝ you have asserted that Maria is a genius.

(54)   Projection from questions
         a. Do you believe me that Lisa won?   English
         b. Glaubst du   mir,   dass Lisa gewonnen hat?
             believe you.NOM me.DAT, that Lisa won   has
             Do you believe me that Lisa won?   German
             Asks: Do you believe that Lisa won?
             Assumes: I have asserted that Lisa won.

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[22]Note that we need to make sure that the DP is truly interpreted as a Source DP, and not as a Content noun with a clausal complement. In German, the Dative case marking on the definite article achieves this. For English, I'm using the noun *article*, since *article*, while it's a plausible Repository-of-Information, does not live a double life as a Content noun, as shown by the fact that it is not available in copular-sentences with clauses, a characteristic typical of Content DPs (see for instance Moulton 2009).

(i)   a.   The claim/*article that the butler did it is true.
       b.   The claim/*article is that the butler did it.

As shown in (55) and (56), projection of the indirect object relation is not a general property of double object constructions; thus casting further doubt on the idea that Source DPs are introduced by a generic Source Applicative.

(55)   English Goal Applicative: negation, questions
       a.   She didn't give him the key.   ↝ the key was given to him
       b.   Did you give him the key?   ↝ the key was given to him

(56)   German Source Applicative: negation, questions
       a.   Sie stahl ihm nicht den Schlüssel.
            she stole him not   the key
            She didn't steal the key from him.   ↝̸ the key was stolen from him
       b.   Stahl sie ihm den Schlüssel?
            stole she him the key
            Did she steal the key from him?   ↝̸ the key was stolen from him

Further tests corroborate the hypothesis that the assertion-inference is presupposed. Here, I show the results from the following tests for presupposed content: (i) the classic 'hey, wait a minute' test (e.g. Shanon 1976; von Fintel 2004); (ii) presupposition filtering (Karttunen, 1973); and (iii) context update potential. Before applying them to Source DPs, (57)–(59) briefly illustrate these tests, using the trigger *Lisa's/her cat*.

A key premise of these tests is that presuppositions, unlike asserted (truth-conditional and *at-issue*) content, have to be entailed by the conversational context. As a consequence, presupposed content projects from the scope of operators that target truth-conditional content, as we saw in (53)–(54). It also means that they will not be targeted by polarity particles. That is, both a *yes* and a *no*-response to an utterance with a presupposition trigger will end up implicitly endorsing and inheriting the presupposition. This is shown in (57)-B. In order to target the presuppositions of a sentence that one is responding to, an explicit 'flag', like *hey, wait a minute. . .* is needed, as shown in (57)-B′.

(57)   A: **Lisa's cat** is a really cute.   ⊨ Lisa has a cat
       B: Yes, that's true. / No, that's not true.   ⊨ Lisa has a cat
       B′: Hey, wait a minute – Lisa doesn't have a cat!   ⊭ Lisa has a cat

However, as Karttunen (1973) notes, presuppositions can be effectively 'filtered out', when their content is entailed by the trigger's local context, as illustrated with the *if, then* sentence in (58) (see Mandelkern, Zehr, Romoli, & Schwarz 2020 for more discussion).

(58)   <u>If Lisa has a cat</u>, then **her cat** must be a Sphynx – given that Lisa is allergic. ⊭ Lisa has a cat

Finally, since presuppositions are not *at-issue* and must already be entailed by the context, it is not felicitous to use an utterance with a presupposition trigger to update the context with the content of the presupposition. That is, as shown in (59) using the 'guess what' test from Caplan & Djärv (2019); Djärv (2019), presuppositions resist being part of the asserted content of the sentence.

(59)   Guess what! **Lisa's cat** is a really cute.   #Asserting that *Lisa has a cat*

Applied to Source DP sentences (57)–(59), we find the same behaviour as with the 'DP-has-asserted-p' inference of Source DP sentences.

(60)   A: Lisa believes her doctor that [$_P$ blueberries cure hiccups]. ⊨ Lisa's doctor has asserted p
       B: Yes, that's true. / No, that's not true.   ⊨ Lisa's doctor has asserted p
       B′: Hey, wait a minute – Lisa's doctor would never say that! ⊭ Lisa's doctor has asserted p

(61)   <u>If Lisa's doctor says that blueberries cure hiccups</u>, then Lisa will definitely believe her (that blueberries cure hiccups) – given that Lisa is very gullible. ⊭ Lisa's doctor has asserted p

(62)   Guess what! Lisa believes her doctor that blueberries cure hiccups.

                                                    #Asserting that *Lisa's doctor has asserted p*

In what follows, I will take this to motivate a presuppositional treatment of Source DPs. There is an ongoing debate in the literature as to the theoretical status of different kinds of presuppositions, and the link between projection and *at-issueness* (see among others: Simons 2007; Simons, Tonhauser, Beaver, & Roberts 2010; Simons, Beaver, Roberts, & Tonhauser 2017; Abusch 2010; Romoli 2015; Abrusán 2011,

2016; Djärv 2019; Djärv & Bacovcin 2020). Here, I will not further investigate the particular nature of the not *at issue* inference introduced by the Source DP. However, it is worth noting that given sufficient context, the source-inference can become *at-issue*, as shown in (63).

(63)   I don't trust anything I read in the tabloids, so I wouldn't believe *the Sun* that blueberries cure hiccups, but if I read it in the BBC, I would definitely believe *them* that it's possible.

This might be taken to motivate a type of *pragmatic triggering* approach, along the lines of Simons (2007); Simons et al. (2010); Abrusán (2011); Anand & Hacquard (2014) and others, where the source-inference is not a lexical definedness condition, but rather a conversationally backgrounded entailment. In what follows, however, I will for simplicity present the source-inference as a 'traditional' presupposition of the head introducing the Source DP; though note that the choice of approach here is orthogonal to the main proposal for the semantics and composition of Source DP-sentences.

3.4   Summary: *believe DP*

Before moving on to the analysis, let us briefly take stock of the analytical conclusions of this section regarding *believe DP* sentences in English and German. In Section 3.1, I examined the syntax and semantics of Source DPs and Content DPs, arguing that they compose with the verb in different ways. For Content DPs, I showed that these combine with *believe*-verbs as a direct object, saturating its propositional argument slot (in line with Uegaki 2016). Source DPs, on the other hand, behave like indirect objects, and are not part of the verbs' lexical meaning/argument structure. In Section 3.2, I looked at the interpretation of Source DP sentences. Using diagnostics from Anand & Hacquard (2009), I showed that semantically, Source DP-sentences are similar to assertion reports. Finally, in Section 3.3, I showed that the source-inference is not-*at issue*. To summarise, Source DP sentences like (64) involve two core components of meaning:

(64)   Mary believes Anna that Lisa won.
    a.   Truth-condition: Mary believes that Lisa won.
    b.   Presupposition: There was an assertion event s.t. Anna proposed to make *Lisa won* common ground.

In Section 4, next, I present the analysis of *know CP/DP* vs. *believe CP/DP* sentences. In Sections 4.2 and 4.1, I spell out my proposal for the remaining ingredients required to capture the empirical observations discussed above: (i) an analysis of the systematic ambiguity of *know DP* vs. *know CP* and (ii) an analysis of the meaning of Source DPs. In Section 4.3, I put the current proposals together with Uegaki's (2016) account for Content DPs, showing how, together, these ingredients give us Generalizations 1 and 2, in both German and English.

4   Proposal

4.1   *know CP/DP*

In Section 2, I pointed to a number of conceptual and empirical problems for polysemy-based approaches to *know DP* vs. *know CP*, which led me to reject polysemy. In this section, I will instead propose a decompositional analysis of *know*-verbs, whereby the DP and CP-selecting versions of these verbs are derivationally related. (I illustrate here with *know*, and comment later on points of lexical variation.)

Specifically, I argue that the DP and CP-selecting versions of these verbs share the same lexical root. My proposal for the lexical root of the verb *know* in *know DP* and *know CP* sentences is given in (65). As on the analysis for *know DP* in (8)/(11), $\sqrt{\text{AQ}}$ is a simple acquaintance predicate, describing a relation between two individuals (type $\langle e, et \rangle$).

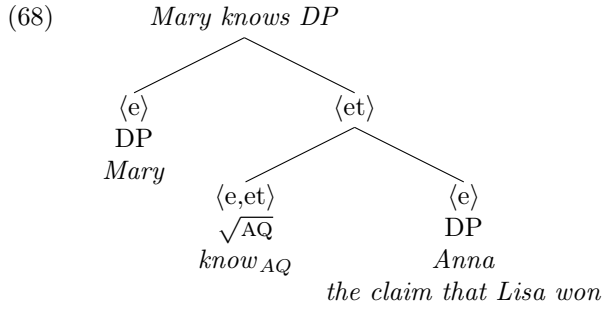(65) $[\![\sqrt{\text{AQ}}]\!]^w = [\lambda y_e.[\lambda x_e.\text{AQ}_w(x)(y)]]$

$Know_{AQ}$ is the result of $\sqrt{\text{AQ}}$ combining directly with an individual, thus saturating its internal argument slot, as shown in (66).

(66) $[\![know_{AQ}]\!]^w = [\![\sqrt{\text{AQ}}]\!]^w([\![\text{DP}]\!]^w) = [\lambda y_e.[\lambda x_e.\text{AQ}_w(x)(y)]]([\![\text{DP}]\!]^w)$

The resulting interpretation of *know DP* sentences is given in (67) (assuming the Kratzer-Moulton analysis of Content DPs from (16) above).

(67) a. ⟦Mary knows Anna⟧^{w} = 1 in w iff $\text{AQ}_w(mary)(anna)$
      b. ⟦Mary knows the claim that p⟧^{w} = 1 in w iff $\text{AQ}_w(mary)(\iota x.\text{claim}_w(x)$ & $\text{CONT}_w(x)=p)$

The LF of *know DP* sentences is shown in (68):

(68)

Mary knows DP
- ⟨e⟩ DP *Mary*
- ⟨et⟩
  - ⟨e,et⟩ $\sqrt{\text{AQ}}$ *know$_{AQ}$*
  - ⟨e⟩ DP *Anna* / *the claim that Lisa won*

Like polysemy-based approaches, this correctly predicts that we neither get a Source reading of the DP in (67-a), nor a propositional entailment in (67-b).

Unlike polysemy-approaches, however, I propose that epistemic, CP-selecting *know*, rather than involving a separate lexical item, as in (8)/(11), is built on-top of the root $\sqrt{\text{AQ}}$ in a more complex morpho-semantic structure. Specifically, I propose that CP-selecting *know* is derived by merging the lexical root $\sqrt{\text{AQ}}$ in (65) with the additional head, SITU (type ⟨⟨e,et⟩,⟨⟨st,t⟩,⟨et⟩⟩⟩), given in (69).

(69) ⟦SITU⟧^{w} = [$\lambda R_{<e,et>}.[\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s$ is a situation exemplifying $p \wedge R(s)(x)]]]]$

To derive *know$_{EPIST}$*, or *know CP*, SITU takes $\sqrt{\text{AQ}}$ as its first (R) argument, causing the object-of-acquaintance slot of $\sqrt{\text{AQ}}$ to be saturated with a situation pronoun (for which I use the variable s), the *res*, and an individual variable x (for the attitude holder). Following Kratzer (2002), I understand situations to be *particulars*, which (for the purpose of the compositional semantics) I take to be of the more general type e. The result is a function of type ⟨⟨st,t⟩,⟨et⟩⟩ given in (70); which I propose is the minimal, bare-bones meaning of *know$_{EPIST}$*. This predicate states that there exists a situation s and a proposition $p_{<st>}$ in $P_{<st,t>}$, such that s exemplifies p, and x is acquainted with s (more discussion on this in a moment).

