Syntax, prosody and gesture constrain the interpretation of double negation

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Prosodic and syntactic restrictions

PART 1

Interaction between syntax and prosody

- Our study investigates under what circumstances Catalan and Spanish n-words in Question-Answer pairs are interpreted as conveying DN.
- Our finding is that a DN interpretation is conveyed by the L+H* L!H% intonation contour.
- **DN:** two negative elements cancel each other out, yielding a positive meaning.

(1) a. **CATALAN**

Ningú.

nobody

'Everybody.'

b. **SPANISH**

Nadie *no* ha comido postre

nobody not has eaten dessert

'Everybody has eaten dessert'

- DN is predicted not to be possible in Negative Concord (NC) languages within the limits of a single clause, as in these type of languages the expression of negation can be spread over multiple items.

- Traditional descriptive and prescriptive grammars for Catalan and Spanish only deal with DN (Solà 1973, Espinal 2002, Bosque 1980, Sánchez 1999)

  (a) in bi-clausal contexts and

  (b) in contexts where a sentential negative marker interacts with a morphological negative prefix.

- However, DN readings in clause-boundedness syntactic environments do exist in Romance languages.

- DN is addressed as a purely syntactic phenomenon in the literature.
  - At most, a particular stress pattern and prosodic phrasing are mentioned as crucial to obtain DN readings, but not much detail is given to the nature of the stress pattern in question.
- Espinal & Prieto (2011) and Huddlestone (2010) investigate the effects of prosody on the interpretation of DN in different kinds of negative utterances.

- **Espinal & Prieto (2011)**
  - Catalan speakers interpret answers containing an isolated n-word as expressing DN whenever this was associated with the prosodic contour L+H* L!H%.

- **Huddlestone (2010)**
  - Speakers of Afrikaans rely on prosody to assign DN readings to combinations of multiple negative indefinites.

- In the present piece of research we experimentally test how prosody interacts with syntax at the time of conveying different interpretations in three different syntactic patterns in both Catalan and Spanish:

(i) isolated n-words

(ii) n-word + *no* + V

(iii) n-word + V

- **The novelty of this study is triple:**

(i) it emphasizes the role of prosody and its interaction with syntax and semantics in contexts other than isolated n-words.

(ii) it shows the relevance of perception experiments for evaluating preferences on grammaticality judgements on the part of native hearers.

(iii) it compares results from two Non-Strict NC Romance languages that have been claimed to differ in the possibility of allowing presentential n-words to co-occur with a preverbal negative marker under a broad focus intonation.

(2) **CATALAN**

a. *Ningú* ha trucat.

nobody has called

'Nobody called'

b. *Ningú no* ha trucat.

nobody not has called

'Nobody called'

(3) **SPANISH**

a. *Nadie* ha llamado.

nobody has called

'Nobody called'

b. **Nadie no* ha llamado.

nobody not has called

Syntactic assumptions

- N-words have two components: a negative one and a quantificational one (Espinal 2000).
  - Catalan and Spanish n-words are negative indefinite expressions that incorporate a numeral meaning zero with a variable underspecified quantificational force.
  - They can occur in isolation holding a negative zero meaning, and both postverbally (polarity item) and preverbally (negative quantifier) in a clause.

- Since n-words are assumed to be lexically specified with a negative feature (||0|| zero numeral meaning), they **lexically encode negation** without the need of a NegP projection.

- NegP is only assumed to be part of the syntactic structure if this contains an overt head *no* 'not' (**syntactically encoded negation**).

- Catalan displays both kinds of negation with presentential n-words:

  - when negation is **lexically encoded** → unmarked syntactic structure (**n-words + V**)

  - when negation is **syntactically encoded** → marked syntactic structure (**n-words + *no* + V**)

- Spanish has been described as only allowing lexically encoded negation with presentential n-words (n-words + V)

BUT

- N-word + *no* + V sequences are not excluded by Spanish native speakers and hearers, if **a specific prosodic contour** is associated with them and **a DN meaning** is intended to be conveyed.

- Syntactically, preverbal n-words are not Topics (Vallduví 1993).

- We claim that n-words in isolation and presentential n-words may both be instances of syntactic Focus or of Contrastive Topic (CT) (Molnár 1998; Puskás 2006).

  – CT is at the intersection between Topic and Focus.

	Focus n-words	CT n-words
Intonation	**L+H* L%**	**L+H* L!H%**
Syntactic features	**[+QF]** They are **answers to wh-questions.**	**[+QF, +C]** They are **answers to wh-questions.**
Semantic properties	They **introduce alternatives.** They **denote an indefinite expression.** They show **scope possibilities.**	They **introduce alternatives.** They **introduce an implication of contrast with respect to the most accessible proposition from context.** They **denote the set of things that have not been talked about.** They **show inverse scope.**

(4) (Supposing that everyone was expected to eat dessert, but the speaker suspects that someone did not)

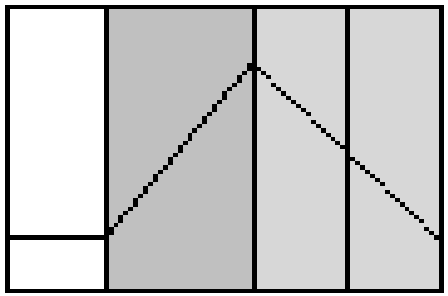
Q: Qui *no* ha menjat postres?
who not has eaten dessert
'Who hasn't eaten dessert?'

