Examining the Meaning of Polarity Subjunctive

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1 Introduction

- **Prevailing view in the literature:** when there is mood alternation in the complement clause of negated verb, see (1), the use of the indicative presupposes commitment to the embedded proposition *p* on the part of the speaker, whereas the use of the subjunctive does not trigger such presupposition (Borgonovo 2003):

(1) a. No sabían que Pedro se había ido de viaje ⇝Peter had gone on a trip
Not knew that Peter SE had.IND gone of trip

b. No sabían que Pedro se hubiera ido de viaje ⇝Peter had gone on a trip
Not knew that Peter SE had.SUBJ gone of trip
'They didn't know that Pedro had gone on a trip.'

- The literature reports that this difference emerges both with factive and non-factive predicates. A list of the verbs that have been claimed to show this behavior is summarized below:

Verb Type	Verb	Translation	References
Non-factive	*decir*	say	Borgonovo (2003)
	indicar	indicate	Ridruejo (1999)
	comunicar	communicate	Ridruejo (1999)
	creer	believe	Ridruejo (1999), Quer (1998), Siegel(2009), Farkas(1992), Rivero (1971), Laca (2010)
	oír	hear	Borgonovo (2003), Bosque (2012)
Factive	*saber*	know	Borgonovo (2003), Bosque (2012), Ridruejo (1999)
	recordar	remember	Bosque (2012)
	averiguar	find out	Ridruejo (1999)
	darse cuenta	realize	Ridruejo (1999)
	enterarse	find out	Ridruejo (1999)
	descubrir	discover	Ridruejo (1999)
	notar	notice	Ridruejo (1999)
	ver	see	Quer (1998)

Table 1. *List of verbs that have been reported to show a difference in presuppositional content.*

- The theoretical explanations given in the literature in principle apply to both verb classes:
  - Quer (1998): In a tripartite quantificational structure Qu-Restrictor-NuclearScope (Partee 1991), indicative maps the complement *p* to the restrictor (hence presupposing its truth) whereas subjunctive fails to do so.
  - Bogonovo (2003): indicative marks the matrix predicate as focus of negation, subjunctive signals that the focus of negation is the embedded clause.
  - Buchczyk (2022) (for *no decir* 'not say'): Indicative signals that the complement p needs to be accommodated into the Common Ground (and thus that Speaker believes *p*); subjunctive gives no such signal.

Goals of this Study

1. Test empirically whether this semantic difference always emerges with both **factive** and **non-factive verbs**, as reported in the literature.
2. Additionally, we want to know if other verbs types such as **fiction verbs** (which have not been explicitly discussed in the literature but for which the theoretical analysis should extend to) show this difference too.

2 Our Work in a Nutshell

Results	**Relevance**	**Analysis**
Does Mood affect Speaker Commitment? • Factive (V1): $p < 0.0001$, $d=0.7$ ✓ • Non-factive/non-fiction (V2): $p > 0.05$ ✗ • Fiction (V3): $p=0.02$, $d=0.2$ ✓	Previous accounts do not predict a difference amongst verb classes	Romoli(2015) scalar approach to the presuppositions of soft triggers + Schlenker(2005) analysis of mood • **Romoli (2015):** diff between classes • **Schlenker (2005):** effect of mood

3 Experiment

→ https://github.com/MaribelRomero/PolaritySubjunctiveMeaning

3.1 Design

- 3 x 2 Factorial Design: [verb class] x [mood]

		Mood	
Verb class		IND	SUBJ
	V1		
	V2		
	V3		

V1 = 5 cognitive factive verbs (*remember*, *notice*, *know*, *find out* and *see*)
V2 = 5 non-factive/non-fiction verbs (*say*, *tell*, *think*, *believe* and *suspect*)
V3 = 5 fiction verbs (*dream*, *fantasize*, *invent*, *fake* and *make believe*)