(70) ⟦*know$_{EPIST}$*⟧^{w} = ⟦SITU⟧^{w}(⟦$\sqrt{\text{AQ}}$⟧^{w}) =
      [$\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s$ is a situation exemplifying $p \wedge \text{AQ}_w(x)(s)]]]$

The LF of *know CP* sentences, on this proposal, is given in (71).

(71)

Mary knows CP
- ⟨e⟩ DP *Mary*
- ⟨et⟩
  - ⟨⟨st,t⟩,⟨et⟩⟩ *know$_{EPIST}$*
    - ⟨⟨e,et⟩,⟨⟨st,t⟩,⟨et⟩⟩⟩ SITU
    - ⟨e,et⟩ $\sqrt{\text{AQ}}$
  - ⟨st,t⟩ CP *that Lisa won* / *whether Lisa won* / *who won*
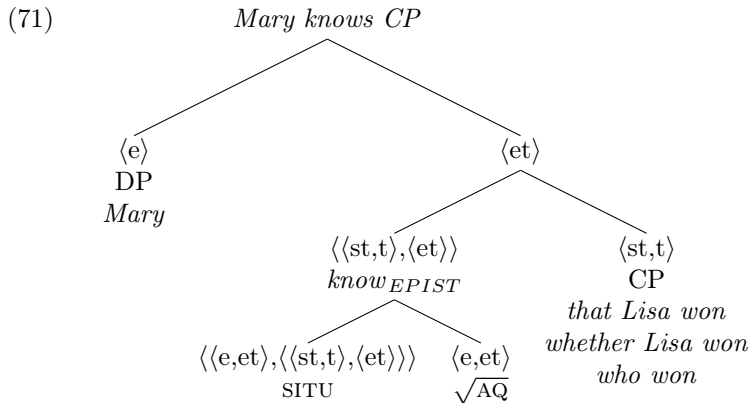
Like Uegaki's (2016) analysis of *know$_{EPIST}$*, this analysis treats CP-selecting *know*-verbs as selecting for questions, rather than propositions. Thus, for *know*-verbs to combine with declaratives, I assume Uegaki's (2016) p-to-Q type-shifter ID (12); see Section 4.3 for details.[23]

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[23]For the purpose of exposition, I assume that the domain of the *wh*-phrase in (72-c) includes only *Lisa* and *Jane*. Importantly, the interpretation of *wh*-questions varies in terms of exhaustivity (Groenendijk & Stokhof, 1982, 1984). On the strongly exhaustive reading, *know who won* entails that the attitude holder, besides knowing the answer to the question *Who won?* additionally knows who did not win. On the weakly exhaustive reading, the attitude holder may have false beliefs or no beliefs about the non-winners. There is currently some debate in the literature concerning the availability of strongly and weakly exhaustive readings across verbs like *know, surprise*, etc. (see for instance Heim 1994; Guerzoni 2007; Klinedinst & Rothschild 2011; Theiler 2014; Nicolae 2013; Guerzoni & Sharvit 2014; Spector & Egré 2015; Uegaki

(72) a. $[\![$Mary knows that Lisa won$]\!]^w = 1$ in w iff
        $\exists s \exists p \in \{\lambda w'.\text{won}(lisa)(w')\}[s$ is a situation exemplifying p $\wedge \text{AQ}_w(mary)(s)]$
    b. $[\![$Mary knows whether Lisa won$]\!]^w = 1$ in w iff
        $\exists s \exists p \in \{\lambda w'.\text{won}(lisa)(w'),\lambda w'.\neg\text{won}(lisa)(w')\}[s$ is a situ. exemplifying p $\wedge \text{AQ}_w(mary)(s)]$
    c. $[\![$Mary knows who won$]\!]^w = 1$ in w iff
        $\exists s \exists p \in \{\lambda w'.\text{won}(lisa)(w'),\lambda w'.\text{won}(jane)(w')\}[s$ is a situ. exemplifying p $\wedge \text{AQ}_w(mary)(s)]$

This account correctly predicts that DP and CP complements of *know*-verbs should be in complementary distribution: if $\sqrt{\text{AQ}}$ combines with a DP like *Anna*, as shown in (66)–(67), then the object-of-acquaintance slot of $\sqrt{\text{AQ}}$ gets saturated, and the resulting predicate, a function of type $\langle et \rangle$ (describing the property of being acquainted with Anna), is no longer able to combine with SITU, which selects for (R) arguments of type $\langle e,et \rangle$. That is, the derivation of *know DP* sentences effectively blocks the derivation of *know CP* sentences. This ensures that *know DP* sentences are interpreted as an acquaintance relation and *know CP* sentences as factive attitudes, and additionally rules out stacking of DPs and CPs (see also discussion in Section 5.1).

We also avoid the challenges faced by polysemy-based accounts. Given that the DP and CP selecting versions of *know*-verbs share the same lexical root, it is not surprising that they should *generally* share the same semantic core and phonological form. In fact, on this view, it is the formal contrast between $know_{AQ}$ and $know_{EPIST}$ in languages like Swedish, German, and French, that is the odd one out. For concreteness sake, I assume that these cases involve contextually triggered allomorphy, such that the *veta/vissen/savoir* forms are triggered in the context of the SITU head, whereas *känna/kennen/connaitre* are the default forms of the verb. The picture presented here is somewhat reminiscent of the case of polarity sensitive items, which can function both as Free Choice and as Negative Polarity Items. As discussed by Chierchia (2006), while these two uses share a common semantic core, there is variation in terms of whether they are lexicalized using one or two phonological forms.

The notion of exemplification in (69) is from Kratzer (2002), building on previous work in situation semantics (e.g. Barwise 1981, 1989; Barwise & Perry 1983; Kratzer 1989). Situation semantics assumes that all situations s are related to a unique maximal element, which is the world which s is a part of. As Kratzer argues, a situation is a highly particular and *worldly* thing, like other individuals. Crucially, a situation may only be part of one possible world.[24] On this perspective, then, propositions are sets of possible situations; and therefore, classify situations. Intuitively, a situation s *exemplifies* a proposition p if whenever there is a part of s in which p is not true, s is a minimal situation in which p is true. Thus, a situation that exemplifies a proposition p is one that does not contain anything that does not contribute to the truth of p. The formal definition of exemplification is given in (73) (for more discussion, see Kratzer 2002, 659–663).

(73) Exemplification (Kratzer, 2002, 660)
      If s is a possible situation and p a proposition, then s is a fact exemplifying p iff for all s' such that $s' \le s$ and p is not true in s', there is an s'' such that $s' \le s'' \le s$, and s'' is a minimal situation in which p is true. (A minimal situation in which p is true is a situation that has no proper parts in which p is true.).

      ...

      where the part-whole relationship $\le$ is a partial ordering on S (the set of all possible situations), satisfying the condition that: For all $s \in$ S there is a unique $s' \in$ S such that $s \le s'$ and for all $s'' \in$ S, if $s' \le s''$, then $s'' = s'$

The current analysis gives us a concrete morpho-semantic implementation of the idea, from Goldman (1967); Lewis (1979), and Kratzer (2002), a.o., that knowledge is tied to acquaintance with a fact, the *res*. This idea has been picked up in a number of recent proposals for accounting for factive inferences more broadly (e.g. Özyildiz 2017; Djärv 2019, and Bondarenko 2020a). These proposals all incorporate the idea that some notion of acquaintance is involved in deriving factivity.[25] However, not all instances

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2015; Romero 2015; Cremers & Chemla 2017). For the sake of exposition, I'm using a weakly exhaustive denotation in (72-c), along the lines of Karttunen (1977a). However, I assume that the current proposal would be compatible also with a strongly exhaustive denotation of the embedded question. Since the issue of exhaustivity is not immediately relevant to the issue at hand, I leave it to the side for the remainder of the paper.

[24]Though they may be related across worlds via a counterpart relation; see Lewis (1986).

[25]I take it to be an open question to what extent these accounts can or should be unified, given that the languages described by these authors behave differently with respect to 'compositional' factivity. Turkish and Barguzin Buryat, discussed by Özyildiz (2017) and Bondarenko (2020a), respectively, show a factivity alternation depending on whether the verb combines with a CP or with a nominalized clause. In English, *know/remember* + CP sentences are factive.

of knowing p are based on *direct* knowledge with unique situations that exemplify p. Here, I understand the acquaintance relation more broadly, as encompassing a range of direct and indirect or 'less vivid' acquaintance relations (e.g. Lewis 1979).

The claim that factive verbs involve an acquaintance relation both in their CP and DP-taking guises is further supported by the interpretation of *know DP* sentences. For instance, it seems clear that with sentences like *I remember/discovered/noticed King Arthur*, there is an inference (which comes out quite sharply with historical-fictional individuals like *King Arthur*) that the attitude holder has some direct acquaintance with this individual.[26] This connection is also noted in Bondarenko (2020a), who discusses similar facts in the context of the verb meaning *think/remember* in Barguzin Buryat. This, then, speaks in favour of the claim that factive verbs involve a type of acquaintance-relation which is shared by the DP and CP-selecting versions. Relatedly, the current proposal also allows us to account for a separate observation (discussed in Egré 2008; Djärv 2019), about the modification possibilities of *know* and *believe*-verbs, shown in (74).

(74) Djärv (2019, 246)

    a.   **How**/#**why** do you know that Lisa won?   ≈ *in what manner did you come to know p?*
          Also: *realize, notice, discover. . .*

    b.   **Why**/#**how** do you believe that Lisa won?   ≈ *what is the reason for believing p?*
          Also: *trust, doubt. . .*

On the analysis proposed here, every state of *knowing p* (unlike a state of *believing p*) is predicated on an event of being acquainted with a situation s which in turn justifies/motivates knowing p. The idea is that in (74-a), *how* is modifying the acquaintance event in *know*. In the case of *believe* (74-b), on the other hand, there is no such event.

As I mentioned above, this analysis is intended as a minimal, bare-bones proposal for the meaning, composition, and argument structure of *know*-verbs. Clearly, the denotations in (65) and (69) lack both lexically specific information (like the manner of acquiring knowledge, as with *notice* and *discover*), and more general inferences, regarding for instance beliefs and exhaustivity (see fn. 23). Note also that while the current proposal gives us the inference that p is a fact, is does not as it currently stands capture projection. That is, verbs like *know* generally give rise to a not-*at issue* inference that the speaker is committed to p, which tends to project from the scope of entailment targeting operators like negation (see Section 3.3). Traditionally, this is captured by a presupposition (definedness condition) associated with verbs like *know*, that p must be true in the world of evaluation (see (2)). However, recent work has argued against treating p as a presupposition of factive verbs (e.g. Karttunen 2016; Wiegand 2018; Djärv 2019; Bondarenko 2020a), and other work has argued that projection of p is the consequence of the not-*at issue* status of a p-entailment (e.g. Abrusán 2011, 2016; Simons et al. 2017). For our purposes, I suggest that the current proposal could be supplemented with the account of Djärv (2019), whereby factivity is derived via a type of evidential presupposition. In the context of the current compositional account, we might frame this idea as saying that SITU presupposes that the situation with which the attitude holder is acquainted constitutes reliable evidence for p (see also discussion in Section 4.5).[27]

Before wrapping up this section, a note on the generality of this proposal is in order. Here, I have argued that this analysis gives us a compositional implementation of the idea that factivity is tied to acquaintance with things in the world. This raises the question of whether the current proposal could be extended to verbs like *explain*. As shown in (75), *explain* behaves like *know* in terms of Generalization 1, in the sense that *explain DP* does not entail *explain CP*.