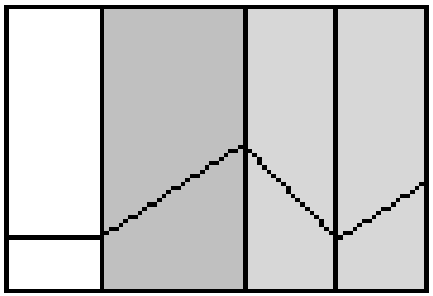
A: a. *Ningú*$_{F}$ ((*no*) ha menjat postres.)
nobody not has eaten dessert
'Nobody ate dessert.'

b. *Ningú*$_{CT}$ ((*no*) ha menjat postres.)
nobody not has eaten dessert
'Nobody didn't eat dessert' (Everybody did)

Prosodic contours

- **Autosegmental-Metrical model of prosodic structure** (Pierrehumbert 1980; Ladd 1996; a. o.)
- The **Cat_ToBI** and **Sp_ToBI systems of prosodic annotation of Catalan and Spanish corpora** (Prieto, in press, for Catalan; Beckman et al. 2002, for Spanish).
- **L+H* L%** **L+H* L!H%**





Methodology

- Perceptual identification experiments with listeners of Catalan and Spanish.
- Participants had to rate the answers/stimuli as meaning either 'nobody/nothing', or 'everybody/everything'.
- Two target n-words (Cat. *ningú* and *res,* and Spa. *nadie* and *nada*) produced in a discourse context by two pairs of subjects.

- **Participants:**
  - 27 Central Catalan speakers from the Barcelona area (21 women, 6 men; mean age = 24.81. Catalan dominance was 85.19% according to their own reports).
  - 27 Peninsular Spanish speakers from the Madrid area (19 women, 8 men; mean age = 22.89).

- **Materials:**
  - Question-Answer pairs
  - Four factors were taken into account:

(i) Syntax of the answer (SYNTAX):

- isolated n-words
- presentential n-words + a preverbal negative marker + an optional postverbal n-word
- presentential n-words + an optional postverbal n-word

(ii) Intonation contour of the answer (INTONATION):

- L+H* L%
- L+H* L!H%

(iii) Syntax of the question (WH-EXPRESSION):

- simple *wh*-question
- Complex *wh*-question

(iv) Negative items in the question (NEGITEM):

- One
- Two

- 24 minidialogues tested for Catalan; 20 for Spanish.
- **Target questions:**

  WH-EXPRESSION (simple/complex) and NEGITEM (1/2) combined
  - Qui *no* ha menjat postres / *res*?
  - Qui és que *no* ha menjat postres / *res*?
- **Target answers:**

SYNTAX (isolated n-word/presentential + no /presentential) and INTONATION (broad focus/contradictory) combined:
- *Ningú*$_{F\ /\ CT}$
- *Ningú*$_{F\ /\ CT}$ (*no*) ha menjat *res*
- *Ningú*$_{F\ /\ CT}$ (*no*) ha menjat postres
- For Spanish [presentential + *no*, broad focus] was not included in the target answers, as this combination is perceived as ungrammatical by both Spanish grammarians and native speakers.

- **Examples of minidialogue (Catalan):**

(5) (A mother enters the dining room when the other three members of the family are around the table. She looks at the fruit bowl and asks:)

Q. Qui *no* ha menjat postres?
who not has eaten dessert
'Who has not eaten dessert?'

A. *Ningú*$_{F}$.
nobody
'Nobody.'

(6) (Same context)

Q. Qui és que *no* ha menjat *res*?
who is that not has eaten nothing
'Who has not eaten anything?

A. *Ningú*$_{CT}$ ha menjat *res*.
nobody has eaten nothing
'Everybody has eaten something.'

- **Examples of minidialogue (Spanish):**

(7) (A mother enters de dining room when the other three members of the family area round the table. She looks at the fruit bowl and asks:)

Q. ¿Quién *no* ha comido postre?
who not has eaten dessert
'Who has not eaten dessert?'

A. *Nadie*$_{F}$.
nobody
'Nobody.'

(8) (Same context)

Q. ¿Quién hay que *no* haya comido *nada*?
who is that not has eaten nothing
'Who has not eaten anything?

A. *Nadie*$_{CT}$ ha comido *nada*.
nobody has eaten nothing
'Everybody has eaten something.'

- **Procedure:**

- 2 tasks per language (one per n-word tested: Cat. *ningú* 'nobody', *res* 'nothing'; Sp. *nadie* 'nobody', *nada* 'nothing').