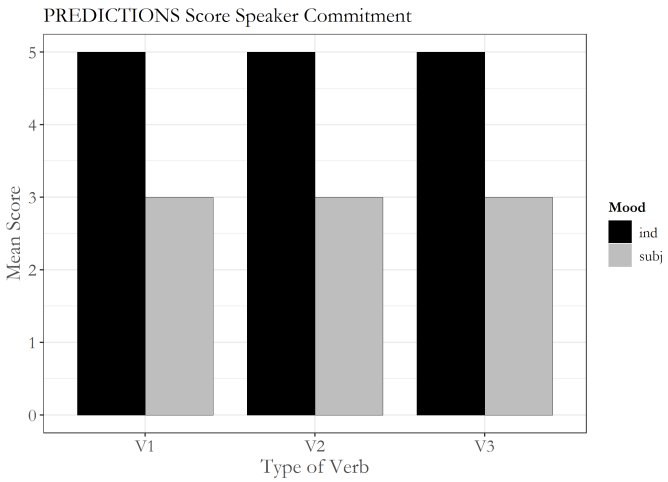
- **Structure items:** *Carmen didn't V1/V2/V3 that Mary arrived.IND/SUBJ on time.*

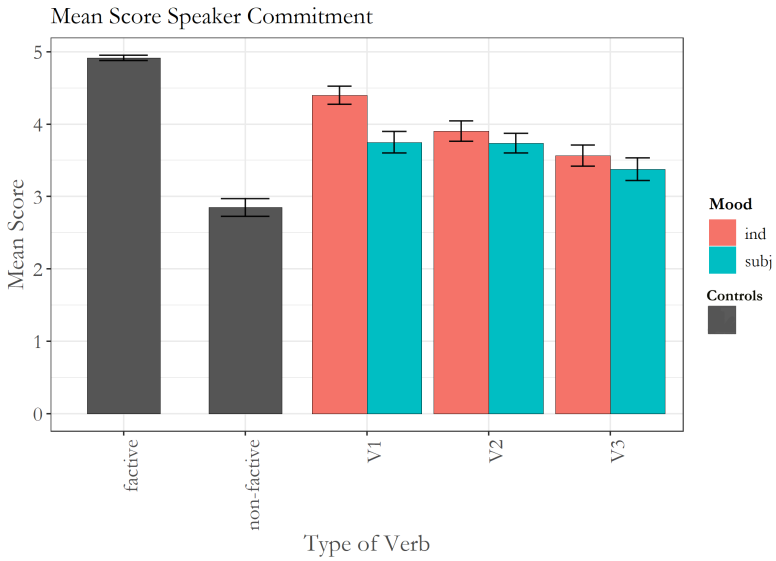
Did Mary arrive on time?
1 2 3 4 5
No ☐ ☐ ☐ ☐ ☐ Yes

- **Test materials:** 30 critical items, 10 controls and 20 fillers counterbalanced across subjects using a Latin-square design.
- **Participants:** 50 native speakers of Peninsular Spanish recruited via Prolific.
- **Platform:** PennController platform (Zehr and Schwarz 2018)
- **Demo of the experiment:** https://farm.pcibex.net/r/yEVYkw/

3.2 Predictions and Results

- Based on what has been reported in the literature, we expected to get the results in the Figure on the left; the results we got are those on the right:





- The only verbs close to what the literature predicts are class V1 verbs. In this category indicative is close to (5) (i.e., there is speaker commitment) and there is a drop (although not as drastic as the literature portrays) for subjunctive.
- Class V2 and V3 on the other hand show a small difference in means between indicative and subjunctive and moreover for class V3 the mean average for indicative is close to 3.5. So, for V2 and V3 verbs, even if we use the indicative, there is no speaker commitment.

3.3 Data Analysis

- **Linear Mixed-Effects Regression Model:** (lmer from the lme4 package in R (version 4.2.1))
  - Dependent variable: Speaker Commitment's Score
  - Fixed factors: mood and verb class
  - Crossed random effects: subjects and items

- **Results:**

	Chisq	Df	Pr(>Chisq)	
(Intercept)	547.14	1	< 2.2e-16 ***	
Mood	57.15	1	4.039e-14 ***	Main effect
VerbType	10.83	2	0.004449 **	Main effect
Mood:VerbType	20.12	2	4.276e-05 ***	**Interaction**

  - Two main effects: mood and verb class
  - Significant interaction between the two

- **Post hoc Test:** Because of the presence of an interaction, a post hoc test was conducted using the emmeans() function in R.

