

Beliefs

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1 The factive inference

- We talk about people's *mental attitudes*, in particular, their beliefs.

The sentences that we use to do so sometimes also convey *whether those beliefs are true or false*.

- (1) a. Duygu's student knows that class got canceled. #But it didn't.
b. Duygu's student thinks that class got canceled. But it didn't.

Reasonable hypothesis:

The meaning of 'know' requires its complement to be true.

The meaning of 'think' does not.

The truth inference in (1a) is *the factive inference*.

- The factive inference is also found in Turkish, in (2a)

- (2) a. Duygu'nun öğrencisi [dersin iptal olduğunu] biliyor. (#) Ama olmadı.
Duygu's student class get canceled BIL but it didn't
Duygu's student knows that class got canceled
b. Duygu'nun öğrencisi [dersin iptal olduğunu] düşünüyor. Ama olmadı.
Duygu's student class get canceled think but it didn't
Duygu's student thinks that class got canceled.

- There are ways in which the inference in Turkish patterns like the inference in English.

But they differ in revealing ways.

What do we learn from this?

- **Three key points to take away from today**

1. Turkish suggests that the factive inference derives from how attitude verbs and clauses come together. (Rather than being hard wired into the meaning of particular lexical items.)
2. The inference can be derived simply and uniformly by using tools that we have already bought. (All we need is beliefs to be about things, and binding.)
3. Factive and non-factive reports differ (at least) in the default position of main sentence stress. We can derive that using the syntax to phonology mapping.

2 Factivity alternates

In Turkish, **factivity alternates**.

The inference is spotted with some verbs.

But if we change even one thing, it disappears.

And that is what it means for factivity to alternate.

- **Starting observation:**

The factive inference is available in Turkish.

In (3), the verb *bil-* embeds a nominalized clause (and is stressed).

The sentence is factive.

- (3) Dilara [yagmur yag-dig-in-i] bil-iyor.
 Dilara rain precipitate-NMZ-3S-ACC BIL-PRES
 Dilara knows that it's raining.

And when the factive inference is available, it patterns just like the inference in English.

– It is not cancelable:

- (4) #ama yag-m-iyor.
 but precipitate-NEG-PRES
 #but it isn't.

⇒ The embedded proposition is at least entailed.

– And it projects:

- (5) Dilara [yagmur yag-dig-in-i] bil-m-iyor. (↗ Yagmur yagiyor.)
 Dilara rain precipitate-NMZ-3S-PRES BIL-NEG-PRES rain precipitate.PRES
 Dilara doesn't know that it's raining. (↗ It's raining.)

⇒ The embedded proposition is presupposed.

- **But, the factive inference in Turkish is a fragile object.**

(One of the reasons that this is surprising is that presuppositions are pretty robust.)

If the nominalization is replaced with a *diye* clause, the inference is lost:

- (6) Dilara [yagmur yag-iyor diye] bil-iyor.
 Dilara rain precipitate-PRES DIYE BIL-PRES
 Dilara thinks that it's raining.

Continuation (4) is not contradictory after (6), suggesting that (6) is non-factive (and in fact non-veridical):
 The sentence neither presupposes nor entails its complement.¹

‘Where’ is the inference encoded?

Other languages that argued to be similar to Turkish with respect to facts discussed today: Azeri and other Turkic languages (Murad Suleymanov, Travis Major, p.c.), Bangla (Ishani Guha, Arka Banerjee, p.c.), Buryat (Bondarenko, 2019), Cypriot Greek (Christos Christopoulos, p.c., Djärv 2017), Hungarian (Dóra Kata Tákacs, Anna Szabolcsi, p.c.), Korean (Lee and Hong, 2016), etc.

¹I do not voice the tests all the time, but they remain having been run in the background. And, throughout the talk, ‘non-factive’ means ‘non-veridical,’ rather than ‘veridical-but-non-factive,’ like *be true* and perhaps *be right*.

- ‘Where’ is the inference encoded?