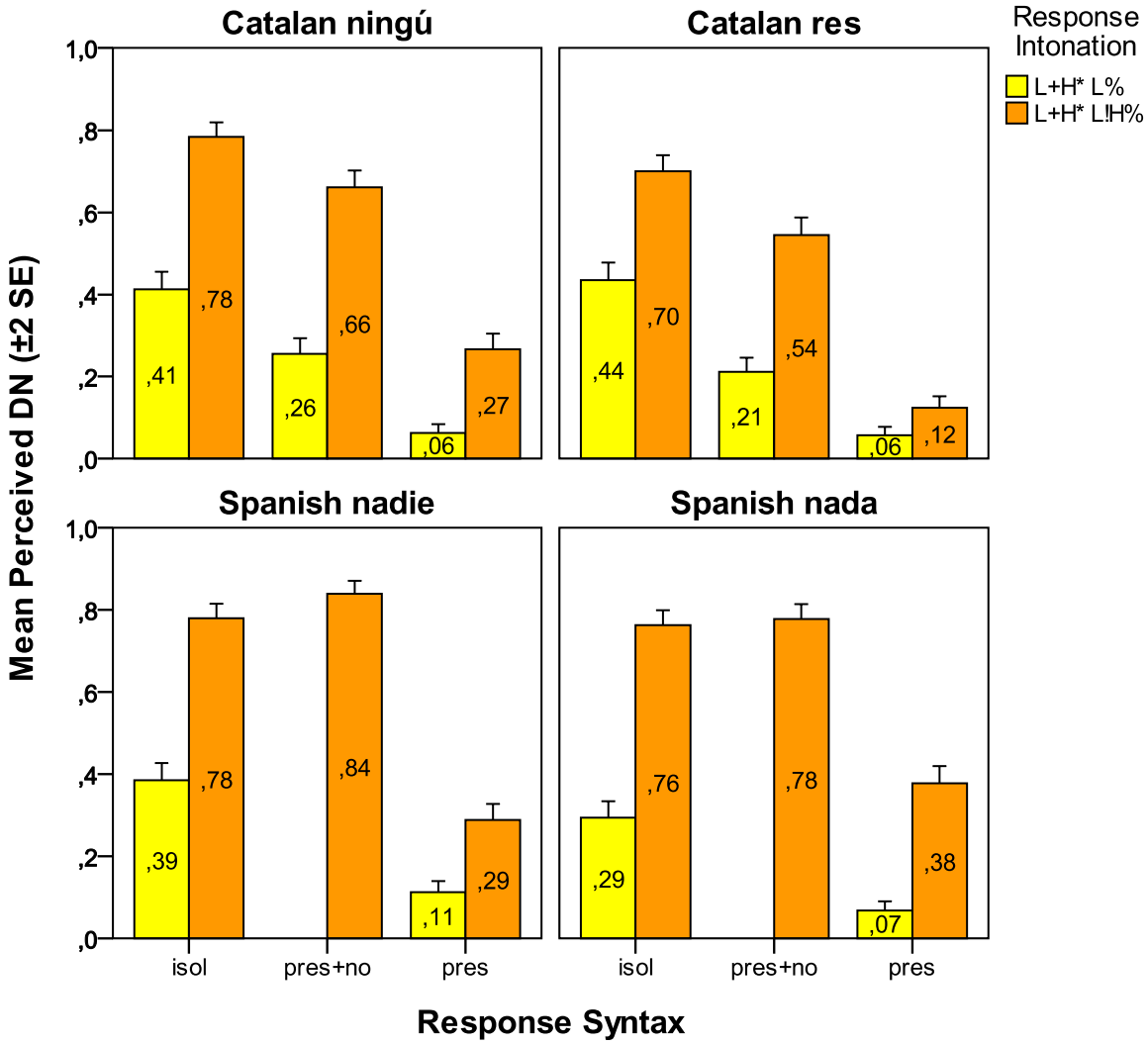
- Participants were tested individually in their target language. The order of the tasks was counterbalanced among participants.

- 6,480 data points for Catalan (2 n-words × 24 minidialogues × 5 blocks × 27 subjects) and 5,400 for Spanish (2 n-words × 20 minidialogues × 5 blocks × 27 subjects).

- Press "N" or "R" for the single negation interpretation; "T" for DN (Catalan).

- Press "N" for single negation; "T" for DN (Spanish).

Results


Catalan ningú
Catalan res
Spanish nadie
Spanish nada
Response Intonation
L+H* L%
L+H* L!H%
Mean Perceived DN (±2 SE)
1,0
,8
,6
,4
,2
,0
,41
,78
,26
,66
,06
,27
,44
,70
,21
,54
,06
,12
,39
,78
,84
,11
,29
,29
,76
,78
,07
,38
isol
pres+no
pres
Response Syntax

Discussion

- The DN interpretation in Catalan and Spanish is triggered by a marked intonation contour (L+H* L!H%) that

  (i) restricts the accessibility to contextual information and

  (ii) activates an interpretation that sets out a contradiction with the contextual assumption or beliefs of the speaker of the question (i.e. that somebody did not eat dessert).

- This effect is stronger in isolated n-words and in presentential + *no* in both languages.

Discussion: isolated n-words

- Isolated n-words with the L+H* L!H% contour tend to have a DN interpretation in both languages, though better results are obtained for Spanish *nada* than for Catalan *res* 'nothing, everything'.
  - While *nada* is bisyllabic with trochaic stress, *res* is monosyllabic. In bisyllabic words with stress on the first syllable the distinction between L+H* L% and L+H* L!H% can be more clearly discriminated.

- Hearers have more trouble interpreting isolated n-words than presentential n-words.
- This can be accounted for if, contrary to what has been standardly assumed in the generative literature, there is no syntax apart from the n-word.
  - Isolated n-words in fragment answers simply project a Focus Phrase or a CT Phrase, but not a whole sentential structure.
  - Without the support of a full sentential structure, hearers hesitate when attributing an interpretation (either single negation/NC or DN) to these isolated n-words.

- Moreover, under an ellipsis analysis it is not clear how it is possible for the speakers to arrive at a single negative/NC interpretation of a given answer in some occasions and at a DN interpretation in some others, for the underlying structure in the three different tested syntactic patterns is ultimately the same.

Discussion: presentential n-words

- Both the prosodic factor and the syntactic factor are significantly relevant in the analysis of the responses.
- Results indicate a **dispreferred form-meaning <f,m>** pair, consisting of an [n-word + *no* + V] syntactic pattern associated with a DN reading chosen as the most optimal pair by hearers iff it is **associated with a L+H* L!H% contour.**
- Catalan and Spanish hearers show <f,m> preferences depending on the syntactic form and the prosodic contour.

(i) If only syntax is considered, the expected meaning associated with a negative form is single negation or NC: $\neg p$. In NC languages this is the unmarked meaning corresponding to a negative form $<f_1,m_1>$.

NB: $<f_1>$ = unmarked syntactic form (without *no*).

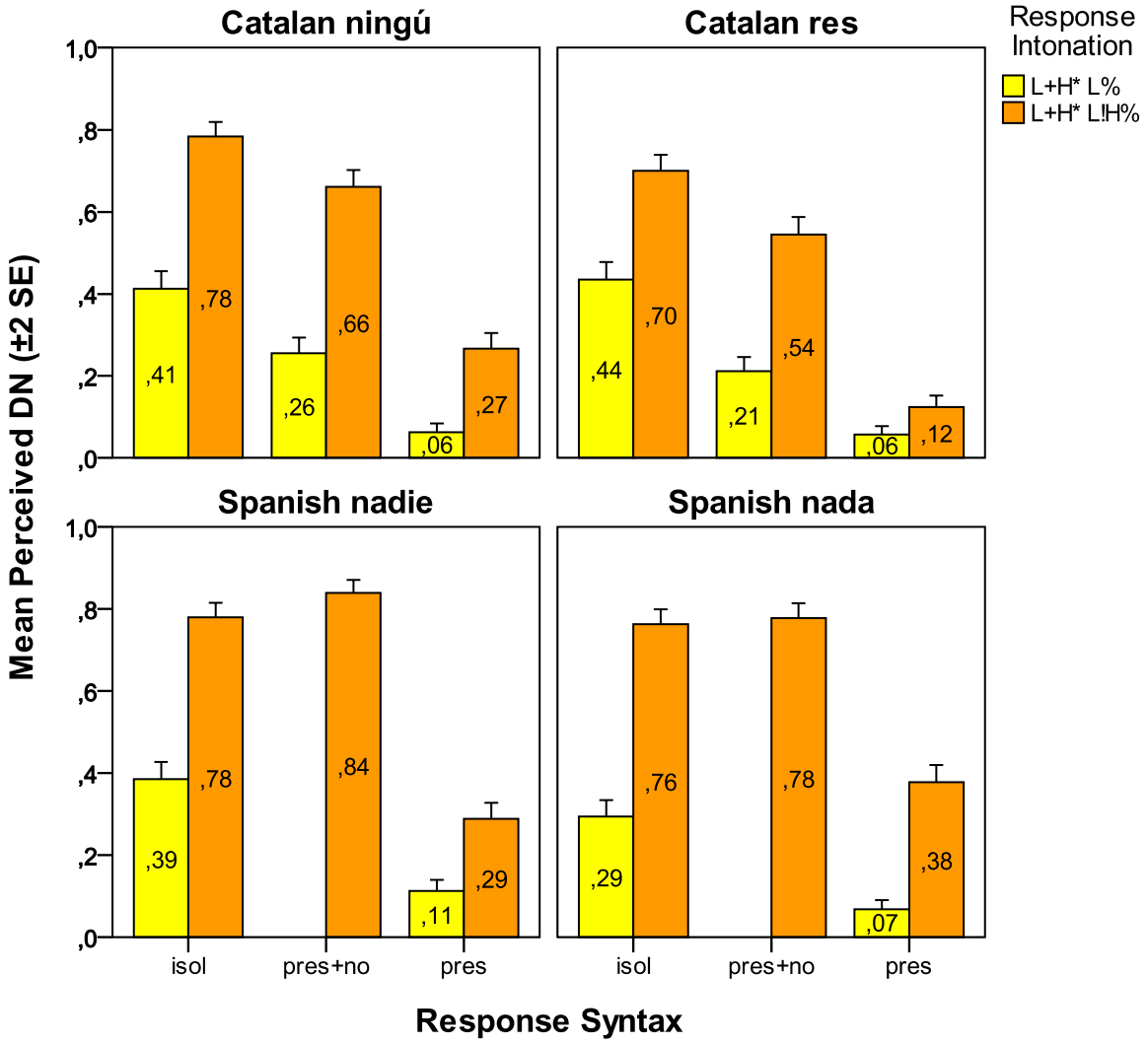
$<f_2>$ = marked syntactic form (with *no*).

$<m_1>$ = unmarked meaning ($\neg p$)

$<m_2>$ = marked meaning ($\neg\neg p$)

(ii) If both syntax and prosody are considered, a more complex model emerges. Additional **<f,m> pairs.**

[n-word + *no* + V] and L+H*L%.	$<f_2,m_1>$
[n-word + *no* + V] and L+H*LH%.	$<f_2,m_2>$
[n-word + V] and L+H*L%.	$<f_1,m_1>$
[n-word + V] and L+H*LH%.	$<f_1,m_2>$



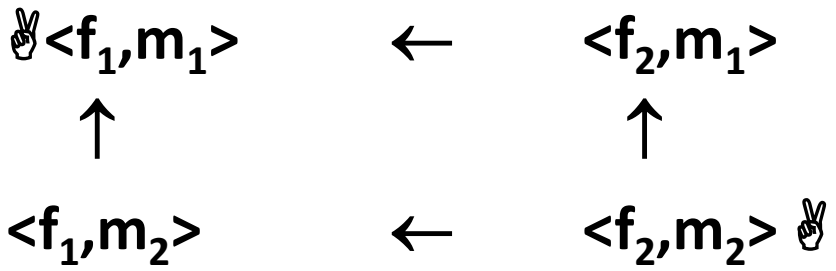
Column 3 <f_2,m_1>
Column 4 <f_2,m_2>

Column 5 <f_1,m_1>
Column 6 <f_1,m_2>

Discussion: Optimality Theory (Blutner 2000, de Swart 2010)

- The picture that emerges reflects preference relations in form-meaning negative expressions, which are best accounted for in a weak bidirectional optimization.

- This idea is expressed in the following Figure, from de Swart (2010:69, 233).



Part 1: Conclusions

- **Syntax and prosody interact**: the distinction between single negation/NC and **DN**, although semantic in nature, is **enhanced by prosody.**

- Different intonation contours convey different meanings by constraining access to contextual assumptions in different ways.

- N-words in NC languages may convey DN interpretations.

- The presence of a contradictory tune on the n-word is what constrains a counter-expectational meaning and thus a denial of a discourse-activated negative assumption.

- **It is not necessary to assume that isolated n-words are full sentences.**

- **Isolated n-words in fragment answers have a different syntax from presentential n-words**: the single negation interpretation vs. the DN interpretation of isolated n-words cannot be based exclusively on syntactic ellipsis, because the discourse context is a negative question in both cases.

- Our study shows **preferences on <f,m> pairs** on the part of speakers and hearers.
  - There is not a single <f,m> pair, but four possible combinations for presentential n-words. Bidirectional optimization semantics is an adequate model for capturing such preferences.

- DN interpretations are more easily inferred by hearers in the case of Spanish than in Catalan.
  - **Isolated n-words:** the n-words for ‘nobody’ and ‘nothing’ have different phonological structures in the two languages.
  - **Presentential n-words:** Spanish grammar does not allow the [n-word + *no* + V] pattern with a broad focus intonation. Hence, DN is the only possible interpretation for an **anti-NC structure**. Since Catalan grammar does allow the structure [n-word + *no* + V] to be associated with a NC reading, this structure cannot be given a DN reading as its only interpretation.

Prosodic and gestural restrictions

PART 2

Multimodal communication

- Visual and **gestural** input provides crucial information for online linguistic interpretation (McNeill, 1992), but no attention has been paid to the **multimodal aspects of DN interpretation** across languages and to the potential interactions between prosody and gesture.
- The visual component plays an important role in various aspects of communication typically associated with verbal prosody.
  - The visual correlates of prominence and focus —such as eyebrow flashes, head nods, and beat gestures— (Krahmer & Swerts, 2007; Swerts & Krahmer, 2008; Dohen & Loevenbruck, 2009), as well as echoic question intonation (Srinivasan & Massaro, 2003; Borràs-Comes & Prieto, 2011), or uncertainty (Swerts & Krahmer, 2005) have been successfully investigated.

- Multisensory effects have been investigated for speech prosody and gestures at a linguistic level, like in perceiving emphasis or in identifying an interrogative utterance.
  - Swerts & Krahmer's (2008) study showed that conflicting visual and auditory prosodic information can affect the location of prominence/emphasis prosodic features.
  - Borràs-Comes & Prieto (2011) showed that when Catalan listeners are presented with conflicting visual and prosodic information when trying to identify counter-expectational questions, they rely more heavily on gestural cues.

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- Even though prosody and gesture are still treated as distinct and separate modules with little or no interaction, it has become increasingly clear that **gestures are used to express pragmatic discourse meanings** and that gesture-prosody interactions contribute to multimodally specific percepts.

Multimodality and negation

- With respect to negation, Harrison (2009), in a recent study on the multimodal expression of negation, investigated the **gestural patterns found in negative speech acts** in English spontaneous speech. The results showed that speakers temporally synchronize and integrate verbal and gestural expressions of negation.
- However, it should be noted that none of these studies have addressed the associations between the prosodic and gestural aspects of sequences that are optimal candidates for conveying DN interpretations.

Goals

- To explore the contribution of **intonation and gestural patterns** to DN interpretations of n-words in fragment answers in two negative concord languages, **Catalan and Spanish**.
- In our view, it is especially relevant to test the effects of intonation and gesture with speakers of these different **NC languages**, which in theory should display a **general resistance to obtaining DN readings**.

- In this study, we support experimentally the hypothesis that prosodic and visual features significantly contribute to online DN inference.
  - It represents an extension of Espinal & Prieto's (2011) study, **testing not only the relevance of intonation but also of gestures**, as well as their matched and mismatched combinations in two different types of NC languages.
  - It was hypothesized that DN interpretations for isolated n-words can be obtained in NC languages if, and only if, prosodic and gestural information interact with and constrain linguistically encoded information.

Methodology

- We ran a set of decision tasks with native speakers of Catalan and Spanish.
- In all of the tasks, participants had to rate the negative answers/stimuli (Cat. *ningú* / Span. *nadie* 'nobody') as meaning either 'nobody', the default meaning, or 'everybody', the marked DN meaning.
  - Participants
  - Audiovisual recordings and materials
  - Procedure
  - Measures and analyses

Participants

- 30 Central Catalan speakers from Barcelona (21 w.; age = 27.17, Catalan dominance = 87%)
- 30 Peninsular Spanish speakers from Madrid (22 w.; age = 23.07)

Audiovisual recordings and materials

- A production study was run with 4 native speakers of Catalan and 4 native speakers of Spanish (henceforth *actors*) in order to investigate which gestural and intonation patterns are representative of the target utterances with negative and DN interpretations.
- A set of productions of the target words ***ningú*** 'Cat. nobody' and ***nadie*** 'Sp. nobody' were videotaped after they were presented with a discourse context and a query.

(1) DISCOURSE SETTING

CATALAN Una mare entra al menjador quan els altres tres membres de la família estan entaulats. Mira la fruitera i demana…
— Qui no ha menjat postres?

SPANISH Una madre entra en el comedor cuando los otros tres miembros de la familia están sentados en la mesa. Mira el frutero y pregunta…
— ¿Quién no ha comido postre?

'A mother enters the dining room while the three other members of the family are eating. She looks at the fruit bowl and asks…'
'Who did not eat dessert?'

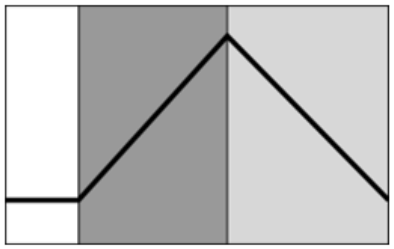
- Each actor was instructed to pronounce the two instances of the target n-word *ningú* / *nadie* in an expressive way, for the two meanings, with no instructions on how to express these meanings.

