Knowing and believing things:

what DP-complementation can tell us about the argument structure and semantic composition of (factive) attitude verbs

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1 Introduction

In the Hintikkan tradition, attitude verbs are standardly analysed as quantifiers over worlds: if Mary believes that Jane won, then all of Mary's belief-worlds have to be worlds in which Jane won:[1]

(1) $[\![\text{believe}]\!]^w = \lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p]$ *where* $\text{DOX}_x^w = \{w': w' \text{ conforms to what x believes in w}\}$

know vs. *believe*:

- On this approach, the primary semantic difference between *know* and *believe* is in terms of the type of *accessibility relation* that determines the set of worlds quantified over (DOX/EPIST).
- They differ additionally in that *know*, like other factives, presuppose that p is true in *w*.

(2) $[\![\text{know}]\!]^w = \lambda p_{<st>}[\lambda x_e:\underline{p(w)=1}.\text{EPIST}_x^w \subseteq p]$ *where* $\text{EPIST}_x^w = \{w': w' \text{ conforms to what x knows in w}\}$

This uniform picture of *know* and *believe* is challenged by cases where these verbs combine with DPs.

2 Challenges from DP-complementation

First, as has been previously observed, verbs like *know* and *believe* differ in terms of whether the verb + a Content DP entails the corresponding verb + CP sentence (e.g. Prior 1971; Pietroski 2000; Ginzburg 1995; King 2002; Moltmann 2013; Uegaki 2016; Elliott 2016):

(3)   *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

Secondly, as Djärv (2019) observes, the entailment contrast tracks a separate contrast in the interpretation and distribution of regular individuals, like *Anna*:

(4)   *Generalization 2: Source contrast* (Djärv, 2019, 210)
   a.   Mary believes Anna (that Lisa won).   ⇝ Mary believes p & Anna is the source of the p-info
   b.   Mary knows Anna (*that Lisa won).   ⇝ Mary is acquainted with Anna

believe: individuals like *Anna* can co-occur with CPs; the doxastic meaning is preserved and the DP is interpreted as the source of the p-information.

know: individuals like *Anna* cannot co-occur with CPs. Without the clause, the the epistemic meaning disappears and the DP is interpreted as an object of acquaintance.

NB: these contrasts are not due to some lexical quirk of *believe* vs. *know*, but represents a more general split between two classes of verbs:

(5)   *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, resents, is surprised by} the rumor that Lisa won.
         ⊭ Mary {knows, discovered, noticed, resents, is surprised} that Lisa won.

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

DP-complementation with *know* vs. *believe*-verbs presents a set of analytical challenges:

1. Why are *know DP* sentences interpreted as descriptions of acquaintance relations, with both abstract Content DPs like *the rumour* and 'regular' individuals like *Anna*?

2. Why does the interpretation of DPs with *believe* vary depending on the type of DP?

3. Why do *believe DP* always entail the belief of some (contextually or explicitly provided) p-content?

Goal of this talk: answer these questions

3   *know CP/DP*

3.1   *know CP* vs. *know DP* as polysemy?

Previous work on *know* in the context of Content DPs have analysed *know DP* vs. *know CP* in terms of polysemy (see for instance King 2002; Moltmann 2013; Uegaki 2016).

(7)   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. $[\![\text{know}_{AQ}]\!]^w = [\lambda y_e.[\lambda x_e.\text{AQ}_w(\text{x})(\text{y})]]$ Acquaintance verb: *know DP*

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

(8)   a.   Maria **vet**   att Lisa vann.
          Maria knows that Lisa won

          Maria knows that Lisa won.   Propositional *know* (Ger. *wissen*, Fr. *savoir*)
   b.   Maria **känner** Lisa.
          Maria knows   Lisa

          Maria knows Lisa.   Aquaintance-*know* (Ger. *kennen*, Fr. *connaitre*)

However, there are several problems with this view:

First, as we saw in (5), the interpretation of DPs as individuals isn't just a lexical quirk of *know*, but is representative of a larger class of verbs including *notice, discover, hear, see*, and so on.

- Thus, to generalize, a polysemy-based account would have to posit systematic polysemy for *all* of these verbs.
- Besides *know*, I am not aware of any language that systematically distinguishes between DP- and CP-selecting *forms* of these verbs; thus undermining the argument from the formal distinction in (8).

Secondly, by appealing to polysemy, we fail to capture the strong intuition that the DP- and DP-taking versions of *know, discover, notice*, etc. all share a semantic core.

- On the polysemy analysis of CP and DP-selecting *know*, it is not clear what derives this intuition.[4]

Finally, Swedish data actually speaks against polysemy: in complex forms, *känna* (by hypothesis *know$_{AQ}$*) can also combine with questions:

(9)   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 polysemy, and propose instead a derivational approach, whereby the DP- and CP-taking versions of verbs like *know* are derivationally related (cf. Chierchia 2006 on NPIs/FCs).

3.2 Analysis: *know CP* vs. *know DP*

I propose that *know CP* ($know_{EPIST}$) and *know DP* ($know_{AQ}$) both involve the root $\sqrt{\text{AQ}}$ (<e,<et>>), which I take to include both direct and indirect acquaintance (e.g. Lewis 1979):[5]

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

The acquaintance reading of *know* arises if an individual saturates the internal argument slot of $\sqrt{\text{AQ}}$, as shown in (13) ((13-b) assumes the analysis of Content DPs from Moulton 2009):

(11) $[\![know_{AQ}]\!]^w = [\![\sqrt{\text{AQ}}]\!]^w$ (type <e,et>)

(12)   a. $[\![\text{Anna}]\!]^w = anna$ (type e)
         b. $[\![\text{the claim that p}]\!]^w = \iota x.\text{claim}_w(x) \ \& \ \text{CONT}_w(x)=p$ (type e)

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

Epistemic, CP-selecting, *know*-verbs, I propose, involves an additional head, SITU (<<e,<et>>,<<st,t>,<et>>>):

(14)   *Minimal denotation for epistemic relations:*[6]
         $[\![\text{SITU}]\!]^w = [\lambda R_{<e,et>}.[\lambda P_{<st,t>}.[\lambda x_e.\exists s\exists p \in P[s \text{ is a situation exemplifying } p \wedge R(s)(x)]]]]$

$know_{EPIST}$ is derived by SITU taking $\sqrt{\text{AQ}}$ as its first (R) argument, as shown in (15):[7]
   - this causes the type e argument slots of $\sqrt{\text{AQ}}$ to be saturated with a situation pronoun s, the *res* (a particular of the more general type *e*), and an individual variable x.
   - the resulting predicate $know_{EPIST}$ (a question-embedding predicate <<st,t>,<et>>) thus 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:

(15) $[\![know_{EPIST}]\!]^w = [\![\text{SITU}]\!]^w([\![\sqrt{\text{AQ}}]\!]^w)$
 $= [\lambda P_{<st,t>}.[\lambda x_e.\exists s\exists p \in P[s \text{ is a situation exemplifying } p \wedge \text{AQ}_w(x)(s)]]]$ (type <<st,t>,<et>>)

The meaning of *know CP* sentences is given in (16), with declarative and interrogative complements:

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

   - Thus, a *minimal* condition on a *know CP* sentences is that there exists a situation s and a proposition p, such that s exemplifies p, and the attitude holder is acquainted with s.[8]

The derivational and argument-structural difference between *know DP* and *know CP*, is given in (17).[9]

   - Because DPs saturate the object-of-acquaintance slot of $\sqrt{\text{AQ}}$, it effectively blocks the derivation of the epistemic meaning (*know CP*; 17b), which is built on-top of $\sqrt{\text{AQ}}$ in a morpho-semantically more complex structure:

(17)   a.   *Mary knows DP*   b.   *Mary knows CP*
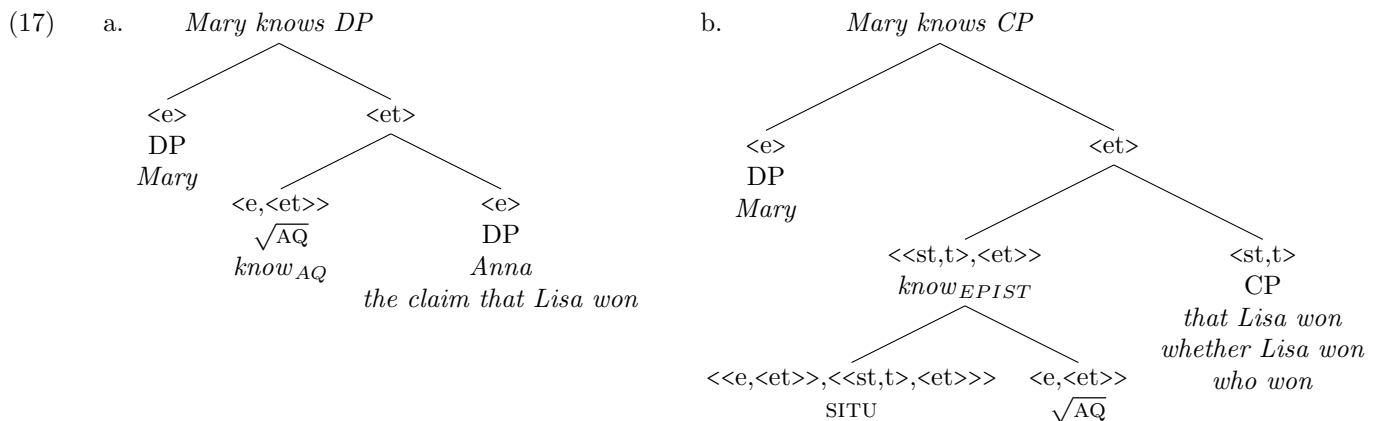
Like polysemy approaches, this results in the correct predictions for know DP sentences:

   ✓ No Source reading of the DP in *I know Anna* (13-a).
   ✓ No propositional entailment in *I know the claim that p* (13-b).

But because of this derivational relation, we also avoid the challenges faced by polysemy accounts!
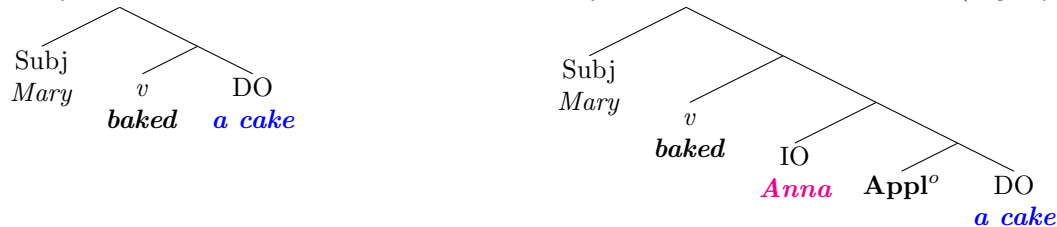
4   *believe CP/DP*

4.1   More on Source (vs. Content) DPs

In this section, I will make three empirical claims about the structure and meaning of Source DP sentences:

Claim 1: syntactically/argument structurally, *believe* is like optionally ditransitive verbs like *bake*.

(18)   a. *Mary baked a cake.*   b. *Mary baked Anna a cake.*   (E.g. Pylkkänen 2008)

(19)   a. *Mary believes (the claim) that Lisa won.*   b. *Mary believes Anna that Lisa won.*   (proposal)
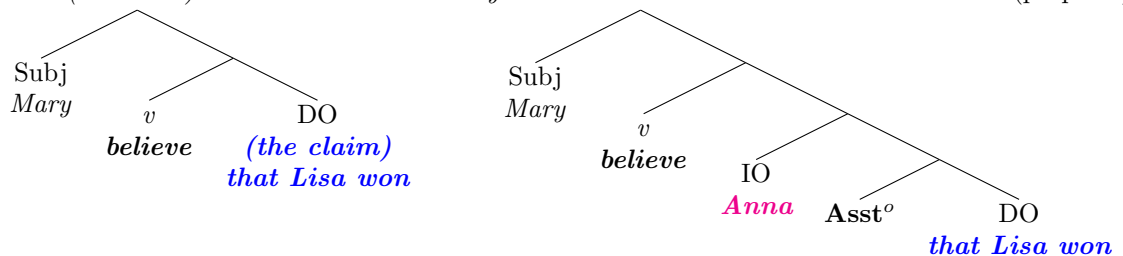
➢ Source DPs are indirect objects of *believe* & Content DPs and CPs are direct objects.

Diagnostics: (in Appendix A.1)

1. In languages like German and Spanish, which distinguish Dative and Accusative case, we get DAT on Source DPs and ACC on Content DPs; just like in other applicatives (e.g. with *bake, steal*).
2. Extraction possibilities in passives are the same as with verbs like *bake, steal* (data from English and German).

➢ **Next:** *What is the nature of the source-inference?*

Claim 2: Semantically, Source DP sentences describe an assertion event.

Diagnostics: (based on Anand and Hacquard 2009)

1. Restrictions on inanimate DPs.
2. Interpretation of epistemic modals (Appendix A.2).

1. Restrictions on inanimate DPs.

A&H observe that doxastic attitudes and assertion reports differ wrt. so-called Repository-of-Information subjects:

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

Crucially, A&H note a split among speech act verbs wrt. so-called 'non-discourse participants' like *the timing*:

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

A&H suggest that sentences like (21-a) are not in fact interpreted assertively, but rather as involving a causative doxastic meaning with an implicit generically quantified over experiencer:[10]

(22)   Based on Anand and 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 $\approx$ Hypothesis 1

Thus, we can tease apart two hypotheses for the meaning of *x believes y that p*:

(23)   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

- If Source DP sentences are interpreted as causatives (as on hypothesis 1) (23-a), then we'd expect that inanimate DPs like *the timing/the time of death* should be available as Source DPs.
- If Source DP sentences are interpreted on par with reported assertions (as on hypothesis 2) (23-b), then we'd expect that inanimate DPs like *the timing/the time of death* should *not* be available as Source DPs.

As shown in (24)–(25), Source DPs are subject to the same restrictions on inanimate DPs as assertion-predicates:[11]

(24)   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).

(25)   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.

➢ **Next:** *What is the status of the source-inference?*

Claim 3: Pragmatically, the source-inference is not *at-issue*.

Diagnostics:

1. Projection
2. *Hey, wait a minute* (Appendix A.3)
3. Presupposition filtering (Appendix A.3)
4. Context update potential (Appendix A.3)

1. Projection from entailment cancelling operators.

Source DP sentences imply both that the attitude holder believes p and that the Source DP has asserted p:

(26)   Mary believes Anna (that Lisa won).   ↝ Mary believes p & Anna has asserted p

➢ Looking at negated sentences and questions, we find that the source-inference, unlike the belief-inference, projects:

(27)   Source DP sentence
        a.   Lisa believes her doctor that apples cure hiccups.   ↝ L believes p, ↝ L's doctor has asserted p
        b.   Lisa doesn't believe her doctor that apples cure hiccups.   ↝̸ L believes p, ↝ L's doctor has asserted p
        c.   Does Lisa believe her doctor that apples cure hiccups?   ↝̸ L believes p, ↝ L's doctor has asserted p

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Conclusions:

1. **Syntax/argument-structure**: Source DPs behave like (externally licensed) indirect objects of *believe*; Content DPs and CPs behave like direct objects:

(28)   a.   Mary believes [$_{IO}$ Anna] [$_{DO}$ that Lisa won].
        b.   Mary believes [$_{DO}$ the claim that Lisa won].

2. **Semantics and pragmatics**: Source DP sentences involve two core components of meaning:

(29)   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.

4.2   Proposal: Source DPs

For the meaning of *believe*, I assume a standard (Hintikkan) relation between individuals and propositions:

(30) $[\![believe]\!]^w = [\lambda p_{<st>}.[\lambda x_e.DOX^w_x \subseteq p]]$ (type <st,et>)

With a CP-complement (type <st>), this gives us the meaning in (31).

(31) $[\![believe\ that\ Lisa\ won]\!]^w = [\lambda x_e.DOX^w_x \subseteq \{w':won(lisa)(w')\}]$

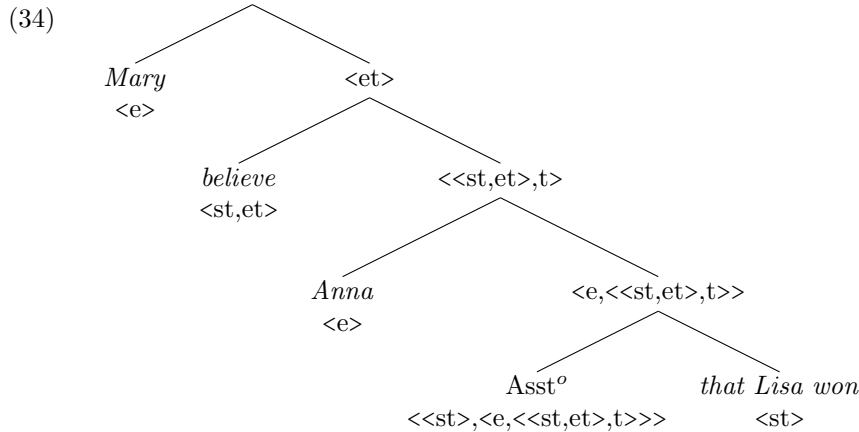To capture the structure and meaning of Source DPs (28)-(29), I propose that they are licensed by the head Asst^o:

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

➤ This gives us the same truth-conditions as for Source DP sentences (33) as for *believe CP* (31);
➤ Additionally, Asst^o introduces a presupposition that there exists an assertion event in the context; the agent of which is the Source DP and the goal of which is to make p common ground:

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

- The goal of an assertion event is identified in terms of a 'projected common ground'; a future conversational state in which p is common ground (e.g. Anand and Hacquard 2009; Farkas and Bruce 2010);
- this is captured by the condition [goal(e) = p ∩ c], where c is the *context set*, the set of world which is the intersection of all of the propositions in the common ground.

The LF and composition of Source DP sentences is illustrated in (34).

(34)

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                        ●
                      /   \
                 Mary      <et>
                 <e>      /    \
                    believe     <<st,et>,t>
                    <st,et>    /      \
                          Anna        <e,<<st,et>,t>>
                          <e>        /        \
                              Asst^o           that Lisa won
                         <<st>,<e,<<st,et>,t>>>    <st>
```

Like regular applicatives, Asst^o preserves the relation between the verb (*believe*) and the direct object (the proposition), and further introduces the assertion-relation between the indirect object (the Source DP) and the direct object.

➤ Thus, *I believe Anna that p* will entail that I believe p, just like *I baked Anna a cake* entails that I baked a cake.

➤ It also explains the interpretation of the Source DP, and why it behaves like a non-core argument of *believe*.

The step-wise derivation of Source DP sentences is given in (35) and (36):

(35) $[\![believe\ Anna\ that\ Lisa\ won]\!]^w$ ***Entails believe p & gives rise to source-reading***
        $= [\![Asst^o]\!]^w([\![that\ Lisa\ won]\!]^w)([\![Anna]\!]^w)([\![believe]\!]^w)$
        $= [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]](\lambda w'.won(lisa)(w'))(anna)(\lambda p_{<st>}.[\lambda x_e.DOX^w_x \subseteq p])$
        $= [\lambda x_e.[\lambda f_{<st,et>}.f(\lambda w'.won(lisa)(w'))]](anna)(\lambda p_{<st>}.[\lambda x_e.DOX^w_x \subseteq p])$ (see presupposition re x)
        $= [\lambda f_{<st,et>}.f(\lambda w'.won(lisa)(w'))](\lambda p_{<st>}.[\lambda x_e.DOX^w_x \subseteq p])$
        $= [\lambda p_{<st>}.[\lambda x_e.DOX^w_x \subseteq p]](\lambda w'.won(lisa)(w'))$
        $= [\lambda x_e.DOX^w_x \subseteq \{w':won(lisa)(w')\}]$
        $\left\{ \begin{array}{l} \textit{defined if } \exists e[assert(e)\ \&\ agent(e)(anna)\ \&\ goal(e) = \{w':won(lisa)(w')\} \cap c] \\ \#\ \textit{otherwise} \end{array} \right\}$

Since Asst^o requires a proposition as part of its argument structure, it follows that a sentence like (36), with a contextually recoverable proposition (p$_C$) and a non-content DP, will be interpreted in the same way as (35).

(36) ⟦believe Anna⟧^{w} ***Entails believe p & gives rise to source-reading***
       = ⟦Asst^o⟧^{w}(p$_C$)(⟦Anna⟧^{w})(⟦believe⟧^{w})
       = [λp$_{<st>}$.[λx$_e$.[λf$_{<st,et>}$.f(p)]]](p$_C$)($anna$)(λp$_{<st>}$.[λx$_e$.DOX$_x^w$ ⊆ p])
       . . .
       = [λp$_{<st>}$.[λx$_e$.DOX$_x^w$ ⊆ p]](p$_C$)
       = [λx$_e$.DOX$_x^w$ ⊆ p$_C$]
       $\left\{\begin{array}{l} \textit{defined if } \exists e[assert(e) \ \& \ agent(e)(anna) \ \& \ goal(e) = p_C \cap c] \\ \# \ \textit{otherwise} \end{array}\right\}$

5   *know DP* vs. *believe DP* & the link to question-embedding

Question: why do *know* and *believe*-verbs differ with respect to DP-complements (Generalizations 1 and 2)?

(37)   *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

(38)   *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

Above, I defined *believe*-verbs as selecting for propositions and CP-taking *know*-verbs as selecting for questions.

Two arguments for a selectional difference between *know* and *believe*-verbs (from Uegaki 2016):

1. **Empirical argument:** The contrast with respect to DPs tracks a contrast in terms of question-embedding (Karttunen 1977, *et seq*):

(39)   a.   Mary believes {that Lisa came / *who came} to the party.
         b.   Mary knows {that Lisa came / who came} to the party.

                         (Uegaki argues for p-to-Q type-shifting for *know that p*; see Appendix B)

2. **Conceptual argument:** If we assume

   (a)   that the entailment with *believe DP* is compositionally derived;
   (b)   that *know* and *believe*-verbs are of the same semantic type (in line with the standard Hintikkan view),

   then we **wrongly predict** that the entailment should also be available with *know*-verbs.

➢ This, then, supports a non-uniform view of the selectional properties of *know* and *believe*-verbs.

Answer: given that Asst^o (32) is defined for proposition-taking predicates (<<st>,<et>>), we predict that *know*-verbs should not be semantically compatible with Source DPs:

➢ With both $know_{EPIST}$ (<<st,t>,<et>>) and $know_{AQ}$ (<e,et>), Asst^o results in a type-mismatch (see box on p. 8).

This is similar to Uegaki's (2016) proposal for Generalization 1, the entailment contrast (see box on p. 8).

Step-wise derivation showing why *know*-verbs are incompatible with Source DPs:

CP-selecting epistemic *know* cannot combine with Asst^o (see Section 3.2 for the analysis of *know*-verbs):

(40) $[\![\text{know}_{EPIST} \text{ Anna that Lisa won}]\!]^w$ ***Type-mismatch***
$= [\![\text{Asst}^o]\!]^w([\![\text{that Lisa won}]\!]^w)([\![\text{Anna}]\!]^w)([\![\text{know}_{EPIST}]\!]^w)$
$= [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]](\lambda w'.\text{won}(lisa)(w'))(anna)(\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s \text{ is a situation exemplifying } p \wedge AQ_w(x)(s)]])$
$\ldots$
$= [\lambda f_{<st,et>}.f(\lambda w'.\text{won}(l)(w'))](\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s \text{ is a situation exemplifying } p \wedge AQ_w(x)(s)]]) = \#$

DP-selecting acquaintance *know* can also not combine with Asst^o:

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

The only way to derive a *know DP* sentence is via the $\sqrt{\text{AQ}}$ root.[12] As we saw in Section 3.2, this only triggers an acquaintance reading, which neither entails knowing p, nor that the DP is the source of the p-information:

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

Uegaki's (2016) analysis of Content DPs:

know-verbs are question-embedding and *believe*-verbs are proposition-embedding:

(43) a. $[\![\text{believe}]\!]^w = [\lambda \mathbf{p_{<st>}}.[\lambda x_e.DOX_x^w \subseteq p]]$
      b. $[\![\text{know}_{EPIST}]\!]^w = [\lambda \mathbf{Q_{<st,t>}}.[\lambda x_e.\exists p \in Q[p(w)=1 \wedge DOX_x^w \subseteq p]]$ (Uegaki, 2016, 631–633)

There exists a content-retrieval type-shifter (based on the content-function from Kratzer 2006 and Moulton 2009), which extracts the intentional content, a proposition, from Content DPs like *the rumour* or *the claim*:

(44) $[\![\text{CONT}]\!]^w([\![\text{the claim that Lisa won}]\!]^w) = \{w': \text{won}(lisa)(w')\}$ (Uegaki, 2016, 634)
$\left\{ \begin{array}{l} \textit{defined if } \text{CONT}_w([\![\text{the claim that Lisa won}]\!]) = \text{CONT}_{w'}([\![\text{the claim that Lisa won}]\!]) \\ \# \textit{ otherwise} \end{array} \right\}$

This allows *believe*-verbs (43-a) to combine with Content DPs (44) by saturation, giving us the entailment:

(45) $[\![\text{Mary believes the claim that Lisa won}]\!]^w = 1$ in w iff $DOX_m^w \subseteq \{w':\text{won}(lisa)(w')\}$ ***✓Entailment***
$\left\{ \begin{array}{l} \textit{defined if } DOX_{mary}^w \subseteq \{w'|\lambda w''.\text{won}(lisa)(w'') = \text{CONT}(w')([\![\text{the claim that Lisa won}]\!])\} \\ \# \textit{ otherwise} \end{array} \right\}$

Truth-conditionally, (45) is equivalent to *believe CP* sentences (31) and Source DP sentences (33).

For *know*-verb (43-b), combination with (44) results in a type-mismatch:

(46) $[\![\text{Mary knows}_{EPIST} \text{ the claim that Lisa won}]\!]^w = \#$ ***Type-mismatch***

As in (42), *know DP* sentences are possible can only be interpreted as describing acquaintance relations; also with Content DPs.

(47) $[\![\text{Mary knows}_{AQ} \text{ the claim that Lisa won}]\!]^w = 1$ in w iff $AQ_w(m)([\![\text{the claim that Lisa won}]\!])$ ***AQ-reading***

Here, I have deviated from Uegaki in arguing that *know CP* and *know DP* are derivationally related, rather than involving polysemy; however, the current proposal for *know*-verbs is straightforwardly applicable to Uegaki's proposal for Content DPs.

- The key insight is that operations that allow *believe*-verbs to combine with DPs are defined for proposition-selecting verbs, and not compatible with question-selecting verbs.

6   Discussion

I have argued that the reason why *know* and *believe*-verbs differ in terms of the interpretation and availability of DP-complements is because of a difference in their argument-structure, internal composition, and selectional properties.

Implications for factivity

- The current analysis captures the shared semantic core of DP and CP-selecting *know*-verbs in terms of *acquaintance*; with a regular individual (with DPs) or a situation, the *res* (with CPs).

- It thus provides a concrete morpho-semantic implementation of the idea that knowledge, and factivity more broadly, is tied to acquaintance with a fact or a situation (e.g. Goldman 1967; Lewis 1979; Kratzer 2002, and more recently also Özyildiz 2017; Djärv 2019; Bondarenko 2020b).

- Is a treatment along these lines motivated also for non-factive verbs like *fear* and *explain*? These verbs have been observed to pattern in a similar way to *know* with respect to Generalization 1 (e.g. Pietroski 2000; Elliott 2016; Bondarenko 2020a). See forthcoming SALT talk + paper for discussion.

Implications for question-embedding

- Previous work has observed a connection between factivity/veridicality and question-embedding (e.g. Egré 2008; Spector and Egré 2015; Uegaki 2015, 2016; Uegaki and Sudo 2017; Theiler et al. 2018; Steinert-Threlkeld 2019).

- Uegaki (2016) further links the contrast in question-embedding to the interpretation of Content DP.

- The current proposal adds to the empirical and analytical picture by providing a compositional relation between the acquaintance-interpretation with DPs and factivity with CPs.

Implications for theories of *believe*-verbs

- I have argued that *believe*-verbs describe standard (Hintikkan) relations to propositions; to combine with DPs, they require type-shifting (Content DPs; Uegaki 2016) or an external licensing head (Source DPs).

- The morphosyntax of Source DP sentences is evidence against a uniform approach to Content and Source DPs, such as that of Roberts (2020), whereby both types of DPs saturate an x_c argument slot of *believe*-verbs.

- Rather, propositional objects (CPs and Content DPs) combine with *believe*-verbs as direct objects (in line with Uegaki 2016). This is unlike Source DPs, which combine with *believe* as externally licensed indirect objects.

Notes

[1]This work builds on and supersedes Chapter 4 of my dissertation Djärv (2019), available here: https://repository.upenn.edu/edissertations/3645/. For discussion and an evidence/acquaintance based proposal of factivity, see Ch. 5, and in particular, Sec. 5.6.

[2]Original example from Free Children's Ministry Resources; equipu.kids4truth.com

[3]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

[4]On the polysemy analysis, we might expect (48) to behave more like (49), which can only be used as word-play.

(48)   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.

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

[5]For other $know$-verbs like $discover$, I assume that there are different $flavours$ of $\sqrt{\text{AQ}}$.

[6]Further conditions must be included to capture inferences about belief, exhaustivity, etc.

[7]In the case of $know_{AQ}$ vs. $know_{EPIST}$ in German and Swedish, etc., I assume contextually triggered allomorphy, such that $veta/vissen$ is triggered in the context of the EPIST head, whereas $känna/kennen$ is the default form of the verb.

[8]Of course, we still need to enrich the minimal bare-bones meaning for $know$-verbs outlined here, in order to capture inferences pertaining to $belief$, $exhaustivity$, as well as lexically specific inferences, e.g. the manner of acquiring/losing knowledge (e.g. $notice, remember, forget$), the emotive attitude towards the individual or situation in question ($surprise, love, resentment$).

[9]In terms of the formal difference between $know_{AQ}$ and $know_{EPIST}$ in German etc. (e.g. $kennen/wissen$), I assume that this involves contextually triggered allomorphy, s.t. $wissen$ is triggered in the context of SITU, whereas $kennen$ is the default form of the verb.

[10]Anand and Hacquard suggests that predicates like $imply$ and $suggest$ 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. Independent evidence:

- With $the book$, the verbs behave like assertives wrt. the Epistemic Containment Principle (50-a).
- With $the timing$, the verbs behave like doxastics (22) wrt. the Epistemic Containment Principle (50-b).

(50)   Anand and 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.

[11]Note that nouns like 'article' don't function as Content DPs, thus allowing us to rule out a non-Source reading:

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

In German, Dative case on the DP ensures a source-reading.

[12]Barring Concealed Questions, which I take to be of type <st,t>. Uegaki (2016) argues that a type-shifter is available to allow epistemic $know$ to combined with DPs as concealed questions, which are of type <st,t>. This, however, as illustrated in (52), is a different reading from what we saw in Section 1 with $know DP$ and $believe DP$.

(52)   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 <e,<st,t>>). For discussion, see Uegaki (2016, p. 638) and Aloni and Roelofsen (2011) for details, discussion, and further references.

References

Maria Aloni. Concealed questions under cover. *Grazer Philosophische Studien*, 77:191–216, 2008.

Maria Aloni and Floris Roelofsen. Interpreting concealed questions. *Linguistics and Philosophy*, 34(5):443–478, 2011.

Pranav Anand and Valentine Hacquard. Epistemics with attitude. In Tova Friedman and Satoshi Ito, editors, *Proceedings of Semantics and Linguistic Theory (SALT)*, volume 18, Ithaca, NY, 2009.

Tanya Bondarenko. Two paths to $explain$. Talk presented at BCGL 13: The syntax and semantics of clausal complementation, Brussels, December 16-18, 2020., 2020a.

Tanya Bondarenko. Factivity from pre-existence: Evidence from Barguzin Buryat. *Glossa: A Journal of General Linguistics*, 5(1):1–35, 2020b. doi: http://doi.org/10.5334/gjgl.1196. 109.

Spencer Caplan and Kajsa Djärv. What usage can tell us about grammar: Embedded Verb Second in Scandinavian. *Glossa: a journal of general linguistics*, 4(1):1–37, 2019.

Gennaro Chierchia. Broaden your views: Implicatures of domain widening and the "logicality" of language. *Linguistic Inquiry*, 37(4):535–590, 2006.

Kajsa Djärv. *Factive and Assertive Attitude Reports*. PhD thesis, The University of Pennsylvania, 2019.

Paul Egré. Question-embedding and factivity. *Grazer Philosophische Studien*, 77(1):85–125, 2008.

Patrick D Elliott. Explaining DPs vs. CPs without syntax. *Proceedings of CLS*, 52, 2016.

Donka F Farkas and Kim B Bruce. On reacting to assertions and polar questions. *Journal of Semantics*, 27(1):81–118, 2010.

Jonathan Ginzburg. Resolving questions. *Linguistics and Philosophy*, 18:459–527,567–609, 1995.

Alvin I Goldman. A causal theory of knowing. *The journal of Philosophy*, 64(12):357–372, 1967.

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

Lauri Karttunen. Syntax and semantics of questions. *Linguistics and philosophy*, 1(1):3–44, 1977.

Jeffrey C King. Designating propositions. *The Philosophical Review*, 111(3):341–371, 2002.

Angelica Kratzer. Facts: particulars or information units? *Linguistics and Philosophy*, 25:655–670, 2002.

Angelika Kratzer. Decomposing attitude verbs. Talk given in Honor of Anita Mittwoch at The Hebrew University of Jerusalem. Available at `http://semanticsarchive.net/Archive/DcwY2JkM/attitude-verbs2006.pdf`, 2006.

David Lewis. Attitudes De Dicto and De Se. *The philosophical review*, 88(4):513–543, 1979.

Matthew Mandelkern, Jérémy Zehr, Jacopo Romoli, and Florian Schwarz. We've discovered that projection across conjunction is asymmetric (and it is!). *Linguistics and Philosophy*, 43:473—514, 2020. doi: 10.1007/s10988-019-09276-5.

Friederike Moltmann. *Abstract objects and the semantics of natural language*. OUP Oxford, 2013.

Keir Moulton. *Natural selection and the syntax of clausal complementation*. PhD thesis, University of Massachusetts at Amherst, 2009.

Deniz Özyildiz. Knowledge reports with and without true belief. Paper presented at Semantics and Linguistic Theory 27 (SALT27), Maryland, MD, 2017.

Paul M Pietroski. On explaining that. *The Journal of philosophy*, 97(12):655–662, 2000.

Arthur N Prior. *Objects of thought*. Oxford: Clarendon Press, 1971. doi: 10.2307/2217551.

Liina Pylkkänen. *Introducing arguments*, volume 49. MIT press, 2008.

Thomas Roberts. Argument saturation and the syntactic status of embedded clauses. Paper presented at BCGL 13: The syntax and semantics of clausal complementation, 2020.

Jeffrey T Runner and Keir Moulton. The accusative plus infinitive construction in English. *The Wiley Blackwell Companion to Syntax, Second Edition*, pages 1–19, 2017.

Benny Shanon. On the two kinds of presuppositions in natural language. *Foundations of language*, 14(2):247–249, 1976.

Benjamin Spector and Paul Egré. A uniform semantics for embedded interrogatives: An answer, not necessarily the answer. *Synthese*, 192(6):1729–1784, 2015.

Shane Steinert-Threlkeld. An Explanation of the Veridical Uniformity Universal. *Journal of Semantics*, 37(1):129–144, 12 2019. ISSN 0167-5133. doi: 10.1093/jos/ffz019. URL `https://doi.org/10.1093/jos/ffz019`.

Christopher Tancredi. A multi-model modal theory of i-semantics: Part i: Modals. *Univesity of Tokyo*, 2007.

Nadine Theiler, Floris Roelofsen, and Maria Aloni. A uniform semantics for declarative and interrogative complements. *Journal of Semantics*, 35(3):409–466, 2018. doi: 10.1093/jos/ffy003.

Wataru Uegaki. *Interpreting questions under attitudes*. PhD thesis, Massachusetts Institute of Technology, 2015.

Wataru Uegaki. Content nouns and the semantics of question-embedding. *Journal of Semantics*, 33(4):623–660, 2016.

Wataru Uegaki and Yasutada Sudo. The anti-rogativity of non-veridical preferential predicates. In *Proceedings of the 21st Amsterdam Colloquium*, pages 492–501. Univ. Amsterdam Amsterdam, 2017.

Kai von Fintel. Would you believe it? The King of France is back! (Presuppositions and truth-value intuitions). In M Reimer and A Bezuidenhout, editors, *Descriptions and Beyond*. Oxford: Oxford University Press, 2004.

Kai von Fintel and Sabine Iatridou. Epistemic containment. *Linguistic Inquiry*, 34(2):173–198, 2003.

Appendices

A   More diagnostics for the nature of Source DPs
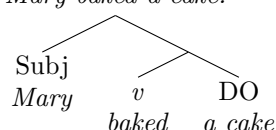
A.1   Syntax/Argument-structure: Source DP sentences are like Applicatives

Claim: syntactically/argument structurally, *believe*-verbs behave like optionally transitive verbs like *bake* (53).

- Source DPs are indirect objects of *believe*;
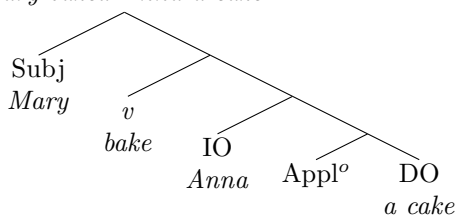- Content DPs and clauses are direct objects of *believe*.

Optionally intransitive verb *bake*:

(53)   a.   *Mary baked a cake.*
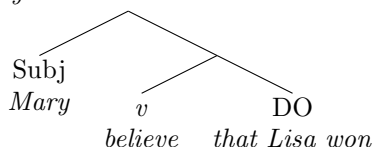
b.   *Mary baked Anna a cake.*   (Applicative, after Pylkkänen 2008, a.o.)
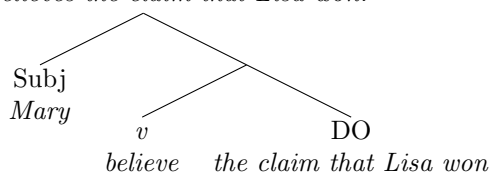
```
        Subj
        Mary    v
                bake    IO
                        Anna    Appl°    DO
                                         a cake
```

believe CP/DP:

(54)   a.   *Mary believes that Lisa won.*   (Proposal: *believe* CP)

```
        Subj
        Mary    v              DO
                believe    that Lisa won
```

        b.   *Mary believes the claim that Lisa won.*   (Proposal: *believe* Content DP)

```
        Subj
        Mary    v                    DO
                believe    the claim that Lisa won
```

        c.   *Mary believes Anna that Lisa won.*   (Proposal: *believe* Source DP)

```
        Subj
        Mary    v
                believe    IO
                           Anna    Asst°        DO
                                            that Lisa won
```
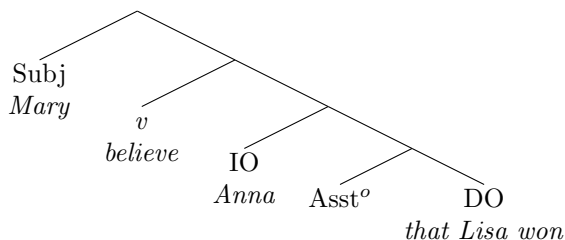
In German (and other languages with Source Datives, like Spanish), the two types of DPs can co-occur (see below):

(55)   *Mary believes Anna the claim that Lisa won.*

```
        Subj
        Mary    v
                believe    IO
                           Anna    Asst°         DO
                                          the claim that Lisa won
```
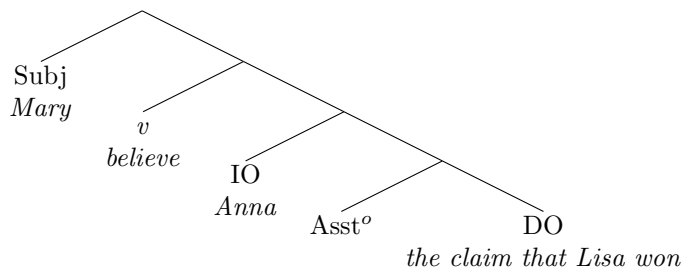
NB: Some speakers report finding heavier NPs clunky in Source-positions. However, most speakers I've consulted allow for both names and common nouns, given appropriate context.

(56)   Sometimes the patient doesn't believe the doctor that he's sick, until the doctor gives it a name. (COCA[13])

Evidence:

1. Case on Source vs. Content DPs in languages like German, which distinguishes DAT and ACC;
2. Extraction possibilities in passives;
3. (Non-)obligatoriness of the Source vs. the *believe p* inference.

1. Case on Source vs. Content DPs in languages like German, which distinguish DAT and ACC.

In German (etc), indirect objects are marked with DAT case, and direct objects with ACC case:

(57)   Sie gab/stahl **ihm**   **den**   Schlüssel.
        she gave/stole him.DAT the.ACC key
        She gave the key to him./She stole the key from him.   Source & Goal Applicatives

As Djärv (2019) notes, the same pattern is found in Source DP sentences in German:

(58)   Djärv (2019, p. 235)
      a.   Ich glaube **ihm**,   dass Maria ein Genie war.
            I   believe him.DAT that Maria a   genius was
            I believe him that Maria was a genius.   **Source DP: DAT**
      b.   Ich glaube **die**   Behauptung, dass Maria ein Genie war.
            I   believe the.ACC claim   that Maria a   genius was
            I believe the claim that Maria was a genius.   **Content DP: ACC**

The two DPs can also co-occur in German, unlike in English:

(59)   Djärv (2019, p. 235)

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

      *I believe him the claim that Maria was a genius.

On the current account, the derivation of such sentences involves both Uegaki's (2016) CONT type-shifter, and the Asst^o head proposed in Section 4.2 (using our –technically ungrammatical– running example from English for exposition):

(60) $\llbracket$believe Anna the claim that Lisa won$\rrbracket^w$ ***Entails believe p & gives rise to source-reading***
      $= \llbracket \text{Asst}^o \rrbracket^w(\llbracket \text{CONT} \rrbracket^w(\llbracket\text{the claim that Lisa won}\rrbracket^w))(\llbracket\text{Anna}\rrbracket^w)(\llbracket\text{believe}\rrbracket^w)$
      $= [\lambda p_{<st>}.[\lambda x_e.[\lambda f_{<st,et>}.f(p)]]](\lambda w'.\text{won}(lisa)(w'))(anna)(\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p])$
      $= [\lambda p_{<st>}.[\lambda x_e.\text{DOX}_x^w \subseteq p]](\lambda w'.\text{won}(lisa)(w'))$
      $= [\lambda x_e.\text{DOX}_x^w \subseteq \{w':\text{won}(lisa)(w')\}]$
      $\left\{ \begin{array}{l} \textit{defined if } \exists e[\text{assert}(e) \ \& \ \text{agent}(e)(anna) \ \& \ \text{goal}(e) = \{w':\text{won}(lisa)(w')\} \cap c], \\ \textit{and if } \text{DOX}_x^w \subseteq \{w':\lambda w''.\text{won}(lisa)(w'') = \text{CONT}(w')(\llbracket\text{the claim that Lisa won}\rrbracket)\} \\ \# \ \textit{otherwise} \end{array} \right\}$

Why do German and English differ in terms of the two DPs being able to co-occur?

- Based on preliminary cross-linguistic data, the ability of Source and Content DPs to co-occur appears to be linked to a general presence of Source Applicative in the language; where the indirect (Dative) object denotes the source of the verbal event (here, *steal*).

(61)   English
      a.   She gave/*stole him the key.   ✗Source Applicative
      b.   I believe you (*the claim) that Mary is a genius.   ✗Source+Content DP

(62)   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

(63)   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

(64)   German

    a.   Sie stahl **ihm**   **den**   Schlüssel.
        she stole him.DAT the.ACC key

        She stole the key from him.   ✓Source Applicative

    b.   Ich glaube **ihm**   **die**   Behauptung, dass Maria ein Genie war.
        I   believe him.DAT the.ACC claim   that Maria a   genius was

        *I believe him the claim that Maria was a genius.   ✓Source+Content DP

(65)   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

- Such a parametric difference can can be naturally thought about in terms of learnability (thanks to Luke Adamson, p.c. for this comment).

2. Extraction possibilities in passives.

Source DPs behave like indirect objects and Content DPs like direct objects. I German, it is only possible to promote the direct object in a passive, but not the indirect object:

(66)   a.   Der   Schlüssel wurde ihm   gestohlen.
        the.NOM key   was   him.DAT stolen

        The key was stolen from him.   ✓Promote direct object

    b.   *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 pattern with direct objects, whereas Source DPs pattern with indirect objects.

(67)   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

Many varieties of English show the opposite pattern, such that the indirect, but not the direct object can be promoted:

(68)   a.   I baked him a cake.

    b.   He was baked a cake.   ✓Promote indirect object

    c.   *A cake was baked him.   ✗Promote direct object

In a sentence with a Source DP + CP, the clause cannot be promoted, like indirect objects. The Source DP, however, *can* be promoted, like indirect objects.

(69)   a.   He was generally believed that Maria was a genius.   ✓Promote Source DP

    b.   *That Maria is a genius was (generally/widely) believed him.   ✗Promote CP

Without a Source DP, it is possible to promote a CP or a Content DP:

(70)   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*, if there is no indirect object present:

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

3. (Non-)obligatoriness of the Source vs. the believe p inference.

Further evidence for the claim that Source DPs are not part of the lexical meaning of *believe* comes from the fact that while *I believe you* implies belief of some contextually salient proposition, *I believe that p* should not imply the existence of some contextually available source of information, as shown in (72)–(73):

(72)   Djärv (2019, p. 243)
    a.   I believe Anna. $\leadsto \exists p_C$ s.t. Anna is the source of p_C
    b.   I believe that [$_P$ it's raining]. $\not\leadsto \exists x_C$ s.t. x_C is the source of p

(73)   a.   Ich glaube Anna.
          I   believe Anna
          I believe Anna. $\leadsto \exists p_C$ s.t. Anna is the source of p_C
    b.   Ich glaube, dass Lisa gewonnen hat.
          I   believe, that Lisa won   has
          I believe that Lisa won. $\not\leadsto \exists x_C$ s.t. x_C is the source of p

A.2   Semantically: Source DP sentences describe an assertion event

2. Interpretation of epistemic modals.

Anand and Hacquard (2009) observe a contrast between doxastic attitudes and assertion-reports with respect to the interpretation of epistemic modals:

(74)   Based on Anand and 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 explain this in terms of the so-called *Epistemic Containment Principle* (von Fintel and Iatridou, 2003; Tancredi, 2007), which states that quantifiers cannot bind their traces across a *subjectively interpreted* epistemic modal:

- With doxastic attitudes, p is evaluated with respect to the attitude holder's private, subjective belief state;
- With assertion reports, p is evaluated with respect to a projected common ground, where p is part of the general consensus, thus yielding an *objective* stance and obviating the Epistemic Containment Principle.

Interestingly, Runner and Moulton (2017, 15) observe that Source DPs sentences, like assertion reports, obviate the Epistemic Containment Principle.

(75)   They believed Holmes that every guest might be the murderer. (Runner and 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

I take this to follow from the fact that Source DP sentences, in addition to making a statement about the attitude holder's private subjective beliefs, additionally presuppose that there was an assertion event such that the Source DP proposed to make p common ground (Hypothesis 2, similar to A&H's semantics for assertion reports);

- Thus, in terms of the presupposition, p is evaluated with respect to a projected common ground; the conversational goal of the assertion-event;
- This yields the objective stance that enables the every > might reading.

A.3   Pragmatically: Source DPs are not-*at issue*

For each test, I also illustrate the test with a possessive DP, which triggers an existential presupposition.

2. Hey, wait a minute test.

➤ Since presuppositions are not part of the *at-issue* content of their host sentences, they need explicit 'flags' in order to be targeted in a response to a sentence with a presupposition (e.g. Shanon 1976; von Fintel 2004).

(76)   Possessive
    A: Lisa's cat is fluffy. $\leadsto$ Lisa has a cat
    B. Yes, that's true. $\leadsto$ Lisa has a cat
    B′ No, that's not true. $\leadsto$ Lisa has a cat
    B″: Hey, wait a minute – Lisa doesn't have a cat! $\not\leadsto$ Lisa has a cat

(77)   Source DP sentence
    A: Lisa believes her doctor that apples cure hiccups.   ↝ L's doctor has asserted p
    B: Yes, that's true.   ↝ L's doctor has asserted p
    B′. No, that's not true.   ↝ L's doctor has asserted p
    B″: Hey, wait a minute – Lisa's doctor would never say that!   ↝̸ L's doctor has asserted p

2. Presupposition filtering

➢ As observed by Karttunen (1973), presuppositions can be effectively filtered out if the trigger's local context entails the presupposition of the trigger (see also Mandelkern et al. 2020 for recent discussion of filtering).

(78)   <u>If Lisa has a cat</u>, then **her cat** must be a Sphynx (since Lisa is allergic).   ↝̸ Lisa has a cat

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

3. Context update potential

➢ Since presuppositions are not *at-issue*, they resist being part of the asserted content of the sentence. (The 'guess what' test is from Caplan and Djärv 2019.)

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

(81)   Guess what! Lisa believes her doctor that blueberries cure hiccups. #Asserting *Lisa's doctor has asserted p*

B   Declarative and question-embedding

To account for the contrast between *know* and *believe*-verbs in terms of combining with questions/declaratives (82), Uegaki (2016) proposes 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 (83).

(82)   a.   Mary believes {that Lisa came / *who came} to the party.
    b.   Mary knows {that Lisa came / who came} to the party.   (p-to-Q type-shifting for *know that p*)

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

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, as shown in (84)–(85).

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

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

(See Uegaki 2016, Sec. 3.2.3 for discussion of why nesting ID and CONT is not an option.)

The current proposal for *know*-verbs derives the same results:

As shown in (86)–(87), *know*-verbs are able to combine with declaratives as singleton sets and with questions as multi-member sets (for other types of questions, see (16) above).

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

(87) $[\![\text{know whether Lisa won}]\!]^w$
    $= [\![\text{know}_{EPIST}]\!]^w([\![\text{whether Lisa won}]\!]^w)$
    $= [\lambda P_{<st,t>}.[\lambda x_e.\exists s \exists p \in P[s \text{ is a situ. exemplifying } p \wedge AQ_w(x)(s)]]](\{\lambda w'.\text{won}(l)(w'), \lambda w'.\neg\text{won}(l)(w')\}) =$
    $[\lambda x_e.\exists s \exists p \in \{\lambda w'.\text{won}(l)(w'), \lambda w'.\neg\text{won}(l)(w')\}[s \text{ is a situation exemplifying } p \wedge AQ_w(x)(s)]]$

As shown in (88)–(89), *believe*-verbs, on the other hand, have no way of combining with questions. This, as proposed by Uegaki (2016), thus captures (82).

(88) $[\![$believe that Lisa won$]\!]^w$
        $= [\![$believe$]\!]^w([\![$that Lisa won$]\!]^w)$
        $= [\lambda p_{<st>}.[\lambda x_e.DOX_x^w \subseteq p]](\lambda w'.won(lisa)(w'))$
        $= [\lambda x_e.DOX_x^w \subseteq \{w':won(lisa)(w')\}]$

(89) $[\![$believe whether Lisa won$]\!]^w$ ***Type-mismatch***
        $= [\![$believe$]\!]^w([\![$whether Lisa won$]\!]^w)$
        $= [\lambda p_{<st>}.[\lambda x_e.DOX_x^w \subseteq p]](\{\lambda w'.won(lisa)(w'),\lambda w'.\neg won(lisa)(w')\}) = \#$

C   More consequences of the current analysis for *know* vs. *believe*

The current analysis of *know* and *believe* allows us to account for a separate observation about the modification possibilities of *know* vs. *believe*-verbs:

- On our analysis, 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;
- in (90), *how* is modifying the acquaintance event in *know*; in *believe*, there is no such event.

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

Moreover, on the analysis proposed here,

- *know*-verbs are (i) factive and (ii) responsive (i.e. allow for both questions and declaratives);
- *believe*-verbs are (i) non-factive, (ii) anti-rogative (i.e. allow only declaratives), and (iii) are able to license DPs.

Together, this might explain why a verb like *think*, which is similar to *believe* both in terms of its meaning and selectional properties nevertheless reject Source DPs:

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

As shown in (92), while *think*, like *believe*, is anti-rogative, it is different from *believe*, in that it neither permits ECM complements, nor Content DPs:

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