Hypotheses: Is it encoded. . .

- in the meaning of *bil-*, but *bil-* is ambiguous with a non-factive variant,
- in the meaning of *bil-*, but, e.g., *diye* clauses defactivize it,
- in the meaning of nominalized clauses.

We look at these two hypotheses, and set them aside: Both are possible, but neither is credible.

- **Hypothesis:** “The inference is coming from the meaning of the nominalization.”

* Ex. (7) is a report with *düşün-*, ‘think,’ and a nominalization. The report is non-factive.²

- (7) Dilara [yagmur yag-dig-in-i] düşünuyor.
 Dilara rain precipitate-NMZ-3S-ACC thinks
 Dilara thinks that it’s raining.

* Moreover, nominalizations can denote things that can be directly predicated to be true, and, more importantly, false.

- (8) Yagmur yag-dig-i {dogru, yanlis}.
 rain precipitate-NMZ-3S.NOM true false
 It’s {true, false} that it’s raining.

* Finally: *bil-* can also combine with a nominalization and give rise to a non-factive report. In (9), STRESS falls on the embedded clause.

- (9) Dilara [YAGMUR yag-dig-in-i] bil-iyor, ama aslinda KAR yag-iyor.
 Dilara rain precipitate-NMZ-3S-ACC BIL but in fact snow precipitate-PRES
 Dilara thinks that it’s raining, but in fact it’s snowing.

⇒ The inference might arise in the presence of, but does not arise because of the nominalization.

If it did, non-factive readings would be unexpected.

And if we duplicated meanings (“there are factive and non-factive nominalizations”) we lose in explanatory power.

- **Hypothesis:** “The inference is lost because of *diye*.”

* No instance of *diye* clauses in factive attitude reports (to my knowledge), but. . .

* But, there are *many* ways of generating non-factive attitude reports with *bil-* without using *diye*. One is in (8).

And, (10), which an ECM construction, is another:

- (10) Dilara [ben-i Northampton-da] bil-iyor.
 Dilara 1S-ACC Northampton-LOC BIL-PRES
 Dilara thinks that I’m in Northampton (lit. *bil-s* me to be in Northampton).

⇒ So it is truer to the facts, and simpler in many ways to make no particular assumption about *diye* being a defactivizer.

²The report is in fact necessarily non-factive, which militates against another reasonable option—that speakers may choose to presuppose whenever they wish to. If this were the case, we do not straightforwardly expect presupposition to be blocked in the presence of particular lexical items like *düşün-* or *diye*.

- **Desiderata:**

We see the factive inference with *bil-* correlate with embedded clause type and stress position. So we will work towards a system where:

- *bil-* introduces a non-factive belief,
- the inference is derived in the syntactic/semantic composition with nominalizations,
- and, the position of main sentence stress follows from the syntax to phonology mapping.

3 Deriving the alternation

Assuming non-factivity as a basis, factive and non-factive meanings can be derived compositionally.

- **De re belief**

Beliefs are sometimes *about* things—“de re.”

- (11)
- a. Context:
[Adapted from Quine (1956).] Suppose that Katherine looks through a classroom window and sees Paloma, a student with short hair, giving a presentation. Katherine comes to believe that the student is a professor. After all it’s usually professors that stand and talk in front of classrooms.
 - b. Katherine’s literal thought:
“The person with short hair is a professor.”
 - c. Sentences:
 - (i) Katherine thinks that *the student* is a professor.
 - (ii) Katherine thinks about the student₇ that she₇ is a professor.

