Spanish Neg-raising: Mood effects on NPI licensing[1]

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Abstract. Although Neg-raising (NR) has been subject to a considerable amount of attention over the last decades, the interaction of NR with other linguistic phenomena such as mood is currently not well understood. This paper addresses this gap from both an empirical and theoretical perspective by investigating how mood interacts with NR in terms of licensing the NR reading and strict NPIs. In particular, two simultaneous online experiments were conducted that showed that, whereas the NR reading availability is not influenced by mood, the grammaticality of the strict NPIs is significantly lower when in the indicative. To account for these results, the paper follows Gajewski's (2011) theory of NPI licensing, whereby not only the asserted content but also the implicatures and presuppositions of the sentence are factored in when testing for anti-additivity. The paper explores two implications potentially induced by indicative mood: (a) the speaker is committed to the embedded proposition *p* (Homer, 2008; Quer, 1998), and (b) the embedded proposition *p* has previously been discussed by the conversationalists (Ridruejo Alonso, 1999). It is then shown that when either implication is factored in, the environment is no longer anti-additive and thus blocks strict NPIs without affecting NR.

Keywords: NPIs, Neg-raising, mood, Spanish.

1. Introduction

When certain attitude predicates are negated, a stronger interpretation typically arises where the negation pronounced in the matrix clause is instead interpreted lower in the embedded clause. For example, sentence (1) has negation scoping over *believe*, but the sentence is interpreted instead with negation under *believe*. This phenomenon has hence been labelled **Neg-raising (NR)**, and the interpretation with the negation taking low scope is the so-called **NR reading**. In contrast, other attitude predicates, e.g. *claim*, do not allow the NR reading, as shown in (2).

(1) Anabelle doesn't believe that Tim ate cake.
$\rightsquigarrow$ Anabelle believes that Tim didn't eat cake. (NR reading)

(2) Anabelle doesn't claim that Tim ate cake.
$\not\rightsquigarrow$ Anabelle claims that Tim didn't eat cake. (NR reading)

Additionally, constructions with negated NR predicates (NRPs) like in (1) license strict NPIs like *in years* in the embedded clause, as can be seen in (3) and in contrast to (4).

(3) Anabelle doesn't think$_{NRP}$ [that Tim has eaten cake in years$_{strictNPI}$].

(4) #Anabelle doesn't claim$_{nonNRP}$ [that Tim has eaten cake in years$_{strictNPI}$].

NR, generally assumed to be a cross-linguistic phenomenon, has received much attention over the last decades, e.g. see Bartsch (1973); Horn (1978); Gajewski (2007); Romoli (2013); Jeretič (2022). However, most research has focused on a few prototypical cases with the purpose of providing an analysis of NR, not taking into account the behavior of NR when more complexity

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in the embedded clause is necessitated by the language. The present paper investigates how the NR reading and NPI licensing interact with embedded mood morphology in Spanish.

Unlike English, where the majority of work in NR has been established, Spanish is a language that encodes mood distinctions on the verb. When a verb is embedded under some negated NR predicates (e.g., *creer* 'believe'), it can be conjugated with indicative or subjunctive morphology, see (5). However, the interaction between the mood of the embedded clause and the behavior of NR is unclear. So far, the consensus is that subjunctive mood allows NR to behave as expected, but few have addressed the case with indicative. Some have claimed that NR is not available with indicative embedded clauses based on their failure to license strict NPIs (Rivero, 1971; Harrington and Pérez-Leroux, 2016). Meanwhile, it has also been claimed that the NR reading is available with indicative mood (Bolinger, 1968; Fignoni, 1982; Siegel, 2009).

(5) Anabel no cree$_{NRP}$ que Tim se [ha / haya] comido el pastel.
Anabel no believe that Tim CLT has-IND has-SUBJ eaten the cake
'Anabel doesn't believe that Tim ate the cake.'

The goal of this paper is to discern how mood and NR interact with each other. In particular, we investigate experimentally whether the availability of the NR readings and the licensing of NPIs is affected by the mood of the embedded verb in Spanish. We will present two experiments with native Spanish speakers, one comparing the grammaticality of constructions with strict NPIs, and the other comparing the availability of the NR reading, in constructions with indicative versus subjunctive embedded clauses. The results will show that, whereas the availability of the NR reading is not influenced by mood, the grammaticality of the strict NPIs is significantly lower with the indicative. This points to a blocking effect of the indicative on the licensing of strict NPIs, but *not* on the NR reading.

To explain the effect of mood on strict NPIs, we will follow Gajewski's (2011) theory of NPI licensing, whereby not only the asserted content but also the conversational implicatures and presuppositions of the sentence need to be factored in when testing downward-entailingness –for weak NPIs– and anti-additivity –for strict NPIs. Two implications potentially induced by indicative mood will be discussed: (a) the speaker is committed to the embedded proposition p (Homer, 2008, for Italian and French; Quer, 1998 for Spanish, but see Montero and Romero, 2023), and (b) the embedded proposition p has been discussed by the conversationalists (Ridruejo Alonso, 1999). We will see that, when either implication is factored in, the environment is no longer anti-additive and thus blocks strict NPIs.

The structure of the article is as follows. Section 2 further discusses the relationship between NR, the licensing of strict NPIs, and observations thereof in Spanish. Section 3 presents the two simultaneous experiments carried out in order to investigate the interaction of indicative versus subjunctive mood in licensing the NR reading and strict NPIs, and Section 4 provides the results of the experiments. Section 5 proposes an account for these results following Gajewski's (2011) theory of NPI licensing. Section 6 concludes.

2. Background

NR constructions involve matrix negation over NR-allowing attitude predicates which embed a complement clause. Such NRPs like *think*, *believe*, and *want* are standardly analyzed as universal quantifiers over sets of worlds compatible with, for example, the agent's beliefs or

desires (Hintikka, 1969). Negation over a NRP thus literally expresses the weak *not all* truth conditions (6a), which, via NR, can result in the strong *all not* interpretation (6b).