Factive: class V1

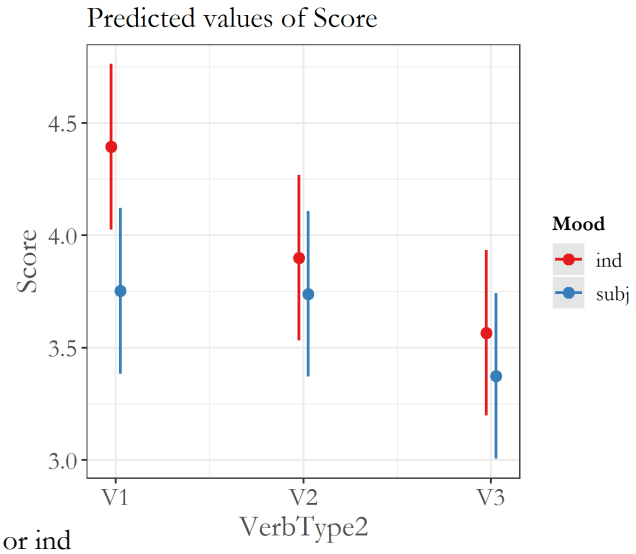
contrast	estimate	SE	df	t.ratio	p.value
ind - subj	0.641	0.0848	1418	7.560	<.0001

Non-factive/Non-fiction: class V2

contrast	estimate	SE	df	t.ratio	p.value
ind - subj	0.160	0.0848	1418	1.891	0.0589

Fiction: class V3

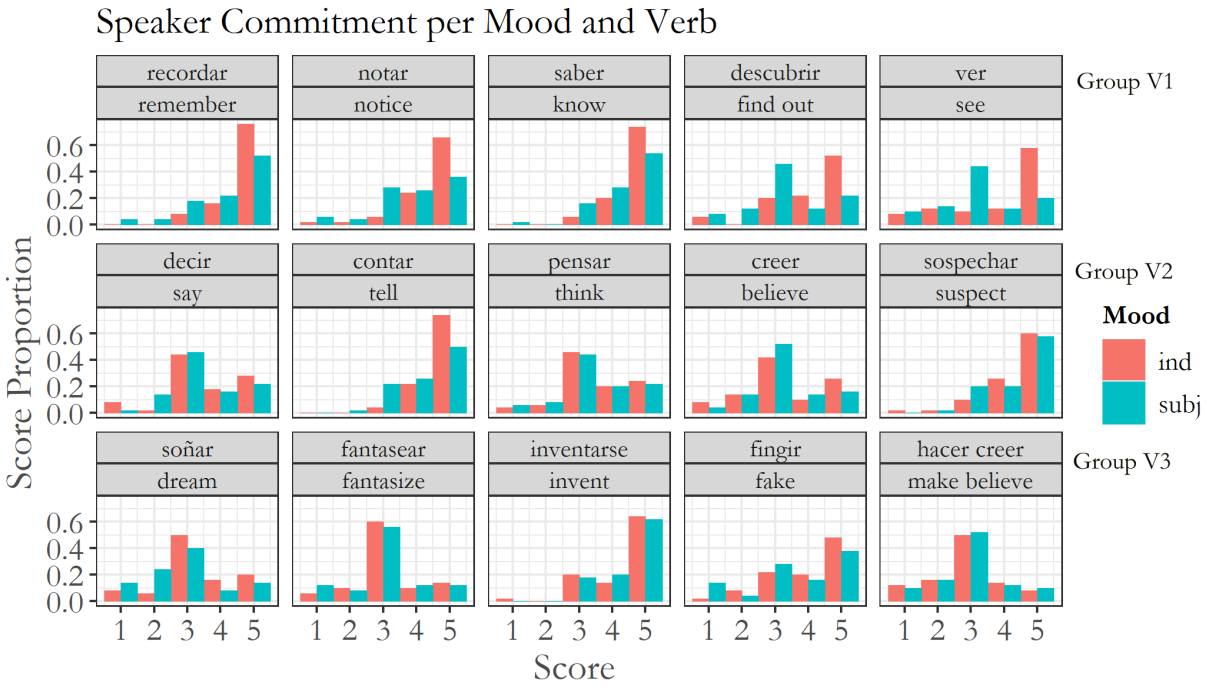
contrast	estimate	SE	df	t.ratio	p.value
ind - subj	0.192	0.0848	1418	2.260	0.0240