‘res’
‘predicate’

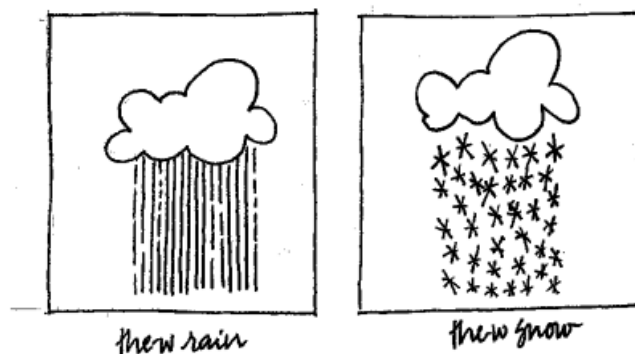
Key intuition:

Although Katherine would incorrectly ascribe to the student the property of being a professor, her thought is nevertheless *about* the student.

- **De re belief about situations**

Beliefs are sometimes about things that are *situations*.³

(12)



I argue in Özyıldız (2016) that the meaning of non-factive *bil-* reports is strictly weaker than knowledge reports (no truth requirement) and strictly stronger than plain belief reports in that *bil-* requires the attitude holder to be *justified* in their belief.

³The main, but general, worry about situations is that they are tricky to delineate (Kratzer, 2019, a.o.).

- We are now ready to talk about *bil-*

(18) **A single meaning:**

$$\llbracket \text{bil} \rrbracket (w) = \lambda s_s. \lambda P_{\text{wst}}. \lambda x_e. \exists D :$$

- a. $D_x(w) = s$
 \wedge
 b. $\forall w'$ compatible with x 's beliefs at $w : P(w')(D_x(w'))$

(19) **Abbreviated as:**

$$\llbracket \text{bil} \rrbracket = \lambda s_s. \lambda P_{\text{wst}}. \lambda x_e. x \text{ believes } P \text{ of } s$$

where P will be saturated by 'RAIN' or 'SNOW,' and s by 'THE SNOW' or 'THE P'

(20) ... there is a description D such that

- a. x describes s as D at w and,
 b. at all of the worlds w' compatible with x 's beliefs at w , the situation that x describes as D at w' fits the property P at w'

- Let's immediately derive a non-factive belief report based on these ingredients.

(21) Context: It's snowing. But someone tells Dilara that it's raining.

a. Sentence:

Dilara yağmur yağıyor diye biliyor.

Dilara rain precipitate.PRES DIYE BIL.PRES

Dilara thinks that it's raining.

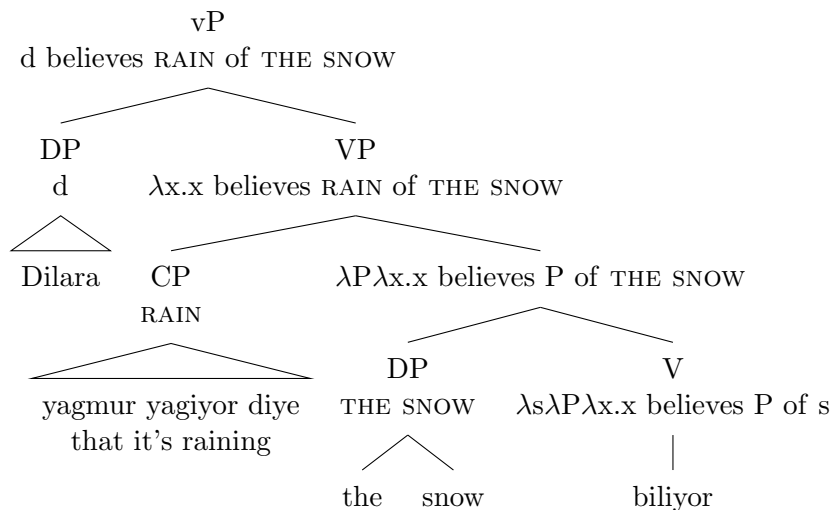
b. Target truth conditions:

Dilara thinks about the snowing situation that it's a raining situation.

Bil-'s res argument is a silent definite description referring to a contextually provided situation. Its predicate argument is saturated by the *diye* clause.