(6) $[\![$ Ana doesn't think that it's raining. $]\!]^w$
a. $= \lambda w.[\ \neg\forall w' \in \text{DOX}_a^w(w') : \text{rain}(w')\ ]$ 'not all of Ana's belief-worlds are rain-worlds'
b. $\rightsquigarrow \lambda w.[\ \forall w' \in \text{DOX}_a^w(w') : \neg\text{rain}(w')\ ]$ 'all of Ana's belief-worlds are not-rain-worlds'
(NR reading)

There have been many proposed accounts, but little consensus, for how the weak *not all* truth conditions are strengthened to the strong *all not* NR reading. A long line of work views NR as the result of integrating an Excluded Middle presupposition carried by NRPs (Bartsch, 1973; Gajewski, 2007; a.o.), which states that either all worlds or no worlds in the modal domain of the attitude verb are *p*-worlds. Others have analyzed NR as the result of either a basic scalar implicature (Romoli, 2013) or a more complex scale-less implicature (Jeretič, 2022). Meanwhile, a separate line of work views NR as the result of more general pragmatic reasoning: The weak *not all* assertion and the strengthened *all not* interpretation convey close enough meanings so that the weak assertion can be used in place of explicitly stating the stronger, but more impolite, embedded-negation alternative (Horn and Bayer, 1984). However, one similarity across accounts is their focus on simple NR constructions with only a few prototypical NRPs. This could be due in part to not all NR constructions straightforwardly allowing the NR reading. Whereas NR constructions with *think* and *believe* are almost always clearly interpreted with the NR reading, in constructions with other NRPs like *advise* and *expect* (7), the inference may more often be suspended, resulting in less clear support for the availability of NR.

(7) I don't [advise / expect] you to quit.
$\overset{?}{\rightsquigarrow}$ I [advise / expect] you not to quit. (?NR reading)

Horn (1978), in discussing which predicates allow NR across languages, uses the licensing of strict NPIs in the embedded clause as a clearer test for the availability of NR. Originally noted by Klima (1964), and as was shown in (3) versus (4), constructions with NRPs are able to license strict NPIs like *in years* and punctual *until* which normally are not licensed without clausemate negation. Thus, if a strict NPI in the embedded clause does not lead to ungrammaticality, there is direct support for the availability of NR. Applying this test to the construction in (7) shows that the strict NPI is licensed, and therefore it indicates that both *advise* and *expect* are NRPs (8). The strict NPI test has since become a classic test for the availability of NR.

(8) I don't [advise / expect] you to quit until next month$_{strictNPI}$.

2.1. NR and NPI licensing

Weak NPIs like *any* and *ever* are licensed by downward-entailing (DE) environments (Ladusaw, 1979; von Fintel, 1999), as defined in (9a). Meanwhile, strict NPIs such as *one bit* and *in years* require a stronger anti-additive (AA) environment (Zwarts, 1998), as defined in (9b).[2]

(9) a. $f(X \vee Y) \Rightarrow f(X) \wedge f(Y)$ (downward entailing)
b. $f(X \vee Y) \Leftrightarrow f(X) \wedge f(Y)$ (anti-additive)

Not only does the truth-conditional content play into the licensing of NPIs, but so can meaning

[2]See Etxeberria et al. (2024) for the differences between weak NPIs, strict NPIs, and n-words.

from implicatures (Chierchia, 2004) and presuppositions (Homer, 2008). Specifically, both types of NPIs are sensitive to meaning from indirect scalar implicatures and presuppositions triggered within the licensing constituent, while strict NPIs are further sensitive to direct scalar implicatures and presuppositions triggered by the licensing operator (Gajewski, 2011). In our case, the result of NR, whether via a presupposition or implicature, makes the embedded clause an anti-additive environment: The formulas (10a) and (10b) corresponding to the NR readings of the two sentences logically entail each other, thus satisfying anti-additivity in (9b). As such, strict NPIs are provided with the necessary environment to be licensed in the embedded clause of a NR construction (Gajewski, 2005).

(10) a. John doesn't think that Mary or Bill left.
$\lambda w.[\ \forall w' \in \text{DOX}_j^w : \neg(\text{leave}(m,w') \vee \text{leave}(b,w'))\ ]$
$\equiv \lambda w.[\ \forall w' \in \text{DOX}_j^w : \neg\text{leave}(m,w') \wedge \neg\text{leave}(b,w')\ ]$
b. John doesn't think that Mary left and John doesn't think that Bill left.
$\lambda w.[\ \forall w' \in \text{DOX}_j^w : \neg\text{leave}(m,w') \wedge \forall w' \in \text{DOX}_j^w : \neg\text{leave}(b,w')\ ]$

However, it then also follows that meaning from implicatures and presuppositions can block otherwise licensed NPIs, provided that they are of the type that the NPI is sensitive to. For example, the weak NPI *anything* and the strict NPI *until seven* are licensed in plain NR constructions, (11a) and (12a) respectively. But with the addition of the adverb *too* into the licensing constituent in sentences (11b) and (12b), the NPIs are blocked and result in ungrammaticality.

(11) a. I don't think [John]$_F$ read anything$_{weakNPI}$ interesting. (Homer, 2008: 433)
b. *I don't think [John]$_F$ read anything$_{weakNPI}$ interesting **too**.

(12) a. I don't think [John]$_F$ arrived until seven$_{strictNPI}$.
b. *I don't think [John]$_F$ arrived until seven$_{strictNPI}$ **too**.

As Homer (2008) explains, the incorporation of *too*'s presupposition disrupts the environment to no longer be DE/AA respective to the NPI. This is shown for (11b), where (13a) $\not\Rightarrow$ (13b).[3]

(13) a. $\mu(\llbracket$I don't think John read a book too$\rrbracket)$
I think [John didn't read a book $\wedge$ someone other than John read a book]
b. $\mu(\llbracket$I don't think John read a novel too$\rrbracket)$
I think [John didn't read a novel $\wedge$ someone other than John read a novel]

Taking this into account, meaning from both the truth-conditional and non-truth-conditional content must be carefully considered in order to determine whether a given context is and remains DE/AA to license the relevant type of NPI.

2.2. NR and mood

Although there is a wide range of cross-linguistic variation regarding which specific lexical predicates license NR, there is much similarity in the types of predicates which do. Horn (1989) classifies English NRPs into five classes (14).

[3]Following Homer (2008) we will use the letter μ to denote the conjunction of the assertive content and the presuppositions of a given sentence.

(14) Horn's English NRP classes: (Horn, 1989: 323)
- a. **Opinion**: *think*, *believe*, *suppose*, *imagine*, *expect*, ...
- b. **Perception**: *seem*, *appear*, *look like*, ...
- c. **Probability**: *be probable*, *be likely*, ...
- d. **Intention/volition**: *want*, *intend*, ...
- e. **Judgment/(Weak) obligation**: *advise*, *suggest*, *should*, ...