Mood is:
- clearly significant for factive verbs (class V1),
- not significant for class V2,
- and significant for fiction verbs (class V3), **but** neither subj or ind show a high degree of speaker commitment

- **Effect Size:** We calculated the size of the effects and obtained that for group V1 the effect size is 0.7(medium/large) and for V3 the effect size is 0.2(small).

4 A CLOSER LOOK AT EACH VERB CLASS



- V1 Class:
  Regardless of mood, different V1 verbs project with different strengths: e.g., *remember* + $p_{IND/SUBJ}$ projects more strongly than *find-out* + $p_{IND/SUBJ}$. This is in accordance with previous findings in the literature (Jarrett & Merino Hernandez 2020).
- V2 class:
  - *Contar* 'to tell' seems to behave more similar to V1 verbs than to V2s.
  - Interestingly, previous literature had noticed that, with some communication verbs (e.g. *announce*, *inform*), when the context makes clear that the attitude subject is trustworthy, the complement p is not just contextually entailed but rather presupposed (Anand & Hacquard 2014, Schlenker 2021).
  - Our Spanish examples with *contar* 'to tell' may have invited an 'autobiographical' reading that makes the attitude subject trustworthy and, thus, makes p presupposed. Hence the resemblance to V1s.
  - If we exclude this verb from class V2, we still get that mood is still not significant for class V2 (p=0.0589, p=0.3687): (Fig in Appendix)
- V3 class:
  Two distinct patterns arise in our data:
  - [x not V3 $p_{IND/SUBJ}$]: neutral with respect to whether p is true or false ← default
    (for *dream*, *fantasize*, *make believe*)
  - [x not V3 $p_{IND/SUBJ}$]: p considered true ← see Section 4.5
    (for *invent*, *fake*)

Summary

1. Contrary to what has been reported in the literature we found that V1s and V2s behaved differently:
   (a) Mood has a categorial effect (significant and large-size effect) on speaker commitment on V1 verbs.
   (b) Mood has no significant effect on class V2 (with and without the verb *contar* 'to tell' the result is non-significant.)
2. Contrary to what the theoretical accounts predict, mood choice does not make a categorial difference in V3s (significant effect but small size).

- How can we explain the differences across verb types?

4 ANALYSIS

4.1 ROMOLI (2015): SOFT PRESUPPOSITIONS AS SCALAR IMPLICATURES

- Romoli (2015) proposes to derive so-called "soft presuppositions" not as lexical presuppositions but as scalar conversational implicatures.

- Core ingredients: i) Scale of ordered alternatives invoked by the soft presupposition trigger
  ii) Exhaustivity operator EXH

- **Ingredient (i):** Scale of ordered alternatives invoked by the soft presupposition trigger
  Each soft presupposition trigger (e.g., *win*) is lexically associated with a scale of ordered alternatives where the trigger itself is the strongest item:

  (2) a. John won
  b. Alt: {WON(j)$_{str}$, PARTICIPATED(j)$_{wk}$ }, → Cf. { every$_{str}$, some$_{wk}$}
  where WON(j) means 'John participated and won'.

- **Ingredient (ii):** Exhaustivity operator EXH
  EXH takes a proposition p and a set of alternatives Alt(p) as arguments and it outputs the negation of all innocently excludable alternatives in Alt(p): (3).
  The innocently excludable alternatives of a set Alt(p) are those alternatives in Alt(p) that can be consistently negated without contradicting the assertion p and without affirming any other alternative r: (4).