Deriving the non-factive alternant

(22)



- (23) Unabridged truth conditions
- a. $\llbracket \text{Dilara yağmur yağıyor diye biliyor} \rrbracket(w) =$
- (i) $\exists D : D_d(w) = \text{the}_w \text{ s s.t. it snows}_w \text{ at s}$
 \wedge
(ii) $\forall w' \text{ compatible with } d' \text{'s beliefs at } w : \text{it rains}_w \text{ at } D_d(w')$
- b. A value for D
 $\lambda w_w. \lambda x_e. \text{the s s.t. x heard about s}$

- Let us now derive factive truth conditions.

- (24) Context:
 It's snowing. And someone tells Dilara that it's snowing.
- a. Target sentence:
 Dilara kar yağdığını biliyor.
 Dilara snow precipitate.NMZ BIL.PRES
 Dilara knows that it's snowing.
- b. Target truth conditions:
 Dilara thinks about the snowing situation that it's a snowing situation.

Key intuition: Make it such that what's true of the actual world situation ($\lambda w. \lambda s. \text{it snows at s at } w$) is also true of belief world situations.

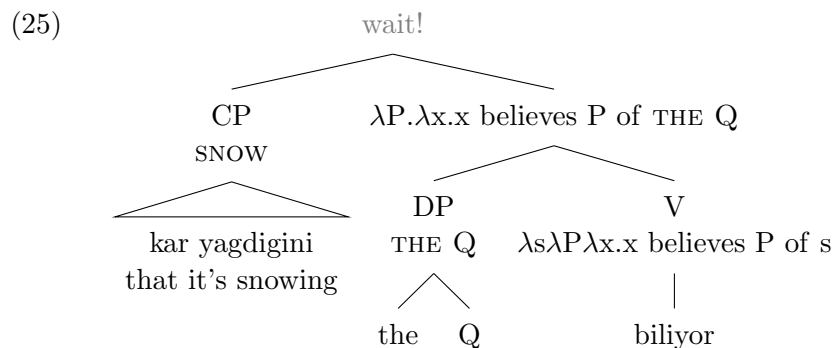
So... we would like to enforce this match in the syntactic and semantic composition.

Binding is the way of achieving this result.

Deriving the factive alternant, Step 1

Merge *bil*'s internal arguments just like before.

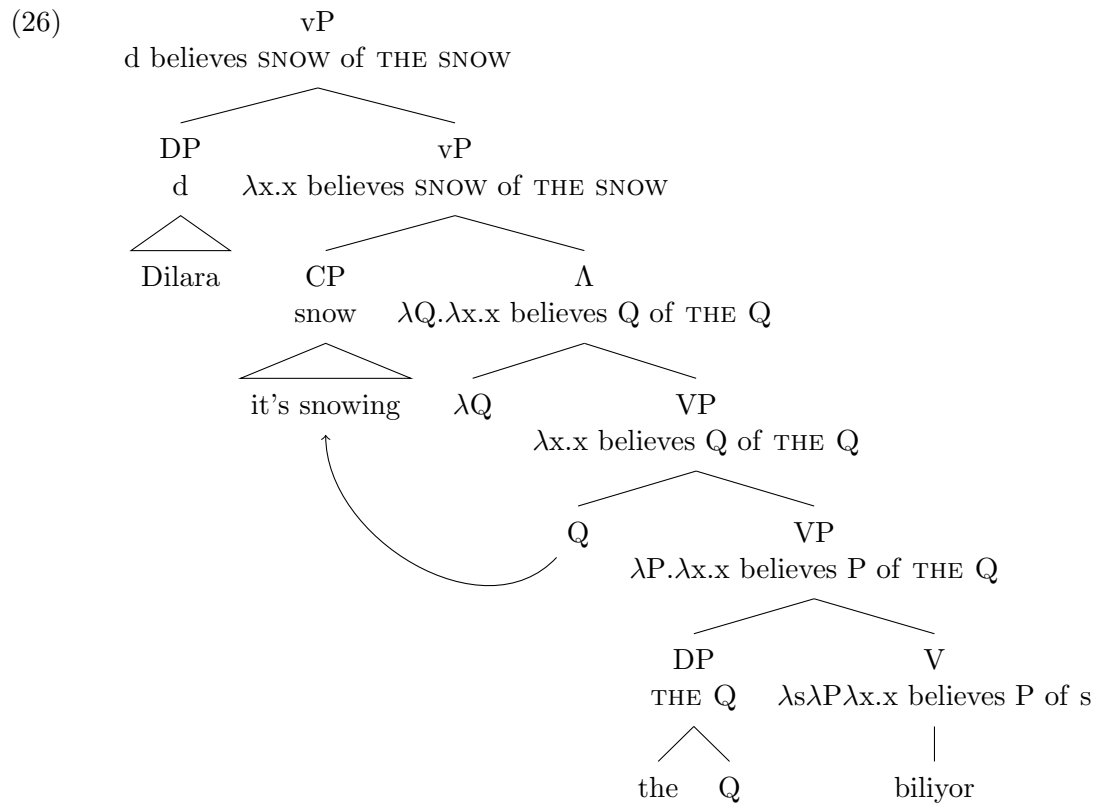
But, make a variable Q appear in the definite description (of type wst).