In Spanish, these predicate classes have different mood selection patterns. Probability, intention/volition, and judgment/(weak) obligation predicates always select for subjunctive complement clauses. Opinion and perception verbs in principle select indicative, but, when negated, they allow for both indicative and subjunctive complement clauses. This is summarized in (15):

(15) Spanish complement clause mood selection in negated contexts
- a. **Opinion**: indicative and subjunctive
- b. **Perception**: indicative and subjunctive
- c. **Probability**: subjunctive
- d. **Intention/volition**: subjunctive
- e. **Judgment/(Weak) obligation**: subjunctive

There is agreement in the literature that NR is available with subjunctive complement clauses. This is exemplified by the availability of the NR reading in (16a) and (16b).

(16) a. Anabelle no cree$_{NRP}$ que Tim se **comiera** el pastel.
Anabelle not believe that Tim CLT ate-SUBJ the cake
'Anabelle doesn't believe that Tim ate the cake.'
$\rightsquigarrow$ 'Anabelle believes that Tim didn't eat the cake.' (NR reading)

b. Anabelle no quiere$_{NRP}$ que Tim **venga**.
Anabelle not want that Tim come-SUBJ
'Anabelle doesn't want Tim to come.'
$\rightsquigarrow$ 'Anabelle wants Tim not to come.' (NR reading)

Further support comes from the strict NPI test. In Spanish, strict NPIs such as *en años* 'in years' and *hasta las ocho* 'until 8 o'clock' are perfectly grammatical under a negated NRP if the complement clause carries subjunctive morphology, see (17a)-(17b). These environments are thus anti-additive when both the asserted and non-asserted content are taken into account.

(17) a. Anabelle no cree$_{NRP}$ [que Tim **haya** comido pastel **en años**$_{stricNPI}$].
Anabelle not believe that Tim had-SUBJ eaten cake in years
'Anabelle doesn't believe that Tim has eaten cake in years.'

b. Anabelle no quiere$_{NRP}$ [que Tim **venga** **hasta las ocho**$_{stricNPI}$].
Anabelle not want that Tim come-SUBJ until the eight
'Anabelle doesn't want Tim to come until 8 o'clock.'

However, there is no agreement concerning NR with indicative complement clauses. Some authors have argued that the NR reading is also available with indicative (Bolinger, 1968; Fignoni, 1982; Siegel, 2009), depicted in (18) where % indicates speaker variation.

(18) Anabelle no **cree** que Tim se **comió** el pastel.
Anabelle not believe that Tim CLT ate-IND the cake
'Anabelle doesn't believe that Tim ate the cake.'
$\overset{\%}{\rightsquigarrow}$ 'Anabelle believes that Tim didn't eat the cake.' (%NR reading)

Others, however, have used the lack of NPI licensing as evidence to argue that NR is not available with indicative complement clauses (Rivero, 1971; Harrington and Pérez-Leroux, 2016). The reasoning is as follows. NR must occur in order for the environment to be strengthened from DE to AA. If strict NPIs are not licensed, then the environment is not appropriately AA. A possible reason for this is that NR was blocked, and so the environment is not strengthened. Thus, the ungrammaticality of the strict NPIs is explained if indicative blocks NR. Indeed, the grammaticality of strict NPIs with indicative is not so clear, cf. (19) vs. (17a).

(19) $^{*/\#/?}$Anabelle no cree [que Tim **ha** comido pastel **en años**$_{stricNPI}$].
Anabelle not believe that Tim had-IND eaten cake in years
'Anabelle doesn't believe that Tim has eaten cake in years.'

On the contrary, if indicative allows NR, as suggested by Bolinger (1968), Fignoni (1982), and Siegel (2009), then the environment can be strengthened to AA. There are then two possibilities concerning the licensing of strict NPIs in indicative complement clauses: (i) the NPI is blocked directly by some meaning introduced by the indicative and the sentences are ungrammatical, or (ii) the NPIs are in fact licensed and the sentences are grammatical.

2.3. Current state of affairs: three alternative hypotheses

There exist, then, three theoretical possibilities regarding the interaction of mood, availability of NR, and licensing of strict NPIs in Spanish:

(20) i. Hypothesis A: indicative blocks both NR and the licensing of strict NPIs.
ii. Hypothesis B: indicative allows both NR and the licensing of strict NPIs.
iii. Hypothesis C: indicative allows the NR but blocks the licensing of strict NPIs.

This is of general interest to theories of NR insofar as, to our knowledge, most theoretical analyses do not predict an interaction between mood and NR. Thus, if mood is shown to play a role in the availability of NR, this will not only help in understanding the interaction between mood and NR, but also to support a unified theory of NR. The next section details the collection of empirical evidence that was conducted in order to determine which hypothesis is supported.

3. Experiments

Two simultaneous experiments were performed, one for each of two research questions. The first concerns the influence of indicative versus subjunctive mood on the licensing, and thus the acceptability, of strict NPIs. The second concerns the availability of NR in constructions with indicative versus subjunctive complement clauses. The two research questions are stated explicitly in (21). The experiments were performed with the same design, items, and participants.

(21) RQ1: How acceptable are strict NPIs in indicative, as compared to subjunctive, embedded clauses under negated NRPs?
RQ2: Do constructions with negated NRPs allow for the NR reading when the complement clause is in indicative, as compared to constructions with subjunctive mood and those with negated non-NRPs?

3.1. Design

The experiments followed a 3×2 design crossing (i) construction type: a negated non-NR predicate (NNR, e.g., *not know*), a negated NR predicate (NR, e.g., *not believe*), and a negated NR predicate with an embedded NPI (NR+NPI, e.g., *not believe [that ... NPI]*) by (ii) subjunctive (SUBJ) vs. indicative (IND) mood in the complement clause. The design is illustrated in (22).

(22) Structure of the critical items:

a.	...neg V_{nonNRP} [that ... EMB $V_{IND/SUBJ}$ ... ADV]	(NNR)
b.	...neg V_{NRP} [that ... EMB $V_{IND/SUBJ}$ ... ADV]	(NR)
c.	...neg V_{NRP} [that ... EMB $V_{IND/SUBJ}$ ... NPI]	(NR+NPI)

Within experiment 1, the main condition is the indicative version of the NR construction with a strict NPI (NR+NPIxIND). The indicative version of the plain NR construction (NRxIND), as well as the subjunctive versions of each construction, function as controls. Within experiment 2, the two main conditions are the indicative versions of the plain NR (NRxIND) and the NR with a strict NPI (NR+NPIxIND) constructions. The constructions with non-NRPs (NNRxSUBJ and NNRxIND) and the subjunctive versions of the plain NR (NRxSUBJ) and NR with a strict NPI (NR+NPIxSUBJ) function as low and high controls, respectively, for the NR reading availability.

3.2. Procedure

In each trial, participants were presented with a sentence and asked to (i) rate its acceptability (Exp 1) and, if the sentence was rated as reasonably acceptable, to (ii) evaluate its ability to convey the NR reading (Exp 2). Participants first rated the sentence's acceptability on a Likert-scale from 1-7, with 1 indicating fully unacceptable and 7 indicating fully acceptable. If they rated the sentence as 4 or higher, they were asked about the interpretation of that sentence. In particular, they were instructed to respond with *yes* or *no* for whether the sentence could be interpreted with low negation (i.e. the NR reading). If, on the other hand, participants rated the sentence with a 3 or lower, the trial ended and they were presented with the next sentence. Participants were not asked to judge the interpretation of a sentence they rated with low acceptability because we considered the judgments to be too unreliable. Thus, the two experiments were conducted simultaneously. This was in order to help ensure that the acceptability of strict NPIs and the availability of the NR reading were judged with as similar an interpretation of the sentence in mind as possible. An example is given with a translated item in (23).[4]

(23) **Sentence**: John didn't believe that Mary had visited the museum in years.
Q1: On a scale of 1-7, how acceptable is this sentence? (1 2 3 4 5 6 7)
(**Q2**:) Can the sentence above have the following interpretation?:
'John believed that Mary hadn't visited the museum in years' (yes/no)

Participants first provided some basic demographic information. Next, they were provided with the instructions and given five practice trials. Then followed 52 experimental trials, including 36 critical and 12 filler items, as well as four attention check trials spaced evenly throughout the experimental trials. The attention check trials started on a new screen and asked participants a four-way multiple choice question on what the preceding trial's sentence was about. Any participants who score incorrectly on more than one attention check would be excluded. The experiment was implemented using the PCIbex platform (Zehr and Schwarz, 2018).

[4]A demonstration of the experiment can be found at: `https://farm.pcibex.net/r/uSzpPA/`

3.3. Critical Items

In total, 36 critical items were constructed using the structure in (22). Six NRPs with six corresponding non-NRPs and two strict NPIs were distributed equally across the items, where each predicate occurred in each relevant condition across six different items. The items were counterbalanced across six participant groups using a Latin Square Design. The NRPs were: *pensar* 'think', *creer* 'believe', *considerar* 'consider', *parecer* 'seem', *opinar* 'reckon', and *dar la impresión* 'give the impression'. The non-NRPs were: *saber* 'to know', *estar seguro* 'be sure', *ser consciente* 'be aware', *resultar evidente* 'be obvious', *asegurar* 'assure/ensure', and *recordar* 'remember'. The strict NPIs were: *en años/meses* 'in years/months' and *hasta* 'until'.[5] Two important aspects were controlled for in creating the items: the verb morphology and the telicity of the embedded verbs. Both aspects are described in the following sections.

3.3.1. Morphology the verbs

Several negated predicates in Spanish only allow mood alternation in the embedded clause when the matrix predicate is in past tense. This is exemplified with *saber* 'know' in (24), where the past tense construction combines with both indicative and subjunctive embedded clauses (24a) whereas the present tense construction only combines with indicative (24b). All sentences in the study were in past tense to allow for mood alternation across items.

(24) a. María no sabía que Ana [estaba / estuviera] enferma.
Maria not know-PST that Ana be-IND be-SUBJ sick
'María didn't know that Ana was sick.'

b. María no sabe que Ana [estaba / *estuviera] enferma.
Maria not know-PRS that Ana be-IND be-SUBJ sick
'María doesn't know that Ana was sick.'

The Spanish verbal paradigm in the past tense consists of two aspects: perfective and imperfective; a two-way mood distinction: indicative vs. subjunctive; and two morphological imperfective subjunctive forms: *-ra* and *-se*. For each of these combinations, there is a simple form and a compound form that is constructed with the auxiliary *haber* 'to have' and the lexical verb in the participle form. Additionally, like in English, verbal periphrasis can be formed with the verb *ir* 'to go' and an infinitive verb. These options are illustrated in Table 1. As can be seen, mood alternation is only possible in imperfective. Thus, the embedded verbs were always in imperfective to allow mood alternation in the complement clause.

	Perfect	**Imperfect**	
	IND	IND	SUBJ
Simple	pensó	pensaba	pensara/pensase
Compound	hubo pensado	había pensado	hubiera/hubiese pensado
Periphrasis	fue a pensar	iba a pensar	fuera/fuese a pensar

Table 1: The verb *pensar* 'think' in the past tense third person singular form in Spanish.

Furthermore, matrix verbs were constructed using the imperfective indicative simple form (e.g.,

[5]The full list of items, as well as further experimental details and the collected data and analysis can be found here: `https://github.com/LeahDoroski/SpanishNegRaising/tree/main`

pensaba) to avoid structural ambiguity in the attachment of the NPI. The strict NPIs used in the items are able to be interpreted as either within the complement clause (low), as intended, or as within the matrix clause (high) which is unintended. This is exemplified with English in (25).

(25) a. Ana didn't think [the box would arrive until eight]. (low, intended)
interpretation: 'Ana thought the box wouldn't arrive until eight'
b. Ana didn't think [the box would arrive] until eight. (high, unintended)
interpretation: 'Only after eight did Ana have the opinion that it would arrive'

This ambiguity can be avoided in Spanish when the matrix predicate is in the imperfective simple form. This is exemplified in (26) with the NPI *hasta las mediodía* 'until midday', where the NPI cannot attach, or at least is odd when attaching, to a verb when it occurs with an imperfective simple form (26b), as compared to when the verb is in the perfect simple (26a).[6] Hence, in sentences with a matrix verb in imperfective simple and an embedded verb in either imperfective compound (27a) or imperfective periphrasis (27b), to which NPIs can also attach, the only likely or possible interpretation is the intended one in which the NPI attaches low.

(26) a. Ana no **pensó** en ello [hasta mediodía]$_{NPI}$. (Perfect Simple)
Ana not thought-PERF in that until midday
'Ana didn't think about it until midday.'
b. */?Ana no **pensaba** en ello [hasta mediodía]$_{NPI}$. (Imperf. Simple)
Ana not thought-IPFV in that until midday
'Ana didn't think about it until midday.'

(27) a. Ana no pensaba que [Carlos hubiera leído un libro en meses]. (only low)
Ana not thought-IPFV that Carlos had-IPFV read the book in months
'Ana didn't think that Carlos had read a book in months.'
b. Ana no pensaba que [Carlos fuera a llegar hasta las ocho]. (only low)
Ana not thought-IPFV that Carlos go-IPFV to arrive until the eight
'Ana didn't think Carlos would arrive until eight.'

In summary, half of the sentences followed the morphological pattern in (28a) and the other half followed the morphological pattern in (28b).

(28) a. NEG $V_{\text{PST.IPFV.IND}}$ [... $\text{Aux}_{\text{PST.IPFV.IND/SUBJ}}$ V ... ($\text{NPI}_{\text{in Ns}}$)]
b. NEG $V_{\text{PST.IPFV.IND}}$ [... $\text{go}_{\text{PST.IPFV.IND/SUBJ}}$ to V ... ($\text{NPI}_{\text{until N}}$)]

Lastly, the two subjunctive forms in imperfective, *-ra* and *-se*, were evenly distributed across the items. This was done to help control for possible dialectal effects as the frequencies of use differ geographically for the two forms, e.g., the *-se* form is more frequent in Galicia (Fernández-Ordóñez, 2016; Lara Bermejo, 2019).

3.3.2. Durative vs. punctual *hasta* 'until' and the telicity of the embedded verb
Like in English, Spanish has two uses of *hasta* 'until', which are influenced by the telicity of the verb. One is the durative sense, which is promoted by atelic predicates like *study* which

[6]It must be highlighted that the judgments on NPI attachment are subtle and are subject to variability. The variability seems to be affected by the specific verb, NPI, and tense (among many other factors), and there seems to be some degree of intra-speaker variability. The items were created using the imperfective to avoid ambiguity as much as possible, but it cannot be fully guaranteed that all items are unambiguous for all speakers and dialects.

have no natural endpoint (29a). The other is the punctual sense, which is promoted by telic predicates like *arrive* which do have a natural endpoint (29b). Crucial to the study is that punctual *hasta*, but not durative *hasta*, is a strict NPI. This is evidenced here in (29b), where the positive version, but not the negative version, of the sentence with *hasta* with a telic predicate is ungrammatical.[7] Thus, in order to ensure that the *hasta* phrase was interpreted in the items as a strict NPI, all the sentences with *hasta* were constructed with a telic embedded verb.

(29) a. Juan (no) estudió hasta las dos. (atelic, durative)
Juan not studied until the two
'Juan studied (/didn't study) until two.'
b. Juan *(no) llegó hasta las dos. (telic, punctual)
Juan not arrived until the two
'Juan *arrived (/didn't arrive) until two.'

3.3.3. Fillers

Along with the critical items, the study included twelve fillers. The fillers were all low in acceptability with the purpose of encouraging participants' use of the entirety of the acceptability scale. There were two types of fillers: ones in which the low acceptability was caused by an unlicensed NPI within a positive environment, and ones in which the low acceptability was caused by incorrect embedded mood morphology, see (30).

(30) Example fillers (translated)
a. #Irene knew that the guest was going to arrive **until eight**. (type 1)
b. *Antonio ensured that his son was$_{\textbf{SUBJ}}$ going to win the lottery that year. (type 2)

3.4. Participants

In total, 48 native speakers[8] of Iberian Spanish were recruited and compensated via Prolific. Forty-six participants answered all attention checks correctly, and the remaining two participants failed only one of the four attention checks. Therefore, no participants were excluded.

3.5. Hypotheses and Predictions

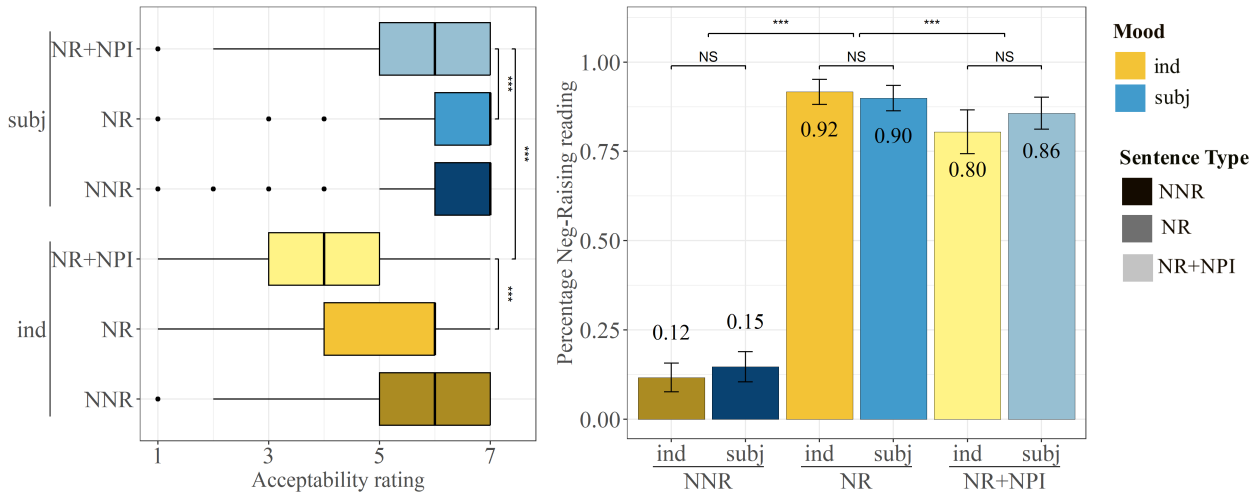
Crucially, the three hypotheses from (20) have differing predictions. Hypothesis A predicts that indicative has an effect on both the acceptability of strict NPIs and the availability of the NR reading, where acceptability is lower in the indicative version of the NR construction with a strict NPI (NR+NPIxIND) and the NR reading is less available in both NR constructions in indicative (NRxIND and NR+NPIxIND). Hypothesis B predicts that indicative has no effect on either the acceptability of strict NPIs or availability of NR readings, and thus the indicative versions do not differ from the subjunctive versions. Hypothesis C predicts that indicative has an effect on the acceptability of strict NPIs, where acceptability is lower in the indicative version of the NR construction with a strict NPI (NR+NPIxIND), but no effect on the availability of the NR reading. The following section presents the results of the study.

[7]For a more complete discussion and an analysis thereof, see Condoravdi (2008), and for a discussion focusing on Spanish in particular see Bassa Vanrell (2017).

[8]Demographic information can be found here: `https://github.com/LeahDoroski/SpanishNegRaising/blob/main/04AdditionalDataAnalysis/Demographic-breakdown.md`

4. Experimental Results and Analysis

The study investigated two research questions. First, whether indicative mood reduces the acceptability of strict NPIs in clauses embedded under negated NRPs. Second, whether indicative mood reduces the availability of NR. Correspondingly, participants were asked first to rate how acceptable they considered a given sentence on a 7-point Likert scale, and, if acceptable (4 or higher), to, second, judge if that sentence conveys the NR reading. The results for each experiment are presented in Figure 1.[9]



(a) Median acceptability ratings (b) Mean percentage of neg-raising readings

Figure 1: Main results of the two experiments across the six conditions. Significance values for the main comparisons are included (***: $p<0.001$). Error bars represent the 95% CI.

4.1. Acceptability results

The results of the acceptability question are shown in the box plot in Figure 1a, where the acceptability rating from 1 (fully unacceptable) to 7 (fully acceptable) is given for each of the six conditions: the three constructions, non-neg-raising (NNR), plain neg-raising (NR), and neg-raising with a strict NPI (NR+NPI), as grouped by mood (IND vs. SUBJ). Overall, the constructions with a subjunctive embedded clause were rated as very highly acceptable and the constructions with an indicative embedded clause were rated as a bit less, but still rather highly, acceptable. The non-NR (NNRxSUBJ) and plain NR (NRxSUBJ) subjunctive constructions were rated as fully acceptable (median of 7), with only a small drop in acceptability (1pt lower median) for sentences with a strict NPI (NR+NPIxSUBJ). Meanwhile, the non-NR (NNRxIND) and plain NR (NRxIND) constructions with indicative were rated as highly acceptable (median of 6), with a comparatively larger drop in acceptability (2pt lower median) for sentences with a strict NPI (NR+NPIxIND). This suggests that, while the strict NPIs generally reduced the acceptability of the sentence, there is an added effect of indicative mood on the reduced acceptability.

In order investigate these trends, a linear mixed-effects model (lmer) with z-scored acceptability as the dependent variable and Mood and Construction Type as fixed factors was run (using

[9]Due to an oversight, one version of one of the items (group F's responses to item 34, NR+NPIxSUBJ) was overwritten and didn't display correctly during the study, and was thus removed from analysis.

the packages lme4 (Bates et al., 2014, v1.1-36) and lmerTest (Kuznetsova et al., 2017, v3.1-3) in R (v4.4.2)). Participants and items were added as crossed random factors, allowing for random intercepts.[10] Results showed a main effect of both Mood (χ^2=7.58, p=0.006) and Construction Type (χ^2=117, p<0.001), and, importantly, a significant interaction between Mood and Construction Type (χ^2=49.9, p<0.001).

Further, a post-hoc test was conducted using the emmeans() function in order to investigate the nature of the interaction. The test showed significant differences in the following key comparisons: within NPI constructions, those in indicative were rated two points less acceptable than those in subjunctive (t=-8.32, p<0.0001, NR+NPIxIND vs. NR+NPIxSUBJ); within indicative NR constructions, NPIs were rated two points less acceptable (t=8.45, p<0.0001, NRxIND vs. NR+NPIxIND); lastly, within subjunctive NR constructions, NPIs were rated one point less acceptable (t=5.49, p<0.0001, NRxSUBJ vs. NR+NPIxSUBJ).

Overall, these results provide evidence against Hypothesis B presented in Section 2.3. This hypothesis predicted indicative mood to allow for both NR readings and the licensing of strict NPIs. The data presented in this section instead indicate that strict NPIs are notably degraded by the presence of indicative mood in the embedded clause. This is further supported by the comparison of the acceptability of the critical items to the ungrammatical fillers. Though the indicative NR construction with an NPI was still rated within the middle of the acceptability scale, this level of acceptability was a smaller difference (1pt higher median) from the six filler items which contained an unlicensed strict NPI in a positive environment (type 1, median of 3) as compared to the 2pt difference from the construction without an NPI.[11]

More generally, the overall lower acceptability of sentences with a strict NPI may be due to their being more difficult to process than the sentences without an NPI. Furthermore, we hypothesize that the generally lower acceptability of the indicative constructions may be due to an ongoing diachronic process, whereby the indicative option is disappearing in the language in these constructions (see Montero (2024)). Moreover, additional investigation into the data indicates that overall acceptability was not affected by the type of strict NPI, as they each had a median of 6 in subjunctive constructions and a median of 4 in indicative constructions.

4.2. Neg-raising results

The results of the availability of the NR interpretation are presented in Figure 1b. Here, the indicative versus subjunctive versions are grouped by each of the three construction types (shown on the x-axis), where the mean percentage of the availability of the NR reading (*yes* response to Q2) for each of the six conditions is plotted on the y-axis. The results from the non-NR constructions (first two columns) present a control for the unavailability of the NR reading, while those from the two NR constructions with subjunctive mood (fourth and last columns) present a control for the availability of the NR reading. Participants responded with low NR reading availability for the two non-NR constructions (12% for NNRxIND and 15% for NNRxSUBJ) and

[10]The addition of random slopes for Mood in both random factors as well as for Construction Type within participants (adding it also within items resulted in a singular fit) significantly improved the model (as estimated by comparing the logLikelihoods of the models using the anova()-function in R), and thus these were also included in the last version of the model.

[11]This and other additional investigations into the data are also provided at: `https://github.com/LeahDoroski/SpanishNegRaising/tree/main/04AdditionalDataAnalysis`.

high NR reading availability for the two NR subjunctive constructions (90% for NRxSUBJ and 86% for NR+NPIxSUBJ), indicating that the task was effective. This is particularly important for an inferencing judgment task, which might have more room for interpretation than a sentence acceptability task. Importantly, the indicative constructions with NRPs had similarly high percentages of NR reading availability (92% for NRxIND and 80% for NR+NPIxIND) compared to the subjunctive percentages as given above.

In order to investigate the significance of these observations, a mixed-effects logistic regression model (glmer) with NR reading availability (*yes*/*no*) as the dependent variable and Mood and Construction Type as fixed factors was run. Participants were added as a crossed random factor, again allowing for random intercepts.[12] Results showed a significant main effect of Construction Type (χ^2=249, p<0.001), but no main effect of Mood (χ^2=0.411, p=0.52) and no interaction between Mood and Construction Type (χ^2=2.46, p=0.29). Next, Mood and the interaction, as non-significant factors, were removed and a simpler model with only Construction Type as a fixed factor, and participants as a crossed random factor, was run. Results showed that the non-NR constructions were interpreted with the NR reading significantly less than the plain NR constructions (z=-19.5, p<0.001) and that the NR constructions with a strict NPI were also interpreted with the NR reading significantly less than the plain NR constructions (z=-3.35, p<0.001). Crucially, these results indicate that mood has no effect on the availability of NR. It can thus be concluded that Hypothesis A, which states that indicative blocks both NR and the licensing of strict NPIs, can also be discarded.

As just mentioned, for both constructions with a strict NPI, there was a small but significant drop in the reported NR reading availability (12% drop for IND and 4% drop for SUBJ). This is an unexpected result according to the theory presented in Section 2, which instead would expect either the same or higher NR reading availability to occur in sentences with a strict NPI due to the application of NR being a prerequisite for their licensing. One possible explanation could be that, despite the targeted attempt to control for low embedded clause attachment of the NPI, some items might have allowed high matrix clause attachment for some speakers, and, if those speakers did not access the NR reading for a particular item, they might instead (re)interpret the NPI as attaching to the matrix clause, resulting in a non-NR interpretation of a sentence with a strict NPI. Another possible explanation could be due to the overall lower acceptability of the sentences with a strict NPI. As it can be less clear in some cases whether the NR reading is available (as discussed briefly in Section 2), a clear *yes* (or *no*) response for the NR reading might be subject to the overall interpretability of the sentence. As such, for less acceptable sentences, which occurred more often in constructions with a strict NPI, participants might be more likely to respond *no* to the availability of an interpretation.[13]

In conclusion, the combination of results from the two experiments supports Hypothesis C. In Spanish, indicative allows NR but blocks the licensing of strict NPIs.

[12] A model with items also added as a crossed random factor failed to converge.

[13] This might be further supported by the larger decrease in NR reading availability between the two indicative NR constructions compared to between the two subjunctive NR constructions (Fig 1b), which aligns with the overall lower acceptability of the indicative sentences compared to their subjunctive versions (Fig 1a). However, plotting the acceptability versus NR reading availability does not show a correlation between the two.

5. Theoretical Analysis

The empirical data show that indicative mood does not block the NR reading. Therefore, irrespective of which mood is used in the embedded clause, the sentences below in (31a)-(31b) have the NR readings. As (31a) and (31b) logically entail each other, the embedded clause is an anti-additive environment regardless of whether indicate or subjunctive mood was used.

(31) a. John doesn't think Mary or Bill $\text{left}_{\textbf{IND/SUBJ}}$.
$\lambda w.[\ \forall w' \in \text{DOX}_j^w : \neg(\text{leave}(m,w') \vee \text{leave}(b,w'))\ ]$
$\equiv \lambda w.[\ \forall w' \in \text{DOX}_j^w : \neg\text{leave}(m,w') \wedge \neg\text{leave}(b,w')\ ]$

b. John doesn't think Mary $\text{left}_{\textbf{IND/SUBJ}}$ and John doesn't think Bill $\text{left}_{\textbf{IND/SUBJ}}$.
$\lambda w.[\ \forall w' \in \text{DOX}_j^w : \neg\text{leave}(m,w') \wedge \forall w' \in \text{DOX}_j^w : \neg\text{leave}(b,w')\ ]$

Nevertheless, strict NPIs are degraded when the embedded verb carries indicative morphology. This raises the question of what blocks their licensing. This section explores a possible explanation of these results based on Gajewski's (2011) theory of NPI licensing. In particular, it is explored whether the indicative carries some implication that blocks NPI licensing in embedded clauses: (a) speaker commitment and/or (b) previous mention.

5.1. Homer (2008): speaker commitment

As briefly discussed in Section 2, NPI licensing has been argued to be affected by non-truth-conditional content. For example, according to Homer (2008), an embedded clause $p_{\textbf{IND}}$ in Italian carries (in certain contexts) the presupposition of speaker commitment to p, which blocks the licensing of weak NPIs. This is illustrated in sentence (32) taken from Homer (2008), where the weak NPI *mai* 'ever' is only blocked when indicative morphology is used.

(32) Gianni non pensa che Maria [*è / sia] **mai** andata a Parigi. (Italian)
Gianni not think that Maria be.IND be.SUBJ ever gone to Paris
'Gianni doesn't think that Maria has ever been to Paris.'

When the presupposition from indicative mood is factored in, the overall context is not downward entailing as (33) $\not\Rightarrow$ (34). Hence the NPI is blocked when indicative mood is present.

(33) $\mu(\llbracket$John doesn't think Mary $\text{has}_{\textbf{IND}}$ been to France$\rrbracket)$
= John thinks [Mary hasn't been to F] $\wedge$ the speaker believes Mary has been to F

(34) $\mu(\llbracket$John doesn't think Mary $\text{has}_{\textbf{IND}}$ been to Paris$\rrbracket)$
= John thinks [Mary hasn't been to P] $\wedge$ the speaker believes Mary has been to P

If indicative mood also carries a speaker presupposition in Spanish, then there would be a direct explanation as to why strict NPIs are blocked when indicative morphology is used. When factoring in the presuppositions of speaker commitment, it can be shown that the context is not anti-additive as (35) $\not\Leftarrow$ (36), see Table 2.

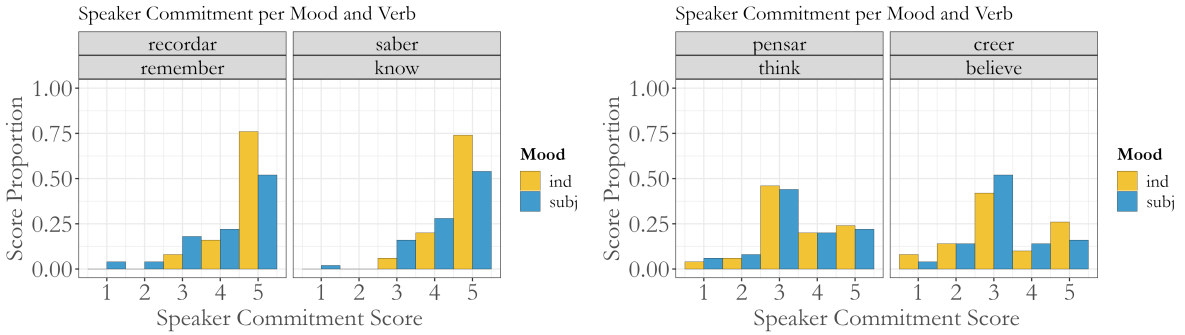
(35) $\mu(\llbracket$John doesn't think Mary $\text{left}_{\textbf{IND}}$ and John doesn't think Bill $\text{left}_{\textbf{IND}}\rrbracket)$

(36) $\mu(\llbracket$John doesn't think Mary or Bill $\text{left}_{\textbf{IND}}\rrbracket)$

	Neg-raising		Speaker Commitment
(35′)	$\lambda w.[\ \forall w' \in \mathrm{Dox}_j^w{:}\neg \mathrm{L}(m,w') \wedge \forall w' \in \mathrm{Dox}_j^w{:}\neg \mathrm{L}(b,w')$	$\wedge$	$\mathrm{L}(m,w) \wedge \mathrm{L}(b,w)\ ]$
	$\Downarrow\Uparrow$		$\Downarrow\not\Uparrow$
(36′)	$\lambda w.[\ \forall w' \in \mathrm{Dox}_j^w{:}\neg(\mathrm{L}(m,w') \vee \mathrm{L}(b,w'))$	$\wedge$	$(\mathrm{L}(m,w) \vee \mathrm{L}(b,w))\ ]$

Table 2: Anti-additive test factoring in a speaker commitment presupposition.

In Spanish, some authors have argued that indicative also triggers speaker commitment towards p in the structure *[x does not V p.IND]* (e.g. Quer (1998)). However, Montero and Romero (2023) experimentally tested this hypothesis for a number of cognitive factive verbs –e.g., *recordar* 'remember' and *saber* 'know'– and cognitive non-factive verbs –e.g., *pensar* 'think' and *creer* 'believe'. Their results support the hypothesis for factives but not for non-factives. As shown in Fig 2a for factives, the use of indicative instead of subjunctive significantly increases the perceived speaker commitment to p in the case of 'know' and 'remember'. But, as shown in Fig 2b for non-factives, the choice of mood does not have a significant effect towards the perceived speaker commitment to p in the case of 'think' and 'believe'. This means that the hypothesis that indicative introduces a presupposition of speaker commitment to p cannot be maintained for Spanish *pensar* 'think' and *creer* 'believe'. Thus, Homer (2008)'s analysis cannot be straightforwardly extended to account for the Spanish data.



(a) Responses for *remember* and *know*.

(b) Responses for *think* and *believe*.

Figure 2: Distribution of Likert scale responses to speaker commitment to p (1: low, 5: high).

5.2. Ridruejo Alonso (1999): previous mention

Ridruejo Alonso (1999) notes another possible meaning that indicative mood in Spanish may convey, namely, that the proposition has been mentioned in the previous discourse, see (37).

(37) Ana no creía que Lucas era abogado.
Ana not believe that Lucas was-IND lawyer
Additional implication: The proposition 'Lucas was a lawyer' has been mentioned.

Following Portner (2009), we can formalize this intuition by deploying what has been termed in the literature as the **common propositional space (CPS)**. The CPS represents the set of propositions in which the participants in the conversation are mutually interested. Indicative would then indicate that $p \in CPS$. If this implication is instead factored in, it can again be shown that the context is no longer anti-additive as again (35) $\not\Leftrightarrow$ (36), see Table 3.

	Neg-raising		Mentioned previously
(35″)	$\lambda w.[\ \forall w' \in \text{Dox}_j^w{:}\neg\text{L}(m,w')$	$\wedge$	$\lambda w''.\text{L}(m,w'') \in \text{CPS}^w$
	$\wedge\ \forall w' \in \text{Dox}_j^w{:}\neg\text{L}(b,w')$		$\wedge\ \lambda w''.\text{L}(b,w'') \in \text{CPS}^w\ ]$
	$\Downarrow\Uparrow$		$\not\Downarrow\Uparrow$?
(36″)	$\lambda w.[\ \forall w' \in \text{Dox}_j^w{:}\neg(\text{L}(m,w') \vee \text{L}(b,w'))$	$\wedge$	$\lambda w''.\text{L}(m,w'') \vee \text{L}(b,w'') \in \text{CPS}^w\ ]$

Table 3: Anti-additive test factoring in a previously mentioned presupposition.

5.3. Main proposal in a nutshell

We propose that, under negated cognitive non-factives, subjunctive is the default form and needs no special motivation whereas indicative is the marked form and needs some special motivation, i.e. a "raison d'être" for the speaker to use it. The "raisons d'être" can be varied, and we have already seen two intuitions in the literature: an embedded $p_{\textbf{IND}}$ can be used to convey that the speaker is committed to p (Quer, 1998), or it may be used to communicate that p has been previously mentioned by the conversationalists (Ridruejo Alonso, 1999). And there might be some other potential implications concerning p. Now, while these are then not presuppositions triggered by indicative per se within our proposal, they are potential implications arising from the use of the non-default indicative form. Depending on the context, one implication or another will be communicated and this will suffice to motivate the use of the embedded $p_{\textbf{IND}}$.

Importantly for strict NPI licensing, the additional implications triggered by the use of non-default indicative will need to be factored in into the calculation of anti-additivity. In other words, regardless of which additional message the use of indicative conveys –speaker commitment, previous mention, etc.– and regardless of whether such message is a presupposition or rather a conversational implicature, the message will play a role in the licensing of strict NPIs. Taking again the examples in (35) and (36), Table 4 summarizes how, if either implication is taken into account, the context ends up being non-anti-additive. Hence, strict NPIs are not in the correct environment to be licensed when the embedded clause appears in the indicative.

	Neg-raising		Spkr Commitment		Mentioned previously
(35‴)	$\lambda w.[\ \forall w' \in \text{Dox}_j^w{:}\neg\text{L}(m,w')$	$\wedge$	$\text{L}(m,w)$	/	$\lambda w''.\text{L}(m,w'') \in \text{CPS}^w$
	$\wedge\ \forall w' \in \text{Dox}_j^w{:}\neg\text{L}(b,w')$		$\wedge\ \text{L}(b,w)$		$\wedge\ \lambda w''.\text{L}(b,w'') \in \text{CPS}^w\ ]$
	$\Downarrow\Uparrow$		$\Downarrow\not\Uparrow$		$\not\Downarrow\Uparrow$?
(36‴)	$\lambda w.[\ \forall w' \in \text{Dox}_j^w{:}$				
	$\neg(\text{L}(m,w') \vee \text{L}(b,w'))$	$\wedge$	$(\text{L}(m,w) \vee \text{L}(b,w))$	/	$\lambda w''.\text{L}(m,w'') \vee \text{L}(b,w'') \in \text{CPS}^w\ ]$

Table 4: Anti-additive test factoring in two possible implications of indicative in Spanish.

6. Conclusion

This paper investigated the interaction between mood, NPIs, and NR in Spanish. It has been shown experimentally that, whereas the availability of the NR reading is not influenced by mood, the grammaticality of strict NPIs is significantly lower when in the indicative. To account for this, the paper has put forth the hypothesis, following Gajewski (2011), that presuppositions and implicatures triggered –in our case– by the indicative cause the blocking of strict NPIs. In particular, if indicative carries either an implication of speaker commitment, as suggested by Quer (1998), or an implication that the proposition has been previously mentioned, as suggested by Ridruejo Alonso (1999), the context is not anti-additive and hence blocks strict NPIs.

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