  (3) $[\![\text{EXH}]\!]$ (Alt(p))(p)(w) = p(w) ∧ ∀q ∈ Excl (p,Alt(p))[¬q(w)]
  (4) Excl(p,Alt(p)) = { q ∈ Alt(p): p ⊈ q ∧ ¬∃r [r ∈ Alt(p) ∧¬q ⊆ r] }

- In positive environments like (5c), since the other alternative is entailed by the asserted alternative, exhaustification is vacuous and no additional piece of meaning is implicated.

  (5) a. John won
  b. Alt: {WON(j)$_{str}$, PARTICIPATED(j)$_{wk}$ } → Cf. { every$_{str}$, some$_{wk}$ }
  c. Exh: WON(j)

- In negative environments like (6a), the entailment relation is reversed, as indicated in (6b). This means that, in the right pragmatic contexts, exhaustification will apply and an additional piece of meaning is implicated: (6c).

  (6) a. John didn't win
  b. Alt: { ¬WON(j)$_{wk}$, ¬PARTICIPATED(j)$_{str}$ } → Cf. { ¬every$_{wk}$, ¬some$_{str}$ }
  c. Exh: ¬WON(j) ∧ PARTICIPATED(j)

4.2 APPLYING ROMOLI (2015) TO OUR CASE STUDY

- Our **V1 verbs** are cognitive factive verbs, classified as soft triggers in the literature. This means that, following Romoli (2015), *know* and the other V1 verbs lexically give rise to a scale of ordered alternatives, among which the soft trigger is again the strongest member, as illustrated in (7b) for *know*.

  (7) a. John knows that Mary runs.
  b. Alt: { KNOW(j, RUN(m))$_{str}$, RUN(m)$_{wk}$ },
  where KNOW(j,RUN(m)) means 'Mary runs and John knows it'.

- In positive environments, since the asserted alternative is stronger than the other alternative, exhaustification is vacuous and no implicature obtains:

(8) a. John knows that Mary runs
b. Alt: { KNOW(j, RUN(m))$_{str}$, RUN(m)$_{wk}$ }
c. Exh: KNOW(j, RUN(m))

- In negative environments, the entailment relation is reversed, giving (9b) below. Again, in the right pragmatic contexts, exhaustification will be applied to the sentence and we obtain (9c).

(9) a. John doesn't know that Mary runs.
b. Alt: { ¬KNOW(j, RUN(m))$_{wk}$, ¬RUN(m)$_{str}$ }
c. Exh: ¬KNOW(j, RUN(m)) ∧ RUN(m)

- Crucially, **V2 verbs** like *say* are not soft presupposition triggers and thus do not lexically give rise to ordered alternatives, as in (10). Since the embedded proposition p does not come into play as a stronger alternative in (11b), no exhaustification will take place and no parallel step (11c) will be obtained. We only have the original literal meaning (11d).

(10) { SAY(x,p) }
(11) a. John didn't say that Mary runs.
b. Alt: –
c. Exh: –
d. : ¬SAY(j, RUN(m))

This derives the difference between V1 vs V2.
However, the difference brought about by mood is unexplained. → To account for that we use Schlenker (2005).

4.3 SCHLENKER (2005)

- Pronominal approach to morphological mood (Schlenker 2005 building on Farkas 2003 and Quer 1998, extended in Romero 2017):

(12) $[\![\text{she}_7]\!]^g$ is defined only if g(7) is female;
if defined, $[[\text{she}_7]]^g = g(7)$

(13) $[\![\text{Past}_2{}^{\text{pro1}}]\!]^g$ g is defined only if g(2) < g(1);
if defined, $[[\text{Past}_2{}^{\text{pro1}}]]^g = g(2)$