Deriving the factive alternant, Steps 2 & 3

Move the embedded clause and bind Q. And compose the attitude holder.

I assume that this movement is overt, although string vacuous.

**(27) Unabridged truth conditions**

- a. $\llbracket \text{Dilara yagmur yagdigini biliyor} \rrbracket =$
- (i) $\exists D : D_d(w) = \text{the}_w \text{ s s.t. it snows at s}$
 - \wedge
 - (ii) $\forall w' \text{ compatible with } d\text{'s beliefs at } w : \text{it snows at } D_d(w')$
- b. A value for D
- $\lambda w.\lambda x.\text{the s s.t. x heard about s}$

- **Bottom line**

Assuming a single non-factive lexical entry for *bil-*, we are able to derive non-factive and factive truth conditions.

- What makes the factive inference an entailment and a presupposition? It is the ‘the’ in the definite description.
- If Dilara’s belief is about the snowing situation in the actual world, then there is a snowing situation, or, simply, it is snowing.
 - * ‘The’ could be interpreted as a partial function, which would get presupposition directly.
 - * We could also keep to stay away from hard wiring a presupposition into ‘the,’ and generate it by backgrounding entailments (Abrusán, 2011, a.o.).

- **A forest of trees predicted, and sized down**

We have seen the two following structures:

- *diyeP* remains in situ, no binding, non-factive truth conditions:

$$(28) \quad [\text{diyeP} [[\text{the Q}] \text{bil}]] \quad \text{x believes rain of snow}$$

- nominalization raises, binds, factive truth conditions:

$$(29) \quad [\text{nmz} [\lambda Q [Q [[\text{the Q}] \text{bil}]]]] \quad \text{x believes snow of snow}$$

What about the following, which we also generate:

- nominalization remains in situ, no binding, non-factive truth conditions:

$$(30) \quad [\text{nmz} [[\text{the Q}] \text{bil}]] \quad \text{x believes rain of snow}$$

Ruled in:

We see *bil-* and a nominalization being non-factive (modulo stress). And this structure will do some work in section 4.

- *diyeP* raises, binds, factive truth conditions (unattested)

$$(31) \quad [\text{diyeP} [\lambda Q [Q [[\text{the Q}] \text{bil}]]]] \quad \text{x believes snow of snow}$$

Ruled out:

There are many differences between *diyeP*s and nominalizations.⁵ Perhaps their non-nominal nature prevents them from moving/binding.

- *nmz* raises, but doesn't bind, non-factive truth conditions

$$(32) \quad [\text{nmz} [\lambda Q [Q [[\text{the P}] \text{bil}]]]] \quad \text{x believes rain of snow}$$

Ruled out:

The truth conditions that (32) would give rise to are equivalent to the truth conditions that (28)/(30) give rise to. But this structure is strictly more complex, and perhaps blocked by economy. (“You may move, but only if moving makes a semantic difference.”)

- **A typology of (non-)factivity**

Not all verbs give rise to factivity alternations. What to do?

Here, I focus on *düşün-*, ‘think.’ These combine both with *diye* clauses and with nominalizations. But, they remain non-factive.

- Verbs like *düşün-*, ‘think’ do not alternate because they only have a single internal argument slot reserved for propositions.

$$(33) \quad \llbracket \text{düşün} \rrbracket(w) = \lambda p_{wt} \lambda x_e. \forall w' \text{ compatible with } x' \text{'s beliefs at } w : p(w')$$

And so, they do not allow deriving factive truth conditions in the way sketched out here.

⁵Yıldırım-Gündoğdu (2017); Özyıldız (2019, 2020)

See the appendix for verbs like *unut-*, ‘forget,’ which are always factive, and do not combine with *diye* clauses. And verbs like *san-*, which raise the question of whether prolepsis is sufficient to derive factivity.

- A worry: Is de re possible at all with *düşün-*? Yes.
These can be obtained in situ (Percus and Sauerland, 2003; Charlow and Sharvit, 2014, a.o.).
(Exercise for the reader: Using a concept generator on an embedded predicate’s situation argument might derive the non-factive alternant, but we will not be able to guarantee a factive one. Why?)
- Cross-linguistically, Turkish is not alone in having attitude verbs that differ in their argument structure.⁶

Deal (2018) argues that Nez Perce a language where:

- * lexical entries similar to *bil-*’s are required, requiring de re ‘ex situ’
- * and that these coexist with lexical entries like (33) for *düşün-*, with the possibility of de re ‘in situ.’

- Finally, within Turkish, evidence for such a difference comes from the observation that both of *bil-*’s hypothesized arguments may be realized overtly. But this is not possible for *düşün-*.

(34) ?Dilara [yagmur yagdigini]_{res} [kar yagiyor diye]_{predicate} biliyor.
Dilara rain precipitate.NMZ snow precipitate.PRES DIYE BIL.PRES
Dilara thinks of the raining situation that it is a snowing situation.

(35) *Dilara [yagmur yagdigini] [kar yagiyor diye] dusunuyor.
Dilara rain precipitate.NMZ snow precipitate.PRES DIYE think.PRES
Int. Dilara thinks of the raining situation that it is a snowing situation.

(Combinations of nominalized/*diye* clauses other than the one in (34) are ungrammatical.)

- Wrapping up:

It is possible to generate factivity in the composition by using belief about situations, and binding. This particular implementation makes use of overtly raising nominalized clauses in order to bind. Overt raising has a further implication, spelled out in the next section.

4 Intonational differences follow from the syntax to phonology mapping

Factive and non-factive attitude reports differ structurally in the height of the embedded clause. I use this structural difference to propose a hypothesis about an intonational difference between them.

- In factivity alternating attitude reports:

- the factive alternant is stressed on the matrix verb, in (36a),
- the non-factive alternant is stressed in a default embedded clause internal position, in (36b).

(36) a. Dilara yagmur yagdigini BILİYOR
Dilara rain precipitate.NMZ BIL.PRES
Dilara knows that it’s raining.

b. Dilara YAGMUR yagdigini biliyor
Dilara rain precipitate.NMZ BIL.PRES
Dilara thinks that it’s raining.

⁶Many thanks here to Seth Cable for connecting Turkish and Nez Perce.

This contrast obtains in ‘out of the blue’ utterances.

- (37) Context: You’re at a party and happen to overhear one of (36a)/(36b). Will you draw the inference that the embedded proposition is true?
- a. Yes, for (36a)
 - b. Not necessarily, for (36b)

And not with any verb.

- (38) a. #Dilara yagmur yagdigini DUSUNUYOR.
 Dilara rain precipitate.NMZ think.PRES
 Dilara thinks that it’s raining.
- b. Dilara YAGMUR yagdigini dusunuyor
 Dilara rain precipitate.NMZ think.PRES
 Dilara thinks that it’s raining.

Given (38), we immediately set aside an account of the form:

Shifting stress away from the embedded clause → presupposing the embedded proposition.

- How do we know that it is ‘main sentential stress’ that is involved rather than some other acoustic event? (E.g., a ‘tonal morpheme’?)

Özyıldız (2017a) elicits attitude reports in contexts manipulating focus and the truth of the embedded proposition, and compare with simple sentences in similar contexts, and with existing models of Turkish intonation (İpek, 2015, a.o.): It looks like shifts in regular stress position.

(Further and harder questions exist, which I would be happy to talk about.)

But, how do we model this contrast in intonation?

- Calculating the position of main sentence stress in Turkish
 - **General assumptions:**
 - * Prosodic structure is read off of syntactic structure. (Kahnemuyipour 2009 and Féry 2017 for overviews.)
 - * In particular, main sentential stress is assigned to the highest pronounced element in the complement of little *v* (aka, “the stress domain”).⁷
 What suffices here is that there is a position within a domain to which stress gets assigned.
 - This usually means that internal arguments carry main sentence stress in simple out of the blue transitive sentences.

- (39) a. Dün gece n’oldu?
 What happened last night?
- b. Ben [v [DENİZ’I gordu.
 Ben Deniz.ACC saw
 Ben saw Deniz.

The details of the intonation facts discussed here can be found in Özyıldız (2017a). Many observe that intonation might have an effect on the projection of the factive inference (Beaver, 2010; Abrusán, 2011; Tonhauser, 2016; Djärv and Bacovcin, to appear; Vaikšnoraitė et al., 2020). Our facts are about a relationship between intonation *and entailment*, which to my knowledge is novel and unexpected.

⁷This is argued for Turkish by Üntak Tarhan (2006), based on Kahnemuyipour’s original proposal. Ideas similar to this have a rich history (Chomsky and Halle, 1968; Breasnan, 1971; Cinque, 1993).

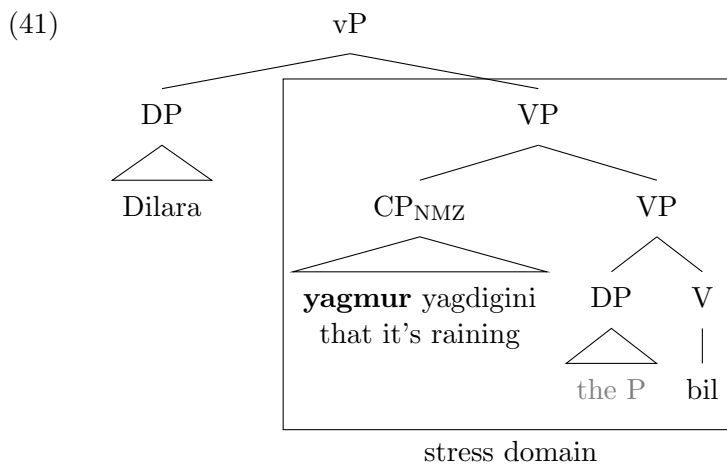
- But, **some kinds of movement make a constituent escape getting stressed**, namely if it moves ‘before’ the position of stress is calculated.

(40) Scrambling: Stress is not carried out

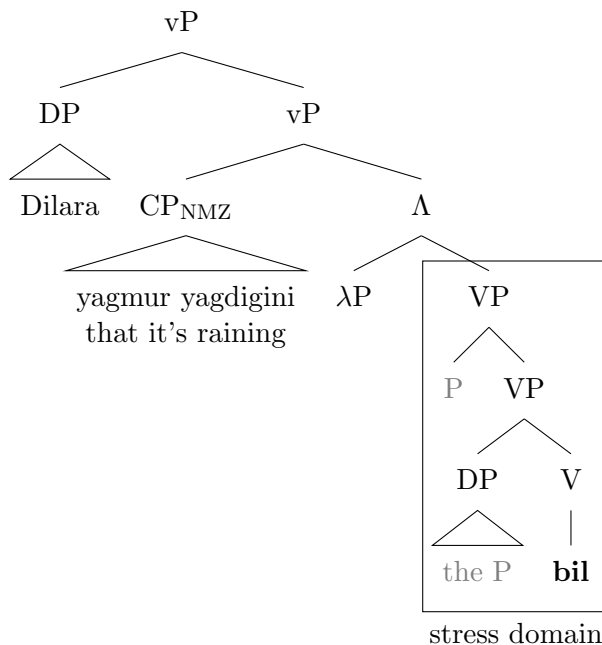
- a. Ben dun DENİZ’I gordu.
Ben yesterday Deniz.ACC saw
Ben saw Deniz yesterday.
- b. Ben Deniz’i DUN _____ gordu.
Ben Deniz.ACC yesterday _____ saw
Ben saw Deniz yesterday.

- **Hypothesis**: The movement that allows us to derive factive truth conditions makes an embedded clause escape the stress domain.

- Given regular stress assignment, embedded clauses carry main sentence stress by default.



- In the factive case, the movement step that derives the inference forces the embedded clause to vacate the stress domain, and the attitude verb remaining within gets it.



5 Wrapping up and the horizon

- Wrapping up

One lexical meaning and two structures derive an alternation both in factivity and in intonation.

- The horizon

Factivity alternations are a case study in attitude verb meaning, clausal composition, and presupposition.

- Which aspects of the meaning of linguistic expressions are memorized, and which can be derived? What cues do listeners and learners rely on to figure out those aspects of meaning? And how?
- What is the range of possible attitude verb meanings across languages? And how does this affect how clauses compose?
- We reduce the factive presupposition to an existence inference coming from a determiner. Can we do better and further simplify the range of presupposition triggers and the kinds of presuppositions that they trigger? And, how does presupposition interact with intonation? Here, we went through the syntax, but is a more direct link possible?

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Appendix

More on non-alternating verbs

- There are uniformly non-factive verbs like *san* that do allow for prolepsis as well as being able to combine with nominalizations:

- (42) a. Dilara yagmur yagdigini sanıyor.
 Dilara rain precipitate.NMZ believe
 Dilara believes that it's raining.
- b. Dilara partnerini Amherst'te sanıyor.
 Dilara her partner.ACC in Amherst believe
 Dilara believes her partner to be in Amherst.

If the binding step is an independent piece of the grammar, then if a verb a) allows for a res argument, and b) combines with nominalized clauses, then there is nothing in principle that would block generating factivity.

The most likely explanation here is that verbs like *san* treat their res arguments differently from verbs like *bil-*.

- (43) a. O durumu biliyorum.
 that situation.ACC I know
 I know that situation.
- b. *O durumu sanıyorum.
 that situation I believe
 #I believe that situation.

- Verbs like *unut-*, ‘forget,’ do not alternate, and are necessarily factive.

I leave these for further research. But, point out:

- There are non-factive belief verbs, but not non-factive ‘forgetting’ verbs (to my knowledge). Such verbs’ meanings could be paraphrased as “Dilara used to but no longer believes p.”
- A verb like *unut-* is ungrammatical with *diye* clauses. Then, the learner is never exposed to an unambiguously non-factive use of it. And perhaps has no reason to posit that that is possible.

- Bottom line for the recalcitrant cases: We might not know yet, but we have a way of where to look for explanations and what parts of the system to modify.

Overt QR

With some quantifier phrases in object position, stress falls on the verb rather than on the direct object. Contrary to what is expected.

- (44)
- Dün gece partide n'oldu?
What happened at the party last night?
 - Ben her alanyali'yi gordu.
Ben every person from Alanya.ACC saw
Ben saw everyone from Alanya.
 - #Ben HER alanyali'yi gordu.
 - #Ben her ALANYALI'YI gordu.