- A total of 32 utterances were produced (4 speakers × 2 meanings × 2 repetitions × 2 languages) and submitted to prosodic and gestural analysis.

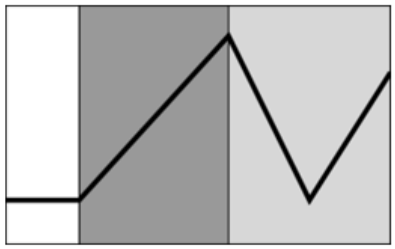
Prosodic characteristics

- The prosodic characteristics of the target utterances were coded with Praat (Boersma & Weenink, 2008).
- They were produced in the two languages with the two target intonation contours described before.
  - **L+H* L%** for NC
  - **L+H* L!H%** for DN

Single negation (NC)



Double negation (DN)



Gestural characteristics

- The target utterances were submitted to independent gestural analysis with ELAN (Lausberg & Sloetjes, 2009).
  - For the expression of negation, speakers displayed a head gesture consisting of a headshake together with a gesture consisting of **two palms down across the body in a horizontal movement**.
  - As for the expression of DN, our speakers displayed **an open palm/open arm gesture**, accompanied by a head down and/or headshake gesture, which corresponds to a general meaning of **contradiction** and denial/challenging of a discourse assumption.

NEGATION

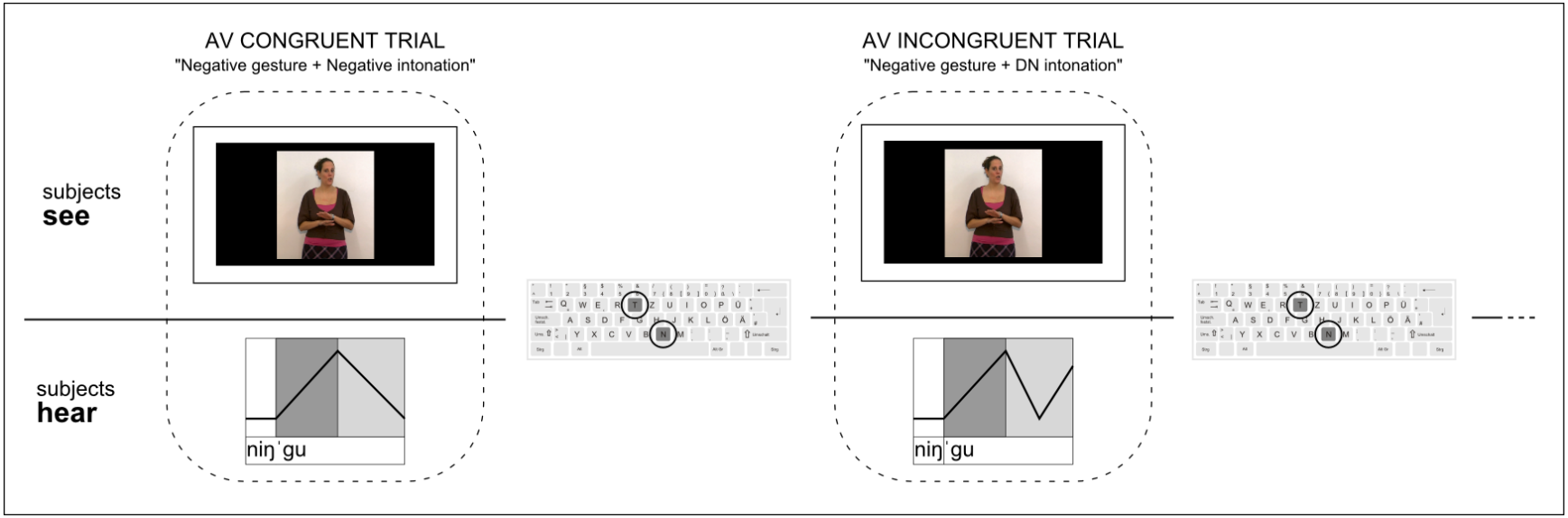
DOUBLE NEGATION

Materials

- For the target materials of the perception experiment, we selected the two instances of ‘nobody’ (negative and double negative) for each actor, for a total of 16 utterances (4 actors × 2 meanings × 2 languages).
- Incongruent video clips were also created by replacing the sound in the two target video clips, and generating new video files.

Procedure

- Participants were tested individually in their target language.
- Experiment divided into 3 tasks: auditory-only (**AO**), visual-only (**VO**), and audiovisual (**AV**). Total ≈ 15 minutes.
- Participants were first presented with the aims of the experiment and then they were presented with a target communicative context. They were told that they would listen to or see the speaker pronouncing the target n-word (Catalan *ningú* and Spanish *nadie*) and that they had to interpret them as meaning either 'nobody' (conveying single negation) or 'everybody' (conveying DN).

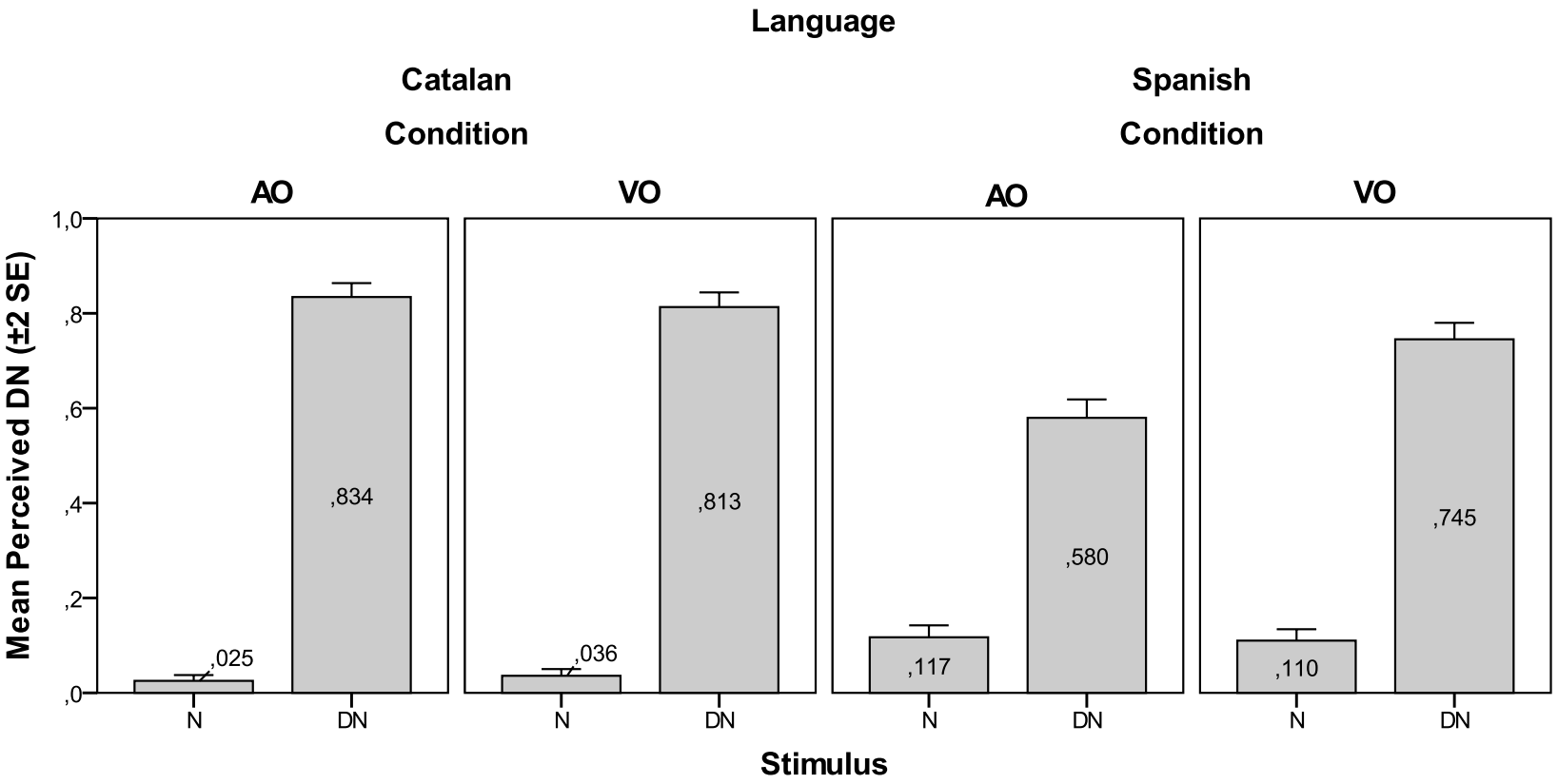

AV CONGRUENT TRIAL
"Negative gesture + Negative intonation"
AV INCONGRUENT TRIAL
"Negative gesture + DN intonation"
subjects
see
subjects
hear
niŋˈgu
niŋˈgu

Tasks

- We obtained a total of 5,760 responses for the AO and VO tasks (2 stimuli NEG/DN × 4 actors × 6 blocks × 30 subjects × 2 languages x 2 tasks),
- and 5,760 for the congruent and incongruent AV tasks (2 intonation patterns × 2 gestural patterns × 4 actors × 6 blocks × 30 subjects × 2 languages).

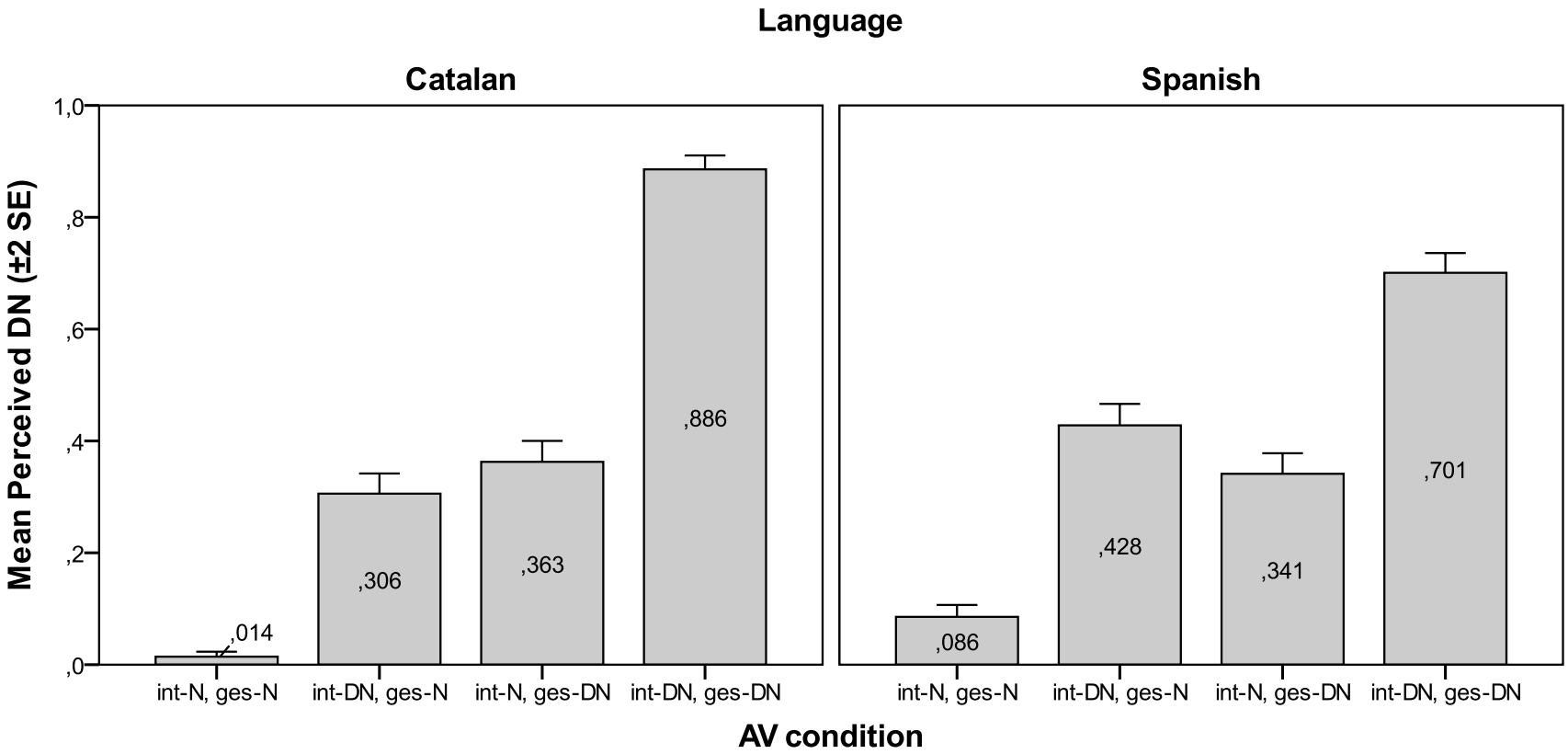
Measures and analyses

- The response measures (perceived DN) and reaction time (RT) measures in the different conditions (AO, VO, AV) were analyzed using a Generalized Linear Mixed Model (GLMM) using IBM SPSS Statistics 19.0 (IBM Corporation, 2010).
- In all GLMM analyses, both subject and items were set as crossed random factors.



Results: Unimodal tasks

Mean perceived DN ratings in the two unimodal conditions AO (left) and VO (right) in the two languages: Catalan (left) and Spanish (right). The x-axis represents the intonation/gestural conditions, while the y-axis represents the perceived meaning: 0 for N and 1 for DN.



Results: Audiovisual task

Mean DN ratings in the bimodal condition AV in Catalan (left panel) and in Spanish (right panel). The x-axis represents the four possible combinations of the intonation condition and the gesture condition, coded as follows: “int-N” = negative intonation; “int-DN” = double negative intonation; “ges-N” = negative gesture; “ges-DN” = double negative gesture. The y-axis represents the perceived meaning: 0 for N and 1 for DN.

Summary of results

- The semantic readings as either entailing a negative reading or implying a positive (DN) interpretation, are strongly constrained by prosodic and gestural patterns.
- In the AV condition, the results show that matching prosodic and gestural patterns trigger clear negative or positive interpretations.
  - DN interpretations associated with congruent audiovisual stimuli in the AV task provides evidence for an influence of the gestural features associated with speech prosody on the detection of specific linguistic phenomena.

Discussion (1)

- Even though there is general agreement on the fact that DN readings are hard to elicit, our results demonstrate that DN interpretations can be facilitated by intonation and gesture patterns.
  - This is an important finding, as it shows that prosodic and gestural features are crucial in language understanding.
- We suggest that listeners are highly sensitive to these prosodic and gesture patterns in online communication and that the semantic ambiguities pointed out by several authors in relation to DN interpretations can be resolved by taking into account prosodic and gestural information.

Discussion (2)

- Asymmetry found between N and DN interpretations in both unimodal and bimodal tasks
  - in all experiments, the N ratings are clearer and higher than the DN ratings
- When prosody and gesture do not match, results show that the interpretation tends to be negative

- Subjects need strong (and congruent) prosodic and gestural cues in order to be able to attain a DN interpretation.
  - This finding is of particular interest in relation to the claim that DN readings are hard to obtain in NC languages and that they correspond to marked interpretations (cf., Horn 1989; de Swart 2010).
  - The resistance of Catalan and Spanish hearers to obtain DN interpretations in general, and also in non-matching audiovisual stimuli, could be interpreted in two not necessarily conflicting ways:
    - all negative expressions are inherently negative
    - DN readings are a marginal phenomenon in NC languages

Discussion (3)

- As for the potential language effects, Catalan participants obtained higher DN responses in all tasks, especially in AO.
  - This result could initially be attributed to the fact that Catalan is a more flexible language in allowing simultaneously both *n*-words and negative markers in preverbal position
  - However, the language factor did not reach significance in any task

- Qualitative prosodic and gestural analysis of the materials showed that the lack of emphasis showed by some actors can explain these small language differences.

Part 2: Conclusions

- This study has provided evidence that DN interpretations are multimodal in nature, and that prosodic and gesture patterns need to be taken into account when studying this phenomenon with respect to isolated n-words in NC languages.
- In line with Fretheim's (1996) and Escandell's (1998) proposals on the role of intonation in inferential processing, we conclude that prosody and gesture constrain meaning by guiding the hearer/listener at the time of interpreting an isolated n-word.

- Importantly, prosody and gesture encode constraints on the communicated proposition, and can reverse the ‘preferred’ negative meaning of n-words, as encoded by grammar, to a positive meaning.

- In general, this piece of research demonstrates that prosody and gesture act as an integral part of language and, as such, provide insight into fundamental aspects of the interpretation of negation in interaction.

Thank you!

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