(14) Where CS is the Context Set of the speaker (CS*) or a derived Context Set of some attitude holder x, namely $\text{Dox}_x(w_0)$:

a. $[\![\text{Ind}_2{}^{\text{pro1}}]\!]^g$ is defined only if g(2)∈g(1), that is, only if g(2) ∈ CS;
if defined, $[\![\text{Ind}_2{}^{\text{pro1}}]\!]^g = g(2)$

b. $[\![\text{Subj}_2{}^{\text{pro1}}]\!]^g$ always defined;
if defined $[\![\text{Subj}_2{}^{\text{pro1}}]\!]^g = g(2)$

(15) $[\![\text{that Mary runs.Ind}_2{}^{\text{pro1}}]\!]^g$ = λw': w' ∈ CS . Mary runs at w'

(16) $[\![\text{that Mary runs.Subj}_2{}^{\text{pro1}}]\!]^g$ = λw': ~~w' ∈ CS~~ . Mary runs at w'

4.4 Applying Schlenker (2005) to our Case Study

- We start with **V1 verbs**.
- After exhaustification has applied we obtained (9c), repeated here as (17):

  (17) Exh: ¬KNOW(j, RUN(m)) ∧ RUN(m)

- **If the embedded CP is in IND:**

- The first conjunct in (17) will lead to the truth conditions in (18b), where the embedded λw.RUN$_w$(m) proposition is only defined for John's doxastic worlds –which leads to the trivial presupposition that Epi$_{w0}$(j) ⊆ Dox$_{w0}$(j)– or only defined for the worlds in the current CS* –leading to the near-trivial presupposition that Epi$_{w0}$(speaker) ⊆ CS*.[1]
- But, crucially, the second conjunct in (17) leads to the truth conditions in (18c). As in the case of a simple matrix declarative clause like (19a), IND in (18c) signals that the speaker intends the proposition to be intersected with the current CS*, which in turn indicates that the speaker is committed to the truth of that proposition.

(18) a. John doesn't know that Mary runs.IND.

b. $\lambda w_0.\ \neg\ \text{KNOW}_{w0}\ (j, \lambda w : \left\{\begin{matrix} w \in \text{Dox}_{w0}(j) \\ w \in \text{CS}* \end{matrix}\right\}.\ \text{RUN}_w(m))$

c. λw: w ∈ CS*. RUN$_w$(m) → speaker's commitment to p

(19) a. Mary runs.IND.
b. λw: w ∈ CS* . RUN$_w$(m) → speaker's commitment to p

- **If the embedded CP is in SUBJ:**
  The two conjuncts in (17) lead to the truth-conditions in (20b)-(20c). In this case, there is no indication as to whether the speaker intends the proposition (20c) to be intersected with the current CS or not and, thus, the addressee can but need not consider the speaker as committed to it.

(20) a. John doesn't know that Mary runs.SUBJ.

b. $\lambda w_0.\ \neg\text{KNOW}_{w0}\ (j, \lambda w : \left\{\begin{matrix} \sout{w \in \text{Dox}_{w0}(j)} \\ \sout{w \in \text{CS}*} \end{matrix}\right\}.\ \text{RUN}_w(m))$

c. λw: ~~w ∈ CS* .~~ RUN$_w$(m)

This derives the different strength in presupposition projection with V1 verbs:
with indicative the embedded proposition p projects whereas with subjunctive it can but need not.

- We turn to **V2 verbs.**
- We saw that, since there are no alternatives, there is no exhaustification. The only implication we have is the literal meaning in (21). This amounts to just having the first component in (17).

  (21) ¬SAY(j, RUN(m))

[1] If the Speaker is sincere and has not put any lie in CS*, then Epi$_{w0}$(speaker) ⊆ CS* is trivial.

- **If the embedded CP is in IND:**
  We will obtain the truth conditions in (22), where the embedded partial proposition λw:. . . .RUNw(m) will lead to trivial or near-trivial presuppositions, as in the case above.

  (22) a. John didn't say that Mary runs.IND.

  b. $\lambda w_0.\ \neg SAY_{w0}\ (j, \lambda w : \{^{w \in Dox_{w0}(j)}_{w \in CS*}\}.\ RUN_w(m))$

- **If the embedded CP is in SUBJ:**
  We obtain the truth conditions in (23), where the embedded total proposition λw. RUNw(m) does not lead to any presupposition.