(75) Based on Pietroski (2000, 655)

    a.   Nora explained the fact that Fido barked.   *explanandum*
    b.   ≢ Nora explained that Fido barked.   *explanans*

While this might seem to motivate a unified analysis (as has been proposed for instance by Elliott 2016; see Section 5.1 below), I will argue that there is reason to approach such a move with some caution. The main reason for this is that *explain* differs from the factive *know*-verbs in terms of the thematic roles of CP and DP complements, respectively. With the factive *know*-verbs, as we have seen above, both CPs and DPs characterize the *object* of the attitude. With *explain*, on the other hand, as discussed for instance by Pietroski (2000); Elliott (2016), and Bondarenko (2020b), this is not the case.

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[26]Unless *King Arthur* is used to refer to something like the story of King Arthur, in which case no direct acquaintance with the individual King Arthur is necessary; here, the acquaintance relation is with the story.

[27]Thanks to Ryan Walter Smith and Craige Roberts for helpful comments on this.

This difference between factive *know*-verbs and *explain* becomes evident when we look at *fact*-nominals. As illustrated in (76-a), if Mary knows a fact that exemplifies a proposition p, then it follows that she knows p.[28] With *explain*, on the other hand, as shown in (76-b), there is no such entailment. If Mary explains some fact, then it does indeed follow that *something* was said by way of explanation. However, if Mary explains a fact that exemplifies p, it does not follow that she gave p as an explanation:

(76) a. Mary knew the fact that there was a delay.   ⊨ Mary knew that there was a delay.
      b. Mary explained the fact that there was a delay. ⊭ Mary explained that there was a delay.

More generally, that an explanation (for something) has been offered doesn't entail that this explanation has some particular propositional content. In fact, it seems to be this contingency that is responsible for the lack of the propositional (DP-to-CP) entailment with *explain*. With the factive *know*-verbs, on the other hand, because facts are special kinds of objects, it follows that acquaintance with 'the fact that p' will entail the corresponding CP-sentence; as those sentences are analysed as describing acquaintance with a situation that exemplifies p (i.e. the fact that p).

This, however, is not to rule out the possibility that *explain*-verbs might still share *some* aspects of their argument structure and semantic composition with *know*-verbs. For instance, *explain*-verbs share the property of *know*-verbs, that they do not allow DP and CP complements to co-occur:[29]

(77) a. *The City explained [$_{DP}$ the delay] [$_{CP}$ that they were having problems with the factory].
      b. *The City explained [$_{DP}$ the fact that there was a delay] [$_{CP}$ that they were having problems with the factory].

As discussed in some detail in this section, this is something that the schematic, compositional dimension of the current proposal for *know*-verbs is well-equipped to handle. Moreover, as mentioned above, an *explanans* (*explain CP*) sentence like (75-b) does entail that there exists some *explanandum*, something that was explained. This is also something that the current compositional proposal for *know* can provide. Thus, while the current proposal is not immediately applicable to verbs like *explain*, in terms of the content of the lexical items in question, I suggest that an extension may nevertheless be motivated, using the same compositional schema as that developed here for *know*-verbs. Here, I sketch such an extension.

The first step would be to say that *explain CP* and *explain DP*, like the *know*-verbs, involve the same lexical root, $\sqrt{\text{EXPLAIN}}$. Like $\sqrt{\text{AQ}}$, this root would be of type $\langle e, et \rangle$ and would have the *explanandum* meaning; i.e. its internal argument denoting the thing explained. Thus, if a DP saturates the internal argument slot of $\sqrt{\text{EXPLAIN}}$, we get the obligatory *explanandum* reading of *explain DP*, and further block the derivation of *explain CP*; thus ruling out sentences like (77).

To derive the *explanans*-reading with *explain CP*, a head of the same semantic type as SITU would be needed (though with quite different semantic content). We might call this head CONT. As with SITU and $\sqrt{\text{AQ}}$ in (70)–(71), CONT would take $\sqrt{\text{EXPLAIN}}$ as its first argument, causing the internal argument-slot of $\sqrt{\text{EXPLAIN}}$ to be saturated with a situation pronoun s (for the explained situation or fact); thus giving us the *explanandum*-entailment of *explain CP* (i.e. that something was explained). In a parallel fashion to SITU, CONT would also be responsible for introducing the propositional content of the explanation; the *explanans*, provided by a CP (of type $\langle st, t \rangle$). This is illustrated schematically in (78). (Crucially, as we have seen, the meaning associated with $\sqrt{\text{EXPLAIN}}$ and CONT would have to be very different from that of $\sqrt{\text{AQ}}$ and SITU in order to give us the interpretation that p is offered as an explanation for s.[30])

(78) a. $[\![\text{explain}_{explanandum}]\!]^w = [\![\sqrt{\text{EXPLAIN}}]\!]^w$ (type $\langle e, et \rangle$)
      b. $[\![\text{explain}_{explanans}]\!]^w = [\![\text{CONT}]\!]^w([\![\sqrt{\text{EXPLAIN}}]\!]^w)$ (type $\langle \langle st, t \rangle, \langle e, t \rangle \rangle$)

For purposes of space, I will not attempt to spell out a complete formal proposal for *explain* along these lines, but it's worth noting that the kind of explanation outlined here would have the same benefits as the current approach to the *know*-verbs; in that it would compositionally derive: the obligatory *explanandum* interpretation of DPs and the *explanans* reading CPs; the *explanandum*-entailment of *explain CP* sentences; the lack of the DP-to-CP entailment; the fact that DPs and CPs can't co-occur; and also the fact that *explain* allows for both questions and declarative complements.

Next, I turn to my proposal for Source DPs, before showing how the current proposals for *know* and *believe* account for Generalizations 1 and 2.

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[28] For discussion and a formal proposal of this, see Uegaki (2016, 651–2).

[29] As discussed in Section 5.1, (77) cannot be used to express the meaning: 'The City explained the (fact that there was a) delay by saying that they were having problems with the factory'.

[30] See also discussion from Bondarenko (2021) on *explain*-verbs in Russian.

4.2 Proposal: Source DPs

The key observation that we wish to account for here is the observation, repeated in (79): that verbs like *believe* allow for a regular DP to co-occur with a *that*-clause, and that such DPs are interpreted as the source of some (implicitly or explicitly provided) propositional information.

(79)   Mary believes Anna (that Lisa won).

In Sections 3.3–3.2, I presented new data which allowed us to refine the notion of what it means to be a source of information in these constructions. The conclusion was that Source DP sentences are similar in meaning to assertion reports, though this inference is part of the sentence's not-*at issue* content. In terms of their *at-issue* content, these sentences are equivalent to the corresponding *believe that p* sentences.

(80)   Components of meaning of Source DP sentences (final version):
   a.   Truth-condition: the attitude holder believes p
   b.   Presupposition: there was an assertion event s.t. x_{source} proposed to make p common ground.

Additionally, I showed, building on observations by Djärv (2019), that Source DPs behave like indirect objects of applicative constructions, as opposed to Content DPs and CPs, which behave like direct objects of the verb; in line with Uegaki's (2016) analysis of *believe* with Content DPs, whereby the DP combines with *believe* by saturating its propositional argument slot.

To capture these various observations, I propose that Source DPs are licensed by a head Asst^o, given in (81) (to replace the head F^o in (26)).

(81) $[\![\text{Asst}^o]\!]^w = [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]]$
   $\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert(e) \& agent(e)(x) \& goal(e)} = p \cap c] \\ \# \textit{ otherwise} \end{array} \right\}$

In terms of its argument structure, Asst^o is similar to applicative heads, as shown in (25)–(26), and (33). Crucially, it preserves the semantic relation between the verb (*believe*) and the direct object or internal argument of the verb: the proposition introduced by the clause, or (as is possible in German and Spanish) a Content DP. Additionally, the head increases the n-arity of the predicate by introducing the indirect object, i.e. the Source DP. Unlike regular applicatives, however, which describe relations between individuals, and is defined for transitive verbs like *bake* and *steal*, Asst^o describes a relation between individuals and propositions, and is defined for proposition-selecting verbs like *believe*.

As shown in (82), a Source DP sentence will be true iff the attitude holder believes p, and will be defined if there exists in the conversational common ground an assertion event e, the agent of which is the Source DP, and the conversational goal of which is to make p common ground; i.e. if the Source DP has asserted p.

(82) $[\![\text{Mary believes Anna that Lisa won}]\!]^w = 1$ in w iff $\text{DOX}^w_{mary} \subseteq \{w':\text{won}(lisa)(w')\}$
   $\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert(e) \& agent(e)}(anna) \text{ \& goal(e)} = \{w':\text{won}(lisa)(w')\} \cap c] \\ \# \textit{ otherwise} \end{array} \right\}$

As in Anand & Hacquard (2009) (and in Farkas & Bruce 2010, a.o.), the goal of the assertion event is identified as a 'projected common ground', a future conversational state in which p is common ground. In (81), this is captured by the condition [goal(e) = p ∩ c], where c is the *context set*, the set of worlds which is the intersection of all of the propositions in the common ground. Unlike with predicates like *claim* and *assert*, this assertion-event is part of the presuppositional, and not the truth-conditional content of Asst^o. The LF and derivation of (82) is given in (83).[31]
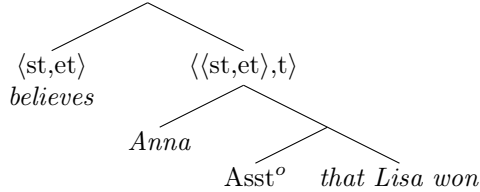
(83)   a. $[\![\text{believe Anna that Lisa won}]\!]^w = [\![\text{Asst}^o]\!]^w([\![\text{that Lisa won}]\!]^w)([\![\text{Anna}]\!]^w)([\![\text{believe}]\!]^w)$
            $= [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]]([\lambda w'.\text{won}(lisa)(w')])(anna)([\lambda p_{<st>}.[\lambda x_e.\text{DOX}^w_x \subseteq p]])$
            $= [\lambda x_e.\text{DOX}^w_x \subseteq \{w':\text{won}(lisa)(w')\}]$
            $\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert(e) \& agent(e)}(anna) \text{ \& goal(e)} = \{w':\text{won}(lisa)(w')\} \cap c] \\ \# \textit{ otherwise} \end{array} \right\}$
       b. $[\![\text{Mary believes Anna that Lisa won}]\!]^w = [\![\text{believe Anna that Lisa won}]\!]^w([\![\text{Mary}]\!]^w)$
            $= [\lambda x_e.\text{DOX}^w_x \subseteq \{w':\text{won}(lisa)(w')\}](mary)$

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[31] For a detailed comparison with the derivation of 'regular' low applicatives, see for instance Pylkkänen (2008, 18).

$$= 1 \text{ in w iff } \mathrm{DOX}^w_{mary} \subseteq \{w':\mathrm{won}(lisa)(w')\}$$

$$\left\{ \begin{array}{l} \textit{defined if } \exists e[\mathrm{assert}(e) \ \& \ \mathrm{agent}(e)(anna) \ \& \ \mathrm{goal}(e) = \{w':\mathrm{won}(lisa)(w')\} \cap c] \\ \# \ \textit{otherwise} \end{array} \right\}$$

(84) (83-b)
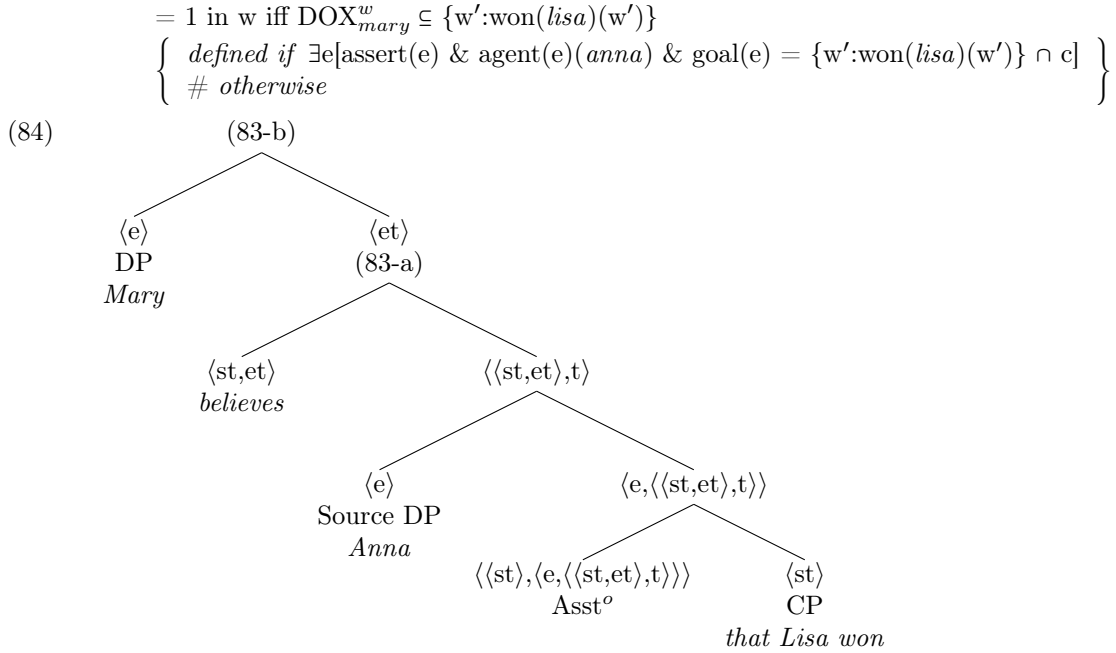
Apart from capturing the above observations about Source DP sentences, the fact that Asst^o selects for a verbal argument of type $\langle st,et\rangle$ ensures, together with the assumption that *know* and *believe* differ in their selectional properties, that *believe*-verbs, but not *know*-verbs, will be compatible with Source DPs. Thus, the explanation for Generalization 2 receives a similar explanation to Uegaki's (2016) account for Generalization 1. Though note that in the case of Generalization 1, the problem was in getting the type $\langle st\rangle$ Content DP to combine with the verb, which selects for questions. Here, as shown in (85), the problem is in getting verbs like *know* to combine with Asst^o. Crucially, unlike with Content DPs, where *know* could compose via the $\sqrt{\mathrm{AQ}}$ root (resulting in a grammatical sentence without an epistemic interpretation), in the case of Source DPs, neither *know$_{AQ}$* nor *know$_{EPIST}$* is able to combine with Asst^o, thus correctly predicting that sentences like *I know Anna that p* are simply ungrammatical.

(85)   a. *believes Anna that Lisa won.*   b. #*knows Anna that Lisa won.*
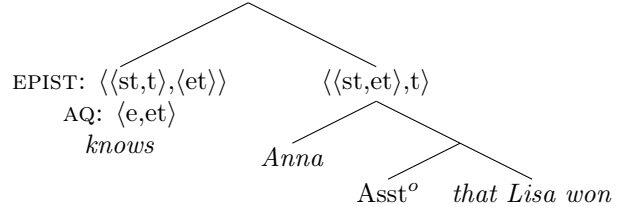
In Section 3.1, I showed that in English, Source DPs must be case-licensed (with Accusative case) by the head associated with *believe*. Thus, the licensing of Source DPs in English involves a syntax-semantics mismatch reminiscent of ECM constructions, as in (86), where a semantic argument, the subject of the embedded predicate, fails to receive Nominative case by the lower T^o, and is therefore syntactically licensed with Accusative case from the matrix verb.

(86)   I believe her$_{ACC}$ to be a talented athlete.

This thus makes the prediction that Source DPs should not be possible with *believe* in English ECM contexts; a prediction that is borne out.[32]

(87)   a.   I believe you$_{ACC}$ that she's a talented athlete.
         b.   *I believe you$_{ACC}$ her$_{ACC}$ to be a talented athlete.

Another consequence of this proposal is that Source DPs should only be possible with verbs that license DPs. This might explain why a verb like *think*, which is similar to *believe* both in terms of its

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[32]Through it's worth noting that there might be other reasons for this incompatibility; as discussed by Moulton (2009), while finite and non-finite complements appear to be semantically equivalent in some contexts, there are contexts where only one of the options are available, suggesting that they are not in fact semantically equivalent.

meaning and it's selectional properties, nevertheless reject Source DPs (88). As shown in (89), while *think*, like *believe*, is anti-rogative, it is unlike *believe* in that it neither permits ECM, nor Content DPs.

(88)   I {believe, *think} Anna that Lisa is the winner.

(89)   a. *Do you {believe, think} whether Lisa won?
         b. I {believe, *think} Lisa to be the winner.
         c. I {believe, *think} the claim that Lisa is the winner.

It's worth noting that neither the restriction on *believe wh* nor on *think DP* is absolute; see for instance Roberts (2019) and White (2019) on the first point, and Moulton (2009) on the second. What these authors observe is that under certain conditions, the generalizations in (89) fail to hold. For discussion of other potential counter-examples to the connection between question-embedding and the interpretation and licensing of DPs (specifically, *doubt, hear*, and *prove*), see Section 4.5.

In the following section, I show how the current proposals for Source DP and *know CP/DP* sentences, together with Uegaki's (2016) proposal for Content DPs, is able to capture the full range of empirical contrasts which this paper set out to account for.

4.3   Proposal summary: deriving Generalizations 1 and 2

We now put all the pieces together, to show how the proposals outlined above capture Generalizations 1 and 2, repeated in (90)–(91). Crucially, the current account also captures the fact that these two generalizations track one another across verbs.

(90)   *Generalization 1: Entailment contrast*
         a. Mary believes the rumour that Lisa won.   ↝ Mary believes p & p is a rumour
         b. Mary knows the rumour that Lisa won.   ↝ Mary is acquainted with the rumour that p

(91)   *Generalization 2: Source contrast*
         a. Mary believes Anna (that Lisa won).   ↝ Mary believes p & Anna has asserted p
         b. Mary knows Anna (*that Lisa won).   ↝ Mary is acquainted with Anna

The current proposal follows Uegaki's (2016) approach to Generalization 1, in appealing to a contrast in the types of complements that these two verb-classes select for. Specifically, *believe*-verbs select for propositions ($\langle st \rangle$), whereas *know*-verbs select for questions ($\langle st,t \rangle$). This assumption is motivated by the observation that *know* and *believe*-verbs differ in terms of the kinds of complements that they may combine with (Generalization 3), repeated in (92).

(92)   *Generalization 3: Selection contrast*
         a. Sue believes {that Lisa came / *who came} to the party.
         b. Sue knows {that Lisa came / who came} to the party.

Before turning to the cases where these verbs combine with DPs (Generalizations 1 and 2), let us first take stock of how these verbs combine with CPs. The lexical entries proposed for *believe* and *know*-verbs are given in (93)–(95). For *believe*-verbs, I assume a traditional Hintikkan relation between an individual x and a proposition p, such that the beliefs of x entail p.

(93)   *Proposal for believe-verbs*
         $[\![\text{believe}]\!]^w = [\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p]]$

For *know*, I have followed Uegaki (2016) in assuming that CP-selecting *know* selects for questions, and that DP-selecting *know* describes an acquaintance relation between individuals. However, I have rejected the idea that these involve two separate lexical items: an epistemic Hintikkan verb and an acquaintance verb, and argued instead that the two verbs are derivationally related via the lexical root $\sqrt{\text{AQ}}$ in (94-a); thus capturing the idea, from Kratzer (2002) and others, that *knowledge* relations are fundamentally anchored in the attitude holder's acquaintance with situations in the world. CP-selecting *know*-verbs are derived by combining $\sqrt{\text{AQ}}$ with the head SITU in (94-b); thus saturating the argument slots of $\sqrt{\text{AQ}}$ with a situation pronouns, the *res*, and a variable x (for the attitude holder). The resulting predicate states that there exists a situation s and a proposition p in the set containing p, such that s exemplifies p and x is acquainted with s.

(94) *Components of know-verbs*
   a. $\llbracket \sqrt{\text{AQ}} \rrbracket^w = [\lambda y_e.[\lambda x_e.\text{AQ}_w(x)(y)]]$
   b. $\llbracket \text{SITU} \rrbracket^w = [\lambda R_{<e,et>}.[\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s \text{ is a situation exemplifying } p \wedge R(s)(x)]]]]$

(95) a. $\llbracket know_{AQ} \rrbracket^w = \llbracket \sqrt{\text{AQ}} \rrbracket^w(\llbracket \text{DP} \rrbracket^w) =$ *know DP*
   $[\lambda y_e.[\lambda x_e.\text{AQ}_w(x)(y)]](\llbracket \text{DP} \rrbracket^w)$
   b. $\llbracket know_{EPIST} \rrbracket^w = \llbracket \text{SITU} \rrbracket^w(\llbracket \sqrt{\text{AQ}} \rrbracket^w) =$ *know CP*
   $[\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s \text{ is a situation exemplifying } p \wedge \text{AQ}(x)(s)]]]$

To explain how *know*-verbs combine with propositions, I adopt Uegaki's (2016) ID type-shifter in (96), which applies to propositions and returns the singleton sets containing them.

(96) $\llbracket \text{ID} \rrbracket^w = [\lambda p_{<st>}.[\lambda q_{<st>}.q=p]]$

Applied to a proposition p, ID returns the singleton proposition set containing p, as shown in (97).

(97) $\llbracket \text{ID} \rrbracket^w(\llbracket \text{that Lisa won} \rrbracket^w) = \{\lambda w'.\text{won}(lisa)(w')\}$

Thus, *know*-verbs are able to combine with declaratives as singleton sets, as shown in (98), and with questions as multi-member sets, as in (99) (for other types of questions, see (72) above).

(98) $\llbracket \text{know that Lisa won} \rrbracket^w$
   $= \llbracket know_{EPIST} \rrbracket^w(\llbracket \text{ID} \rrbracket^w(\llbracket \text{that Lisa won} \rrbracket^w))$
   $= [\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s \text{ is a situation exemplifying } p \wedge \text{AQ}_w(x)(s)]]](\{\lambda w'.\text{won}(lisa)(w')\})$
   $= [\lambda x_e.\exists s \exists p \in \{\lambda w'.\text{won}(lisa)(w')\}[s \text{ is a situation exemplifying } p \wedge \text{AQ}_w(x)(s)]]$

(99) $\llbracket \text{know whether Lisa won} \rrbracket^w$
   $= \llbracket know_{EPIST} \rrbracket^w(\llbracket \text{whether Lisa won} \rrbracket^w)$
   $= [\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s \text{ is a situ. exp. } p \wedge \text{AQ}_w(x)(s)]]](\{\lambda w'.\text{won}(l)(w'),\lambda w'.\neg\text{won}(l)(w')\})$
   $= [\lambda x_e.\exists s \exists p \in \{\lambda w'.\text{won}(l)(w'),\lambda w'.\neg\text{won}(l)(w')\}[s \text{ is a situation exemplifying } p \wedge \text{AQ}_w(x)(s)]]$

As shown in (100)–(101), *believe*-verbs, on the other hand, have no way of combining with questions. This, as proposed by Uegaki (2016), captures Generalization 3.

(100) $\llbracket \text{believe that Lisa won} \rrbracket^w$
   $= \llbracket \text{believe} \rrbracket^w(\llbracket \text{that Lisa won} \rrbracket^w)$
   $= [\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p]](\lambda w'.\text{won}(lisa)(w'))$
   $= [\lambda x_e.\text{DOX}_x^w \subseteq \{w':\text{won}(lisa)(w')\}]$

(101) $\llbracket \text{believe whether Lisa won} \rrbracket^w$ ***Type-mismatch***
   $= \llbracket \text{believe} \rrbracket^w(\llbracket \text{whether Lisa won} \rrbracket^w)$
   $= [\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p]](\{\lambda w'.\text{won}(lisa)(w'),\lambda w'.\neg\text{won}(lisa)(w')\}) = \#$

Let us turn now to the core desiderata of the paper; namely accounting for Generalizations 1 and 2. Broadly speaking, these both follow from the fact that the means by which attitude verbs can combine with DPs, which preserve the doxastic relation, are only defined for propositional relations. Therefore, since *know*-verbs describe relations to questions or proposition sets, these means of combining with DPs and preserving their propositional entailment are not defined for these verbs.

Deriving Generalization 1. The explanation for Generalization 1 given here follows Uegaki (2016); the difference being in the approach to *know CP* vs. *know DP*. To extract the intentional content of Content DPs, I follow Uegaki (2016) in assuming the content retrieval type-shifter in (102) (for a more detailed discussion of these functions, see Section 2.2). Applied to a Content DP like *the claim that Lisa won*, CONT in (102) returns its propositional content, as shown in (103).

(102) $\llbracket \text{CONT} \rrbracket^w(x) = \lambda w'.w' \in \text{CONT}_w(x)$ $\left\{ \begin{array}{l} \textit{defined if } \text{CONT}_w(x) = \text{CONT}_{w'}(x) \\ \# \textit{ otherwise} \end{array} \right\}$

(103) $\llbracket \text{CONT} \rrbracket^w(\llbracket \text{the claim that Lisa won} \rrbracket^w) = \lambda w'.\text{won}(lisa)(w')$
   $\left\{ \begin{array}{l} \textit{defined if } \text{CONT}_w(\llbracket \text{the claim that Lisa won} \rrbracket) = \text{CONT}_{w'}(\llbracket \text{the claim that Lisa won} \rrbracket) \\ \# \textit{ otherwise} \end{array} \right\}$

In Section 3.1, I showed that *believe*-verbs (93) combine with both Content DPs and CPs via saturation, as direct objects. As shown in (104), CONT explains how this is achieved compositionally. Crucially,

this analysis predicts that *believe*+Content DP sentences (104) will entail the corresponding *believe CP* sentences (100), since at the level of truth-conditional content, they are equivalent.[33]

(104)   ⟦believe the claim that Lisa won⟧^{w} ***Entails believe p***
= ⟦believe⟧^{w}(⟦CONT⟧^{w}(⟦the claim that Lisa won⟧^{w}))
= [λp$_{<st>}$.[λx$_e$.DOX$_x^w$ ⊆ p]]({w': won(*lisa*)(w')})
= [λx$_e$.DOX$_x^w$ ⊆ {w': won(*lisa*)(w')}]
$\left\{ \begin{array}{l} \textit{defined if } \text{DOX}_x^w \subseteq \{w':\lambda w''.\text{won}(\textit{lisa})(w'') = \text{CONT}(w')(⟦\text{the claim that Lisa won}⟧)\} \\ \# \textit{ otherwise} \end{array} \right\}$

As shown in (105), CP-selecting *know*-verbs (95-a) cannot combine with Content DPs in this way, as this results in a type-mismatch (see footnote 10 for discussion of why nesting ID and CONT is not an option).

(105)   ⟦know$_{EPIST}$ the claim that Lisa won⟧^{w} ***Type-mismatch***
= ⟦know$_{EPIST}$⟧^{w}(⟦CONT⟧^{w}(⟦the claim that Lisa won⟧^{w}))
= [λP$_{<st,t>}$.[λx$_e$.∃s∃p ∈ P[s is a situ. exemplifying p ∧ AQ(x)(s)]]]({w':won(*lisa*)(w')}) = #

The only way that *know*-verbs can combine with Content DPs is by saturating the internal argument slot of the $\sqrt{AQ}$ root;[34] thus giving rise to the acquaintance meaning of *know*, as shown in (106).

(106)   ⟦know$_{AQ}$ the claim that Lisa won⟧^{w} ***AQ-reading***
= ⟦know$_{AQ}$⟧^{w}(⟦the claim that Lisa won⟧^{w})
= [λy$_e$.[λx$_e$.AQ$_w$(x)(y)]](ιx.claim$_w$(x) & CONT$_w$(x) = {w': won(*lisa*)(w')})
= [λx$_e$.AQ$_w$(x)(ιx.claim$_w$(x) & CONT$_w$(x) = {w': won(*lisa*)(w')})]

Deriving Generalization 2. In Section 3.1 I argued, building on previous insights from Djärv (2019), that syntactically and in terms of their argument structure, Source DPs behave like indirect objects of applicative constructions. This is unlike Content DPs, which, like CPs, saturate the propositional (direct object) argument slot of *believe* (104). Semantically, I showed that Source DPs are presuppositional, and that the presupposition they introduce is, informally, that *there was an assertion event s.t.* DP_{source} *proposed to make p common ground.* Truth-conditionally, *believe*+Source DP sentences (like *believe*+Content DP sentences) are equivalent to *believe CP* sentences. To capture these observations, I proposed that Source DPs are licensed by the head Asst^o, repeated in (107).

(107)   ⟦Asst^o⟧^{w} = [λp$_{<st>}$.[λx$_e$.[λf$_{<st,et>}$.f(p)]]]
$\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert}(e) \& \text{agent}(e)(x) \& \text{goal}(e) = p \cap c] \\ \# \textit{ otherwise} \end{array} \right\}$

As we saw in Section 4.2, Asst^o is straightforwardly compatible with *believe*-verbs (type ⟨st,et⟩) (93).

(108)   ⟦believe Anna that Lisa won⟧^{w} ***Entails believe p & gives rise to source-reading***
= ⟦Asst^o⟧^{w}(⟦that Lisa won⟧^{w})(⟦Anna⟧^{w})(⟦believe⟧^{w})
= [λp$_{<st>}$.[λx$_e$.[λf$_{<st,et>}$.f(p)]]](λw'.won(*lisa*)(w'))(*anna*)(λp$_{<st>}$.[λx$_e$.DOX$_x^w$ ⊆ p])
= [λx$_e$.[λf$_{<st,et>}$.f(λw'.won(*lisa*)(w'))]](*anna*)(λp$_{<st>}$.[λx$_e$.DOX$_x^w$ ⊆ p])

the x argument of Asst^o (*anna*) goes into agent(e)(x) in the presupposition

= [λf$_{<st,et>}$.f(λw'.won(*lisa*)(w'))](λp$_{<st>}$.[λx$_e$.DOX$_x^w$ ⊆ p])
= [λp$_{<st>}$.[λx$_e$.DOX$_x^w$ ⊆ p]](λw'.won(*lisa*)(w'))
= [λx$_e$.DOX$_x^w$ ⊆ {w':won(*lisa*)(w')}]
$\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert}(e) \& \text{agent}(e)(\textit{anna}) \& \text{goal}(e) = \{w':\text{won}(\textit{lisa})(w')\} \cap c] \\ \# \textit{ otherwise} \end{array} \right\}$

As shown in (108)–(110), given that the third (*f*) argument of Asst^o is a predicate of type ⟨st,et⟩, Asst^o is neither compatible with *know$_{EPIST}$* (95-b), nor with *know$_{AQ}$* (95-a).

(109)   ⟦know$_{EPIST}$ Anna that Lisa won⟧^{w} ***Type-mismatch***
= ⟦Asst^o⟧^{w}(⟦that Lisa won⟧^{w})(⟦Anna⟧^{w})(⟦know$_{EPIST}$⟧^{w})
= [λp$_{<st>}$.[λx$_e$.[λf$_{<st,et>}$.f(p)]]](λw'.won(*lisa*)(w'))(*anna*)(λP$_{<st,t>}$.[λx$_e$.∃s∃p ∈ P[s is a situation exemplifying p ∧ AQ$_w$(x)(s)]])

---

[33]I'm omitting the presupposition in the intermediate steps of the derivations below.
[34]Not including potential Concealed Question readings; see footnote 8.

$$\cdots$$
$$= [\lambda f_{<st,et>}.f(\lambda w'.won(l)(w'))](\lambda P_{<st,t>}.[\lambda x_e.\exists s\exists p \in P[s \text{ is a situ. exempl. } p \wedge AQ_w(x)(s)]]) = \#$$

(110) $\llbracket \text{know}_{AQ} \text{ Anna that Lisa won}\rrbracket^w$ **Type-mismatch**
$$= \llbracket \text{Asst}^o\rrbracket^w(\llbracket \text{that Lisa won}\rrbracket^w)(\llbracket \text{Anna}\rrbracket^w)(\llbracket \text{know}_{AQ}\rrbracket^w)$$
$$= [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]](\lambda w'.won(lisa)(w'))(anna)(\lambda y_e.[\lambda x_e.AQ_w(x)(y)])$$
$$\cdots$$
$$= [\lambda f_{<st,et>}.f(\lambda w'.won(lisa)(w'))](\lambda y_e.[\lambda x_e.AQ_w(x)(y)]) = \#$$

Crucially, since *believe*-verbs do not combine with DPs as part of its argument structure, and since individuals like *Anna* have no propositional content, the only way that *believe* can combine with non-contentful individuals is via Asst^o. This guarantees that in cases where the proposition in question is contextually recoverable (p_C), the sentence is going to entail the belief that p_C and that Anna has asserted p_C, as shown in (111).[35]

(111) $\llbracket \text{believe Anna}\rrbracket^w$ **Entails believe p & gives rise to source-reading**
$$= \llbracket \text{Asst}^o\rrbracket^w(p_C)(\llbracket \text{Anna}\rrbracket^w)(\llbracket \text{believe}\rrbracket^w)$$
$$= [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]](p_C)(anna)(\lambda p_{<st>}.[\lambda x_e.DOX_x^w \subseteq p])$$
$$\cdots$$
$$= [\lambda p_{<st>}.[\lambda x_e.DOX_x^w \subseteq p]](p_C)$$
$$= [\lambda x_e.DOX_x^w \subseteq p_C]$$
$$\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert}(e) \text{ \& agent}(e)(anna) \text{ \& goal}(e) = p_C \cap c] \\ \# \textit{ otherwise} \end{array} \right\}$$

A sentence like *know Anna*, on the other hand, while it has the same surface string as (111), it can only be derived by combining *Anna* with the $\sqrt{\text{AQ}}$ root, thus guaranteeing that these sentences neither entail knowing p, nor that the DP is the source of the p-information, as shown in (112), which is derived in the same fashion as (106).[36]

(112) $\llbracket \text{know}_{AQ} \text{ Anna}\rrbracket^w$ **AQ-reading**
$$= \llbracket \text{know}_{AQ}\rrbracket^w(\llbracket \text{Anna}\rrbracket^w)$$
$$= [\lambda x_e.AQ_w(x)(anna)]$$

Finally, as we saw in Section 3.1, German allows Source DPs and Content DPs to co-occur, as shown in (113), repeated from (24) above. Putting the accounts for Generalizations 1 and 2 together, we get a straightforward explanation for the fact that such sentences are interpreted, truth-conditionally, like their counterparts in (108).

(113) Ich glaube ihm die Behauptung, dass Maria ein Genie war.
I believe him.DAT the.ACC claim that Maria a genius was
I believe the claim, that he told me, that Maria was a genius.

On this account, the derivation of such sentences involves both Uegaki's (2016) CONT type-shifter, and the Asst^o head proposed here. The derivation is given in (114).[37]

(114) $\llbracket \text{believe Anna the claim that Lisa won}\rrbracket^w$ **Entails believe p & gives rise to source-reading**
$$= \llbracket \text{Asst}^o\rrbracket^w(\llbracket \text{CONT}\rrbracket^w(\llbracket \text{the claim that Lisa won}\rrbracket^w))(\llbracket \text{Anna}\rrbracket^w)(\llbracket \text{believe}\rrbracket^w)$$

---

[35] A question remains of why it is possible to not pronounce the clause in a *believe*+Source DP sentence, given that *believe* typically doesn't allow this (e.g. #*I believe* vs. *I know*). Here, I have no definitive answer to this question; perhaps it it linked to the fact that with Source DPs, p must be accessible in the common ground; this is one of it's definedness conditions (similarly to *know*). However, I take this to be an orthogonal question about the PF-discourse interface, and I leave this issue for future research to resolve.

[36] Note that the current proposal does not rule out the option of sources of knowledge being specified in other ways with these verbs, e.g. in adjunct *from*-PPs. Interestingly, as pointed out to me by Muffy Siegel (p.c.), *know from x that p* completely lacks the restrictions on inanimate DPs that we observed with Source DPs in Section 3.2, (50)–(51):

(i) a. Mary knows from the time of death that the butler did it. (Muffy Siegel, p.c.)
    b. #Mary believes the time of death that the butler did it. ≈(50-b)

It's also noteworthy that there seems to be some variation with respect to the availability of such PPs with *believe*: while *from*-PPs are (predictably) degraded with *believe* if the intended meaning is the same as what we would get with a Source DP (**I believe from Anna that. . .*; cf. *I believe Anna that p*), such *from*-PPs are possible in other cases, e.g. *I believe from what I heard on the radio that p* (cf. **I believe what I heard on the radio that p*). Thanks to Kyle Rawlins, Mandy Simons, and Hans Kamp, p.c. for this point.

[37] Using our (technically ungrammatical) running example from English for clarity of exposition.

$= [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]](\lambda w'.\text{won}(lisa)(w'))(anna)(\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p])$
$= [\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p]](\lambda w'.\text{won}(lisa)(w'))$
$= [\lambda x_e.\text{DOX}_x^w \subseteq \{w':\text{won}(lisa)(w')\}]$

$$\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert}(e) \ \& \ \text{agent}(e)(anna) \ \& \ \text{goal}(e) = \{w':\text{won}(lisa)(w')\} \cap c], \\ \textit{and if } \text{DOX}_x^w \subseteq \{w':\lambda w''.\text{won}(lisa)(w'') = \text{CONT}(w')(\llbracket\text{the claim that Lisa won}\rrbracket)\} \\ \# \ \textit{otherwise} \end{array} \right\}$$

In the final part of the proposal, I return to the contrast between English and German in terms of the ability of Source and Content DPs to co-occur.

4.4 Source DPs and Case in German vs. English

In Section 3.1, I suggested that the availability of Source DPs to co-occur with Content DPs is linked to the general presence or absence of Source Applicatives in the language. This is supported by the observation that the restriction on multiple DPs in Source DP sentences appears to track whether the language in question allows for Source Applicatives more generally. The following is by no means a comprehensive cross-linguistic survey. However, it is indicative of such a link, that Dutch and Swedish, which *lack* Source Applicatives, pattern like English in terms of not allowing Source and Content DPs to co-occur (115)–(116), whereas Spanish, which *does* have Source Applicatives, behaves like German in terms of *allowing* the two DPs to co-occur (117).

(115) Dutch

    a. Zij heeft hem het boek gegeven/*gestolen.
         she has   him the book given/stolen

         She gave the book to him./She stole the book from him.   ✗Source Applicative

    b. Ik geloof je (*de bewering) dat Mary een genie is.
         I believe you (the claim)   that Mary a   genius is

         I believe you (*the claim) that Mary is a genius.   ✗Source+Content DP

(116) Swedish

    a. Hon gav/*stal honom boken.
         she gave/stole him   book.DEF

         She gave the book to him./She stole the book from him.   ✗Source Applicative

    b. Jag tror   dig (*påståendet/ditt påstående) att Maria är ett geni.
         I   believe you (claim.DEF/your claim)   that Mary is a   genius

         I believe you (*the claim) that Mary is a genius.   ✗Source+Content DP

(117) Spanish

    a. Le   di/robé   el libro.
         her.DAT gave.1SG/stole.1SG the book

         I gave the book to her./I stole the book from her.   ✓Source Applicative

    b. Le   creo   (la afirmación) que Maria es un genio.
         her.DAT believe.1SG (the claim)   that Maria is a   genius

         I believe you (the claim) that Mary is a genius.   ✓Source+Content DP

In Section 3.1, I suggested that the co-occurrence contrast between English and German follows from a 'parametric' difference in terms of whether Asst^o, the head responsible for introducing the Source DP, assigns case. What (115)–(117) suggests is that this contrast is not due to a lexical quirk of Asst^o in German vs. English, but rather, tracks the availability of Source Datives in the language more broadly.

We can think about this in terms of learnability.[38] That is, if a language has both Source Applicative Datives, and Source DPs, then it is not surprising if the child will infer that the Source DP, like other source-arguments in the language, will be Dative. In languages like English, on the other hand, there is no evidence in the child's input that would lead the child to infer that source-arguments should be marked with Dative. Thus, on this view, the Source Dative is linked to the presence of Source Applicatives, even though the head introducing the Source DP is not in fact itself a Source Applicative head. Crucially, on this view, the co-occurrence contrast follows from syntactic, rather than semantic facts.

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[38]Thanks to Luke Adamson, p.c. for this point.

4.5 Rogativity and DP-complementation: potential counter-examples

In Section 4.1, I cautioned against directly extending current proposal for *know* to *all* question-embedding verbs (though I also showed what such an extension might look like in the case of *explain*). We also saw in Section 4.2 that not all verbs that are exclusively declarative embedding are predicted to behave like *believe* in terms of DP-complementation (e.g. *think*).

In this section, I look at three verbs that, at least on the surface, seem to provide a counter-example to the link assumed here between question-embedding and DP-complementation: *hear, doubt,* and *prove.* These verbs appear to behave like *believe* in terms of DP-complementation, but like *know* in terms of question-embedding. Indeed, if these verbs are genuinely question-embedding, and can furthermore be shown to compose with DPs in the same way as *believe*, then this would undermine the current proposal (originally from Uegaki 2016) for why verbs like *know* (a) do not give rise to a propositional entailment when they combine with Content DPs and (b) do not combine with Source DPs.

Here, I show that these cases are not all of one kind, and that none of them does in fact present this kind of challenge. In the case of *hear*, I show that we have what is in fact a clear example of a *know*-verb (factive with CPs, denotes a type of acquaintance-relation to DPs, and behaves like *know* with respect to question-embedding). Crucially, I show that the p-inference with *hear* (unlike with *believe*) depends on pragmatic, rather than compositional factors; thus highlighting the structural ambiguity that is present with *know*-verbs, but not with *believe*-verbs. In the case of *doubt*, I maintain that *doubt* is in fact a *believe*-verb (doxastic, non-factive, with DPs describing either sources or 'containers' of propositional content, and not *generally* question-embedding), and that its behaviour with respect to question-complements is crucially different from that of *know*, and requires more investigation. Finally, in the case of *prove*, I claim that it is a different kind of verb from both *know* and *believe* (veridical, non-factive, question-embedding; but with different constraints on question-embedding compared to *know*-verbs, and –crucially– with a different behaviour with respect to DP-complementation from *believe*-verbs).

1. Hear. As shown in (118) from Theiler, Roelofsen, & Aloni (2019), *hear* appears to behave like *believe* in terms of Generalization 1, despite being question-embedding (119).[39]

(118)   Theiler et al. (2019, 126)
John heard the rumor that Mary left.   ⊨ John heard that Mary left.

(119)   When I listen, I want to hunt down bootlegs of the band to hear whether this was as good live as it sounds like it might have been.

The case of *hear* is interesting, as it highlights the fact that *hear* is simultaneously a perception verb and a weak factive predicate. As shown in (120)–(121), in *hear DP* sentences, these readings come apart.

(120)   Context: Reliable source of information ↝ entailment

There's a rumour currently going around the office that Lisa has been promoted to CEO. This morning, our colleague Mary, who had just come back from her honeymoon in Peru, walked into the office just in time to overhear the head of HR and a couple of senior board members discuss the promotion. So Mary heard the rumour/claim that Lisa has been promoted to CEO.

a.   ⊨ Mary heard that Lisa has been promoted to CEO.   (perception reading)
b.   ⊨ Mary heard that Lisa has been promoted to CEO.   (factive reading)

(121)   Context: non-reliable source of information ↝̸ entailment

There's a rumour currently going around the office that Lisa has been promoted to CEO. This morning, our colleague Mary, who had just come back from her honeymoon in Peru, walked into the office just in time to overhear a couple of the interns and a guy from housekeeping discuss the promotion. So Mary heard the rumour/claim that Lisa has been promoted to CEO.

a.   ⊨ Mary heard that Lisa has been promoted to CEO.   (perception reading)
b.   ⊯ Mary heard that Lisa has been promoted to CEO.   (#factive reading)

In both (120) and (121), Mary heard the rumour or claim that Lisa had been promoted. And because of what it means to hear something, it follows that if Mary heard a claim or rumour with content p, then Mary must have heard p being said. This is the 'perception reading' of *hear that p*, which always follows from *hear the claim/rumour that p*. However, *hear that p* also has a (dominant) epistemic/factive reading, which I argued in Section 4.1 comes about by composing the lexical root with the SITU head. As shown by the contrast between (120) and (121), this reading is not entailed by *hear the claim/rumour that*

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[39]Example from Davies (2008-), the Corpus of Contemporary American English (COCA).

p. Rather, whether this reading is licensed depends on whether or not the rumour/claim has a reliable source. In (120), where the source is the head of HR and a couple of senior board members, who would most likely be well-informed about Lisa's promotion, the epistemic reading of *hear that p* is supported. In (121), on on the other hand, where the source of information is some of the interns and a person from housekeeping, who would not necessarily know the truth of the matter, the epistemic inference associated with *hear that p* is not supported. This is what we would expect on the current approach to *know*-verbs, where *hear DP* is derived via the $\sqrt{\text{AQ}_{hear}}$ root, coupled with a view of factivity like that of Djärv (2019), whereby factivity is derived via a presupposition that the speaker takes the attitude holder to have reliable evidence for p (see Section 4.1). In (120), that presupposition of factive *hear that p* is met. In (121), however, this presupposition is not met; thus explaining why the epistemic/factive reading is not supported and comes across as infelicitous. (Note that we still need to explain how the CP in (120-a) comes to be associated with the non-factive perception reading. One option is that these cases involve a covert D-layer meaning 'the claim that p'; cf. Bogal-Allbritten & Moulton 2016; Moulton et al. 2020. On this view, the perception reading in (120-a) would be derived directly via the $\sqrt{\text{AQ}_{hear}}$ root, and the epistemic/factive reading in (120-b) via $\sqrt{\text{AQ}_{hear}}$ + SITU, as in Section 4.1.)

Crucially, this is unlike what we predict in the case of *believe*, which I have argued can only combine with Content DPs via Uegaki's (2016) CONT ($\langle$e,st$\rangle$) type-shifter.[40] This guarantees that *believe p* will always follow from *believe the claim that p*; regardless of the perceived reliability of the source of the claim or rumour that p. As shown in (122), this prediction is borne out.

(122)   Context: non-reliable source of information $\rightsquigarrow$ entailment (*believe*)
        There's a rumour currently going around the office that Lisa has been promoted to CEO. This morning, our colleague Mary, who had just come back from her honeymoon in Peru, walked into the office just in time to overhear a couple of the interns and a guy from housekeeping discuss the promotion. Now Mary believes the rumour/claim that Lisa has been promoted to CEO.

        ⊨ Mary believes that Lisa has been promoted to CEO.

These examples also nicely illustrate the core observation of this paper; that *believe*-sentences, unlike *know*-sentences, are not ambiguous with respect to the interpretation of CPs and DPs. In the case of *believe*, Content and Source DPs simply add (not-*at issue*) information about the source or 'container' of the propositional content of the doxastic state; they don't change the basic interpretation of the verb as describing a doxastic relation to p.

2. Doubt. As we saw in Section 1.1, *doubt* patterns like *believe* with respect to DP-complementation. (123), repeated from (6)–(7), shows that *doubt* behaves like *believe* in terms of Generalizations 1 and 2:

(123)   a.   Mary doubted the rumour that Lisa won.   ⊨ Mary doubted that Lisa won.
        b.   Do you have any reason to doubt him that it was on that night that that conversation happened?

However, as shown in (124), *doubt* also allows for polar questions. Crucially, however, it does not allow for alternative or constituent questions (see also Karttunen 1977b; Egré 2008).

(124)   Biezma & Rawlins (2012, 395)
        a.   Alfonso doubts whether (*or not) it is raining (*or not).
        b.   *Alfonso doubts whether it is raining or snowing.
        c.   *Alfonso doubts what the weather is.

This is clearly a different pattern from what we observe with *know*. Here, I take the evidence to weigh in favour of treating *doubt* as a *believe*-verb; leaving its puzzling behaviour with respect to question-embedding as a question for future research.

3. Prove. The final case involves the verb *prove*. As shown in (125), *prove* behaves like *believe* in terms of Generalization 1, despite being question-embedding, as shown in (126).

(125)   Theiler et al. (2019, 126)
        John proved the hypothesis that every positive integer has a unique prime factorization.
        ⊨ John proved that every positive integer has a unique prime factorization.

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[40]Or when the DP can function as a so-called Repository of Information, as a Source DP, via Asst^o; see Section 3.1.

(126)   Egré (2008, 17)
         As yet, there is probably no evidence that would definitely prove whether or not some di-
         nosaurs were warm-blooded.

However, if we look more closely at the complementation-behaviour of *prove*, we find that it appears to
be a very different kind of verb from both *know* and *believe* (see Egré 2008 for more discussion of the
properties illustrated in (127)–(129)). To start, while *prove* is veridical, it is not factive, as shown in
(127). This is unlike *know*, as shown in (128) .

(127)   a.   Mary proved that Lisa won, #but in fact, Lisa lost.
         b.   Mary didn't prove that Lisa won, and in fact, Lisa may have lost.

(128)   a.   Mary knows that Lisa won, #but in fact, Lisa lost.
         b.   Mary doesn't know that Lisa won, #and in fact, Lisa may have lost.

Secondly, as shown in (129-a), *prove wh* is not felicitous in contexts that entail the corresponding *prove
that* sentence. As shown in (129-b), this is unlike *know*.

(129)   a. #Mary proved whether Lisa won. (If Mary proved that Lisa won.)
         b.   Mary knows whether Lisa won. (If Mary knows that Lisa won.)

    This suggests that *prove* should not be analysed on par with the *know*-verbs. This is also evident by
the fact that *prove* does not allow for acquaintance-type readings of DPs, as shown in (130).

(130)   #Mary proved Lisa.

    Crucially, however, *prove* also differs from *believe*-verbs, not just in terms of question-embedding and
veridicality, but importantly also in terms of the interpretation of Content DPs. Given that the *believe p*
entailment of *believe DP* sentences is compositionally derived, it does not depend on pragmatic or lexical
factors. We saw its independence from pragmatic factors illustrated in (122) above; contrasted with *hear*.
As shown in (131),[41] the entailment of *believe DP* also does not depend on the meaning of the noun; the
entailment appears to go through with any contentful DP, including DPs like *the propaganda, the lie,
the narrative*, and *the declaration*. This is unlike *prove*, which, as shown in (132), is generally infelicitous
with such DPs, and does not license a corresponding *prove p* inference with these DPs.

(131)   a.   only the privileged believe the propaganda that US workers won't do certain jobs.
               ⊨ only the privileged believe that US workers won't do certain jobs
         b.   I believe the declaration that all men are created equal
               ⊨ I believe that all men are created equal
         c.   at the expense of every kid who believed the lie that education would lead to prosperity
               ⊨ at the expense of every kid who believed that education would lead to prosperity
         d.   [they] believe the narrative that is provided by their opinion network
               ⊨ [they] believe [the content of the narrative] that is provided by their opinion network

(132)   a. #they proved the propaganda that US workers won't do certain jobs.
         b. #I proved the declaration that all men are created equal
         c. #they proved the lie that education would lead to prosperity
         d. #[they] proved the narrative that is provided by their opinion network.

This suggests that the entailment in (125) is not in fact derived in the same way as with *believe*; if it were,
(132) would be expected to behave like (131).[42] The pattern in (125)–(126) would only be a problem
for the current account if it could be shown that *prove* combines with DPs in the same compositional
fashion as *believe* does (thereby deriving the entailment). However, as this does not seem to be the case,
I submit that *prove* is not in fact a genuine problem for the current proposal.

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[41]Examples from Davies (2008-), the Corpus of Contemporary American English (COCA).

[42]Of course, given that *prove* is veridical, a meaning like *they proved p and p is a lie* (132-c) would seem contradictory,
and might therefore be ruled out on independent grounds. However, this is not the case for *the propaganda*; being the
content of propaganda doesn't render it false. Therefore, if *prove* worked in the same way as *believe*, we would imagine
(132-a) to mean something like *they proved that US workers won't do certain jobs, and 'that US workers won't do certain
jobs' is propaganda*, just like (131-a) means that *only the privileged believe that US workers won't do certain jobs, and
'that US workers won't do certain jobs' is propaganda*. Similarly, there is nothing contradictory about showing that the
content of a declaration or a narrative is true (132-b), (132-d). This suggests that the general problem with the sentences
in (132) lies in the selectional restrictions that *prove* imposes on its DP-complements and the way that *prove* composes
with DPs; which are different from *believe*-verbs.

Nevertheless, what *prove* does highlight is that a more fine-grained typology of attitude verbs is motivated, in terms of the relationship between DP-complementation, factivity/veridicality, and question-embedding. Here, I leave it a question for future research to continue investigating the ways in which these and other properties may interact in order to give rise to the kinds of empirical generalizations that we observe in natural language.

Before concluding this paper, I compare the current approach with two recent alternative approaches to DP and CP complementation with verbs like *know* and *believe*.

5 Alternative approaches to DP and CP complementation

5.1 Elliott (2016) on *know*-verbs and the *lack of* entailment

A previous proposal for the lack of the DP-to-CP entailment with *know*-verbs comes from Elliott (2016), who focuses on the case of *explain* as a representative case for the class of *know*-verbs (though as I discussed in Section 4.1, this is problematic, given that *explain* behaves quite differently from the factive *know*-verbs in terms of the relation between the two types of arguments). Elliott (2016) proposes that the lack of entailment can be accounted for in terms of a *general* difference in terms of how CPs vs. DPs combine with attitude verbs. Recall from (75) above that CP-complements of *explain* are (typically) interpreted as the explanation provided for something, the *explanans*, whereas DP-complements are interpreted as the thing explained, the *explanandum*. This is shown again in (133).

(133) Elliott (2016, 171)
   a. Angela explained [$_{DP}$ the fact that Boris resigned].   *explanandum*
   b. Angela explained [$_{CP}$ that Boris resigned].   *explanans*

To account for this, Elliott analyses attitude verbs as simple predicates of events, as shown in (134).

(134) Elliott (2016, 180)
   $[\![\text{explain}]\!]^w = \lambda e.\text{explaining}_w(e)$

Building on the view from Moulton (2009), whereby clauses combine with content nouns like *claim*, via Predicate Modification, Elliott proposes that CPs also combine with *verbs* by modifying the eventuality argument of the attitude verb. This is illustrated in (135). (Elliott assumes that individuals and eventualities are of the same semantic type.)

(135) Elliott (2016, 180)
   a. $[\![\text{that Boris resigned}]\!]^w = \lambda x.\text{CONT}_w(x) = \lambda w'.\text{resigned}(boris)(w')$
   b. $[\![\text{explain that Boris resigned}]\!]^w = \lambda e.\text{explaining}_w(e) \wedge \text{CONT}_w(e) = \lambda w'.\text{resigned}(boris)(w')$

As a result, clausal complements of attitude verbs are invariably interpreted as a set of (explaining, saying, believing, knowing, etc.) events with propositional content p. To allow DPs to combine with verbs, Elliott proposes a neo-Davidsonian approach, whereby the verb first combines with a theme-head, which allows the verb to combine with the DP. This is illustrated in (136).

(136) Elliott (2016, 177, 180)
   a. $[\![\text{the fact that Boris resigned}]\!]^w = \iota x.\text{fact}_w(x) \wedge \text{CONT}_w(x) = \lambda w'.\text{resigned}(boris)(w')$
   b. $[\![\text{TH}]\!]^w = \lambda f_{<e,et>}.\lambda x.\lambda e.f(e) \wedge \text{theme}_w(e) = x$
   c. $[\![\text{explain TH}]\!]^w = \lambda x.\lambda e.\text{explaining}_w(e) \wedge \text{theme}_w(e) = x$
   d. $[\![\text{explain the fact that Boris resigned}]\!]^w$
       $= \lambda e.\text{explaining}_w(e) \wedge \text{theme}_w(e) = \iota x.\text{fact}_w(x) \wedge \text{CONT}_w(x) = \lambda w'.\text{resigned}(boris)(w')$

This account thus correctly predicts the lack of the entailment from *explain DP* to *explain CP*, as well as the interpretation of CP and DP complements of *explain*. There are three problems, however, with this approach.

The first problem is that on this account, there is nothing preventing the generation of sentences like (137), repeated from (77) above.

(137) a. *The City explained [$_{DP}$ the delay] [$_{CP}$ that they were having problems with the factory].
       b. *The City explained [$_{DP}$ the fact that there was a delay] [$_{CP}$ that they were having problems with the factory].

Compositionally, sentences like (137) should be possible, given that *explain*, when it occurs with a theme-argument (136-d), is of the same semantic type as *explain* when it occurs on its own (134) (type ($\langle et \rangle$)).

(138)   a. $[\![\text{explain}]\!]^w = \lambda e.\text{explaining}_w(e)$
        b. $[\![\text{explain DP}]\!]^w = \lambda e.\text{explaining}_w(e) \wedge \text{theme}_w(e) = \text{DP}$

Thus, just as we were able to derive *explain that p* in (135-b) via Predicate Modification, we should also be able to combine an *explain DP* sentence like (136-d) with a CP by Predicate Modification, with the result in (139); meaning that the explanation for Boris' resignation was that he wanted a holiday.

(139) $[\![\text{explain the fact that Boris resigned that Boris wanted a holiday}]\!]^w$
        $= \lambda e.\text{explaining}_w(e) \wedge \text{theme}_w(e) = [\iota x.\text{fact}_w(x) \wedge \text{CONT}_w(x) = \lambda w'.\text{resigned}(boris)(w')]$
        $\wedge \text{CONT}_w(e) = \lambda w'.\text{wanted-a-holiday}(boris)(w')$

Conceptually, there is also no obvious reason why sentences like (137) and (139) should be ill-formed, given that the meaning assigned to them on this system is essentially equivalent to that of the well-formed sentences in (140).

(140)   a.   the City explained [$_{DP}$ the delay] by saying [$_{CP}$ that they were having problems with the factory][43]
        b.   the City explained [$_{DP}$ the fact that there was a delay] by saying [$_{CP}$ that they were having problems with the factory]

On the account proposed in Section 4.1 for *know*-verbs, on the other hand, *know DP* and *know CP* sentences share the same 'morpho-semantic core', the lexical root $\sqrt{\text{AQ}}$, which describes an acquaintance relation. When a DP combines with $\sqrt{\text{AQ}}$, the DP saturates its object-of-acquaintance slot and, as a consequence, blocks the derivation of CP-selecting *know*, which is built on-top of $\sqrt{\text{AQ}}$ in a morpho-semantically more complex structure. As discussed above, in the context of both *explain* and *know*-verbs, this correctly predicts that sentences like (137) and (139) should be ruled out.

The second challenge for Elliott's (2016) approach, is how to account for the *presence* of the entailment with verbs like *believe, trust,* and *doubt*. According to Elliott, the interpretation of a theme argument is an idiosyncratic fact about the root itself. For *believe*, Elliott (2016, 181) proposes that the theme specifies the propositional content of the belief-eventuality; thus, giving us the DP-to-CP entailment. On Elliott's proposal then, CPs and Content DPs compose with *believe* in different ways, and it is essentially a lexical quirk of *believe* that it gives rise to the entailment with Content DPs. As we saw in Section 3.1, however, there is strong morpho-syntactic evidence suggesting that with *believe*-verbs, Content DPs and CPs combine with the verb in the *same* way, i.e. by saturating the (propositional) direct object slot of the verb.

Finally, on this account, it is not clear why the entailment-contrast between *know* and *believe*-verbs (Generalization 1) should correlate with other properties, like the availability of Source DPs (Generalization 2) and question-embedding (Generalization 3). On the current approach, where both the derivation of Content and Source DPs is defined only for proposition-selecting verbs, it is no coincidence that they should pattern together.

5.2   Roberts (2020) on *believe* with Content and Source DPs

As we discussed in Sections 3.1 and 4.4, Source DPs and Content DPs in English cannot co-occur. In Section 3.1, I mentioned that this might lead us to think that the two DPs saturate, and therefore compete for, the same argument slot of *believe*. This was in fact proposed by Roberts (2020), who argues that *believe* selects for contentful individuals, as shown in (141) (where v is the type of eventualities and c the type of content individuals)[44]

(141)   Roberts (2020, 11)
        $[\![\text{believe}]\!] = \lambda x_c.\lambda e_v.\text{believe}(e) \wedge \text{CONT}(x) = \text{CONT}(e)$

Roberts (2020) proposes that Content DPs and Source DPs both combine with *believe* by saturating its internal argument (x_c) slot. For Content DPs, this works out straightforwardly, as shown in (142).

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[43] From Davies (2008-), the Corpus of Contemporary American English (COCA).

[44] Roberts's (2020) analysis of *believe*-verbs (and how they combine with *Content* DPs) is similar to that in Djärv (2019), which I discussed briefly in fn. 12.

(142) Roberts (2020, 6)

    a. $[\![$the claim that it's raining$]\!] = \iota x_c[\text{claim}(x) \wedge \text{CONT}(x) = \lambda w'.\text{rain}(w')]$

    b. $[\![$believe the claim that it's raining$]\!]$
       $= \lambda e_v.\text{believe}(e) \wedge \text{CONT}(\iota x_c[\text{claim}(x) \wedge \text{CONT}(x) = \lambda w'.\text{rain}(w')]) = \text{CONT}(e)$

With Source DPs, on the other hand, since they are not associated with propositional content, Roberts (2020) argues that they are type-shifted into a contentful DP by an operator which Roberts terms CLAIM (143-a), denoting a function from individuals to the unique contentful individual with the same content as their claim in w (type $\langle e,c \rangle$). Thus, as shown in (143), Roberts takes Source DPs to combine with *believe* in the same way as a Content DP, by saturating an x_c argument slot of *believe*.

(143) Roberts (2020, 12, 14)

    a. $[\![\text{CLAIM}]\!]^w = \lambda y_e.\iota x_c[\text{CONT}(x_c)(w) = \text{CONT}(\text{claim}(y)(w))]$

    b. $[\![\text{CLAIM}]\!]^w([\![\text{Maude}]\!]) = \iota x_c[\text{CONT}(x_c)(w) = \text{CONT}(\text{claim}(\textit{maude})(w))]$

    c. $[\![$believe Maude$]\!] =$
       $\lambda e_v.\text{believe}(e) \wedge \text{CONT}(\iota x_c[\text{CONT}(x_c)(w) = \text{CONT}(\text{claim}(\textit{maude})(w))]) = \text{CONT}(e)$

To further combine with a CP (of type $\langle vt \rangle$, as shown in (144-a)), Roberts proposes that it combines with the *believe*+Source DP constituent as a modifier of the event argument of *believe*, as shown (144-b).

(144) Roberts (2020, 13, 14)

    a. $[\![$that it's raining$]\!]^w = \lambda e_v.\text{CONT}(e)(w) = \lambda w'.\text{rain}(w')$

    b. $[\![$believe Maude that it's raining$]\!]^w =$
       $\lambda e_v.\text{believe}(e) \wedge (\text{CONT}(\iota x_c[\text{CONT}(x_c)(w) = \text{CONT}(\text{claim}(\textit{maude})(w))]) = \text{CONT}(e))$
       $\wedge (\text{CONT}(e)(w) = \lambda w'.\text{rain}(w'))$

The LFs proposed by Roberts (2020) for Source and Content DPs is given in (145).

(145) Roberts (2020, 10)

    a.   Content DPs: $[_{<vt>} [_{<vt>} \text{believe}_{<c,vt>} [_{<c>}$ the claim that p$]] [_{<vt>}$ that it's raining$]]$

    b.   Source DPs: $[_{<vt>} [_{<vt>} \text{believe}_{<c,vt>} [_{<c>} \text{CLAIM}_{<e,c>}(\text{Mildred}_{<e>})]] [_{<vt>}$ that it's raining$]]$

As we have already seen, however, this approach makes the wrong predictions for the morpho-syntactic and argument structural properties of Source DP sentences.

First, given that Roberts (2020) takes Source and Content DPs both to saturate an x_c argument slot of *believe*, this account predicts that the two types of DPs should be in complementary distribution. However, as Djärv (2019) showed in the case of German, and as we have seen here also in Spanish, the two types of DPs *can* co-occur, contrary to the predictions of Roberts' account.

Moreover, as we saw in Section 3.1, Roberts makes the wrong predictions also for English. As we saw in Section 3.1, syntactic evidence shows us that in *both* English and German, Source DPs pattern like indirect objects of *believe*, whereas Content DPs (and CPs) pattern like direct objects. Thus, both the German and the English data speak *against* the type of uniform treatment of Source DPs and Content DPs proposed by Roberts (2020), and further, *in favour* of a uniform treatment of *believe DP* sentences in English and German, as proposed here.

6 Conclusion

Based on the interpretation of different kinds of DP and CP complements of *know* vs. *believe*-verbs, I have argued that the two verb-types differ fundamentally from one another at the level of internal morpho-semantic composition and argument structure, and thus combine with DPs via different routes.

For *know*-verbs, I have proposed a novel derivational approach, according to which *know*-verbs describe relations that are fundamentally anchored in the attitude holder's acquaintance with abstract or concrete individuals in the world; both when they combine with CPs and DPs. This account avoids problems faced by previous accounts (in particular with respect to the assumption of polysemy), and further provides a close compositional and conceptual link between factivity (with CP-complements) and the interpretation of DPs as objects of acquaintance; a connection which is not present with *believe*-verbs. In particular, I have argued that *know DP* and *know CP* involve the same lexical root, which describes an acquaintance relation between individuals. The object-of-acquaintance argument of this root can either be saturated by a regular individual (with DPs) or by a situation pronoun, the *res* (with CPs).

The latter option is achieved in a morpho-semantically more complex structure, via head SITU, which takes the acquaintance root as its first argument. The head SITU fills two key roles: introducing the *res* (which saturates the object-of-acquaintance slot of the acquaintance root), and further providing an open argument slot for the CP, of type $\langle st,t\rangle$. The resulting predicate, CP-selecting *know*, states that there exists a situation s and a proposition $p_{<st>}$ in $P_{<st,t>}$, such that s exemplifies p, and x is acquainted with s. On this view then, *know*-verbs always describe an acquaintance relation, both when they combine with DPs and CPs. While the idea that knowledge, and factivity more broadly, involves acquaintance is in itself is not new (e.g. Goldman 1967; Lewis 1979; Kratzer 1989, 2002), this account is novel in that provides an explicit and compositional morpho-semantics for the relation between *know DP* and *know CP* that captures this intuition, as well as the behaviour of *know*-verbs when they combine with DPs. I have also provided a tentative sketch for how the schematic, compositional aspect of this proposal could be extended to non-factive verbs like *explain*.

For *believe*-verbs, I have argued that they are fundamentally Hintikkan: i.e. they combine only with propositions, and are not intrinsically anchored to facts. To combine with DPs, they thus require either type-shifting (defined for contentful DPs, as proposed by Uegaki 2016), or an external licensing head (defined for agentive Source DPs; proposed here). For Content DPs, which I have shown behave like direct objects of *believe*, similarly to CPs, Uegaki's (2016) content-retrieval type-shifter guarantees that *believe that p* and *believe the rumour that p* will be truth-conditionally equivalent. For Source DPs, I have shown that they are indirect objects of *believe*, introduced by a type of attitudinal applicative head, Asst^o, which describe a not-*at issue* assertion event, such that the Source DP has proposed to make p common ground. Like other applicatives, Asst^o preserves the relation between the verb and the direct object. This guarantees that *I believe Anna that Lisa won* will entail that I believe that Lisa won, just like *I baked Anna a cake* will entail that I baked a cake.

This proposal also has implications for theories of question-embedding. Previous work has observed a connection between factivity/veridicality and question-embedding (e.g. Egré 2008; Spector & Egré 2015; Uegaki 2015, 2016; Uegaki & Sudo 2017; Theiler et al. 2018; Steinert-Threlkeld 2019), and Uegaki (2016) further links the contrast in question-embedding to the interpretation of Content DPs. Following Uegaki (2016), I have argued that the reason why the mechanisms that enable *believe*-verbs to combine with DPs (type-shifting and the head Asst^o) are not available to *know*-verbs, is because of a contrast in their selectional properties: *know*-verbs being question-embedding and *believe*-verbs being proposition-embedding. Given the compositional relation between the acquaintance-interpretation with DPs and factivity with CPs proposed here, the current proposal thus adds further to the our understanding of the link between DP-selection, factivity, and question-embedding.

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