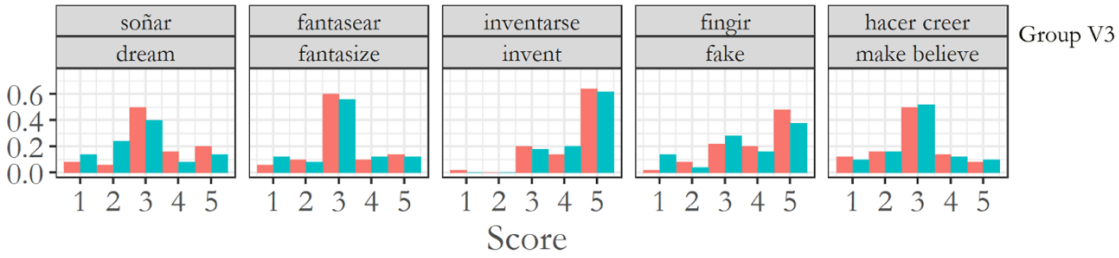
  (23) a. John didn't say that Mary runs.IND.

  b. $\lambda w_0.\ \neg SAY_{w0}\ (j, \lambda w : \{^{\sout{w \in Dox_{w0}(j)}}_{\sout{w \in CS*}}\}.\ RUN_w(m))$

This derives the lack of significant impact of mood choice on the truth of p with V2 verbs.

4.5 On the Behavior of V3 Verbs

- Since **V3 verbs** are not soft presupposition triggers, the proposed analysis will lead to the same truth conditions as for V2 verbs.
- This is indeed what we found: the observed interaction of mood and speaker commitment for V3 verbs in our experimental results, though significant, does not lead to a categorical difference in the perceived speaker commitment on p, as predicted by the analysis.
- Still, an open issue: Two distinct patterns in our data
  - [x not V3 $p_{IND/SUBJ}$]: neutral with respect to whether the Speaker considers *p* is true or false (for *dream*, *fantasize*, *make believe*) → As predicted by our analysis
  - [x not V3 $p_{IND/SUBJ}$]: Speaker considers *p* true (for *invent*, *fake*) → Why???



- A tentative suggestion: A look at the organization of the lexicon[2]

(24)	[x invented/faked that p]	as antonym of	[p is true]
	¬[x invented/faked that p]	as synonym of	[p is true]
(25)	[x dreamt/fantasized that p]	~~as antonym of~~	~~[p is true]~~
	¬[x dreamt/fantasized that p]	~~as synonym of~~	~~[p is true]~~

[2] If this tentative suggestion is proven right and the verbs *invent* and *fake* are analyzed separately from the V3 class, the effect of mood is non-significant for remaining class V3 (p=0.08).

5 CONCLUSIONS

- Contra previous literature, our experimental results show that mood choice has a significant effect on the speaker's commitment to the complement proposition *p* in the V1 class (cognitive factive verbs) but not in the V2 class (non-factive/non-fiction).
- An analysis has been proposed that correctly derives this effect of mood choice for **V1s** and not for **V2**, based on the following two ingredients, independently argued for in the literature:
    - V1s give rise to the scalar implicature *p* (Romoli 2015); V2s do not.
    - Indicative signals that the Speaker intends the implicated *p* to be intersected with the matrix CS*; Subjunctive sends no such signal.
- The **V3 class** patterns like the V2 class, except for some verbs invoking certain antonymic relations.

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7 APPENDIX:

- Results Post Hoc Test comparing the class V2 with and without *contar* (both ways non-significant):

Class V2

contrast	estimate	SE	df	t.ratio	p.value
ind - subj	0.160	0.0848	1418	1.891	0.0589

Class V2 without *contar* `to tell´

contrast	estimate	SE	df	t.ratio	p.value
ind - subj	0.0852	0.0948	1418	0.899	0.3687

- Medians of the Experiment: