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## Expletive Negation: from syntax to eye-movements

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### 1 Introduction

The logical function of negation in human languages is quite clear: it is a one-place operator reversing the truth-value conditions of a proposition or, alternatively, a complement-set operator (cfr. Speranza & Horn 2012, Delfitto 2013). However, sometimes negation in natural languages shows a puzzling behavior, like in the following Italian sentence:

- (1) *Resisti finchè non arrivo!*  
hold on until neg arrive  
'Hold on until I arrive!'

In (1), negation does not negate the propositional content of the sentence in which it occurs and this constitutes an example of what is called *expletive negation* (EN). Many semantic, pragmatic, and syntactic hypotheses about EN have been advanced in literature (see, among others, Yoon 2011, Makri 2013, Greco 2019b and the references therein) but EN remains a puzzling issue for, at least, two reasons: (i) many languages, like Italian, display the same negative marker for both the propositional and the expletive negation, suggesting that the context – mostly syntactic – where negation is introduced is crucial in order to derive one or another of these two interpretations; (ii) no empirical data have been collected in order to shed light on the expletive interpretation of negation.

Clearly, the former question pertains to a theoretical domain, the latter to an experimental one: in this work we will thus adopt a twofold approach, to account for both theoretical and processing aspects.

Crucially, different instances of EN structures display syntactic and semantic dissimilarities (Greco 2019a); therefore, we will focus on a single EN case in Italian, i.e. *Surprise Negation Sentences* (SNEGs) (Greco 2019b):

- (2) *E non ti ho visto*  
and EN CL.to you I-have seen

*Luca in aeroporto?!<sup>2</sup>*  
 Luke at airport  
 ‘I saw Luke at the airport!’

The meaning of (2) could be fully paraphrased as ‘The fact that I saw Luke at the airport was a surprise’. SNEGs are limited to those contexts in which speakers are struck by surprised facts (hence, the label “Surprise”) and they want to express it by a dedicated syntactic structure.

SNEGs displays some specific and heterogeneous properties that seem to have no immediate explanation. For example, they asymmetrically host discourse-related phenomena, i.e., topicalization and focalization, licensing the former (3a), but not the latter (3b).

- (3) a. *E la gomma non me*  
 and the eraser EN CL.to me  
*l’ha data a Luca?!*  
 CL.it -has given to Luke  
 ‘The fact that the eraser, s/he gave it to Luke, was a surprise!’
- b. \**E LA PENNA non mi ha*  
 and the pen EN CL.to me has  
*dato a Luca?! (non la gomma)*  
 given to Luke not the eraser

To account for the pattern in (3) and many other phenomena (see below), Greco (2019b) proposes a syntactic representation of SNEGs combining some assumptions of the cartographic project pertaining to the left periphery (Cinque & Rizzi 2010) and of the minimalist program (Chomsky 1995), and we will adopt this analysis here.

Coming to the second question, we know from the literature that the elaboration of negative sentences yields a longer processing time and higher error rates than the elaboration of affirmative sentences (Wason 1961, Carpenter & Just 1975, Kaup *et al.* 2007) and that negation is incorporated into sentence processing in a late stage, after thousands of milliseconds (Giora 2006, Lüdtke, *et al.* 2007). It has been proposed that these effects may be caused by either the additional processing costs of negative sentences compared to the affirmative ones (Carpenter & Just 1975, Hasegawa, Carpenter & Just 2002) or by the inhibitory power of negation, which reduces the accessibility of the information taken under its scope (MacDonald & Just 1989, Tettamanti *et al.* 2008). Since SNEGs are set up by a negative marker even though their meaning is affirmative, our general aim is to clarify whether they

<sup>2</sup> The combined diacritic “?!” is due to the fact that SNEGs display a marked intonation blending the acoustic features pertaining to both questions and exclamatives.

are elaborated as affirmative clauses, according to their semantic value, or as negative clauses, according to their morphological shape.

The paper is organized as follows: We will first set the theoretical background by summarizing both the essential features of SNEGs and their syntactic analysis (Section 2). Then, we will present the experimental part of this work discussing the preliminary results of an eye movement study (Section 3).

## 2 Surprise Negation Sentences: a syntactic analysis

Let us summarize a few (core) properties of SNEGs.

(i) According to Greco (2019a), EN consists of distinct subtypes organized into a twofold classification between *weak* and *strong* EN: the former hosts weak-NPIs and neg-words, the latter does not. Crucially, SNEGs fall into the strong class, yielding ungrammaticality when they occur with weak-NPIs, like *alzare un dito* ('to lift a finger'), and with neg-words, like *nessuno* ('nobody') in a post verbal position:

- |     |    |               |               |                   |            |                    |
|-----|----|---------------|---------------|-------------------|------------|--------------------|
| (4) | a. | <i>*E</i>     | <i>Gianni</i> | <i>non</i>        | <i>mi</i>  | <i>ha</i>          |
|     |    | and           | John          | EN                | CL.to me   | has                |
|     |    | <i>alzato</i> | <i>un</i>     | <i>dito</i>       | <i>per</i> | <i>aiutarti?! </i> |
|     |    | lifted        | a             | finger            | to         | help-you           |
|     | b. | <i>*E</i>     | <i>non</i>    | <i>mi</i>         | <i>è</i>   | <i>sceso</i>       |
|     |    | and           | EN            | CL.to me          | is         | got                |
|     |    | <i>dal</i>    | <i>treno</i>  | <i>nessuno?! </i> |            |                    |
|     |    | off-the       | train         | nobody            |            |                    |

(ii) According to Cinque (1999), negation usually interacts with high adverbs, for instance *deliberately*, in two possible ways: either negation scopes over the adverb or the adverb scopes over negation – although the order of the element does not change (5a). Crucially, these two possibilities are ruled out in the correspondent SNEG clause (5b) and the only possible interpretation is the one in which negation and the adverb do not interact:

- |     |    |   |               |           |                        |                        |
|-----|----|---|---------------|-----------|------------------------|------------------------|
| (5) | a. | <i>Luca</i>   | <i>non</i>    | <i>ha</i> | <i>deliberatamente</i> |                        |
|     |    | Luke  | not           | has       | deliberately           |                        |
|     |    | <i>fatto</i>  | <i>cadere</i> | <i>la</i> | <i>penna.</i>          |                        |
|     |    | made  | to.drop       | the       | pen                    |                        |
|     |    | i) Luke deliberately did not drop the pen.' (deliberately...not)  |               |           |                        |                        |
|     |    | ii) 'Luke dropped the pen not-deliberately.' (not...deliberately) |               |           |                        |                        |
|     | b. | <i>Luca</i>   | <i>non</i>    | <i>mi</i> | <i>ha</i>              | <i>deliberatamente</i> |
|     |    | Luke  | EN            | CL.to me  | has                    | deliberately           |
|     |    | <i>fatto</i>  | <i>cadere</i> | <i>la</i> | <i>penna?! </i>        |                        |
|     |    | made  | to.drop       | the       | pen                    |                        |

- i) '#Luke deliberately did not drop the pen!' (# deliberately...not)
- ii) '#Luke dropped the pen not-deliberately!' (#not... deliberately)
- iii) 'The fact that Luke deliberately dropped the pen was a surprise!'

(iii) Assuming Rizzi (2001), CP is the landing site for elements carrying discourse-related features, such as topicalized and focalized phrases. According to Belletti (2004), Italian also displays a CP-like periphery inside TP, hosting discourse-related elements even *in situ*. SNEGs only host topicalized phrases, rejecting the focalized ones, both in fronted (3) and in TP-internal position (6):

- (6) a. *E non me lo ha dato*  
 and EN CL.to me CL.it has given  
*a Luca il libro?!*  
 to Luke the book  
 'The fact that the book, s/he gave it to Luke, was a surprise!'
- b. \**E non mi ha dato LA*  
 and EN CL.to me has given the  
*PENNA a Luca?! (non il libro)*  
 pen to Luke not the book

(iv) The whole proposition in SNEGs conveys completely new information. This appears clear when SNEGs are employed as answers to questions:

- (7) A: *Che cosa è successo?*  
 'What happened?'
- B: *Non ti ho visto Luca in aeroporto?!*  
 'The fact that I saw Luke at the airport was a surprise'

Greco (2019a) proposes that questions like (7A) only refer to events falling into the class of "Propositional Questions". The fact that SNEGs are employed as answer to propositional questions shows that the whole proposition in SNEGs carries new information.

To sum up, we saw that (i) SNEGs are strong ENs (weak NPIs and neg-words are not licensed), (ii) the negative marker in SNEGs does not interact with high adverbs, like *deliberately* – contrary to what negation usually does in negative sentences – (iii) SNEGs host topicalized phrases, but not the focalized ones, and (iv) the whole proposition in SNEGs conveys new information. Now we will summarize an analysis of SNEGs from which all these properties will follow in a unitary way.

According to Greco (2019b), it is possible to derive all the phenomena in (i-iv) in a unitary way by proposing that: (i) the Italian negative marker *non* (“not”), generally assumed to be merged in the TP-domain (Zanuttini 1997, Poletto 2008), can also be externally merged in the CP-domain (*à la* Laka 1990); (ii) when the head *non* (“not”) is merged, the v\*P-phase has already been closed; (iii) the entire TP is focalized moving to [Spec, Foc°]:

$$(8) \quad [\text{CP} \dots [X^\circ \text{ non} ] \dots [\text{TP Foc}^\circ [\dots \text{t}_{\text{TP}} \dots]]]$$

From this particular derivation many consequences follow.

For example, it follows that SNEGs are strong ENs: according to Zeijlstra (2004) and Giannakidou (2011), a negative operator must bind all the free variables in the vP domain in order to license them. Consequently, if no negative operator is available – like in affirmative clauses – or if the v\*P has already been closed when negation is merged – like in the SNEGs case – then this kind of binding chain fails and the negative operator-variable structures are excluded.

The fact that *not* is merged in the CP-domain also takes into account the pattern with high adverbs: according to Mizuno (2010), Edelstein (2012), and Giorgi (2016), adverbs like *deliberately* are base generated in the v\*P-phase and, therefore, negation cannot interact with them if it is generated in another phase, i.e., the CP-phase.

Coming to the third point of the proposal – i.e., the whole TP raised to [Spec-Foc°] realizing the argument of negation – it follows that no space is available for other focalized elements because, as Rizzi (2001) argued, Italian displays only one focus projection. On the contrary, the topicalized elements can occur because topic projections are available. This is exactly the pattern in (3) and (6).

Finally, assuming that TP ends up in the [Spec, Foc°] also implies another remarkable consequence: the whole predicate is the new information introduced in the context of the discourse. More specifically, according to Ovalle & Guerzoni (2004) and Brunetti (2004), what carries new information, at least in answers, lays in the focus domain of a sentence and we saw in (7) that, indeed, SNEGs are suitable answers to Propositional Questions.

To sum up, in this section we saw that some heterogeneous properties of SNEGs can be taken into account in a unitary way by assuming a particular syntactic configuration. Such a syntactic analysis also predicts that negation loses its ability to negate a proposition since it is merged in a different phase than the predicative one. From this point of view, SNEGs resemble affirmative sentences instead of negative ones. We have now all the tools to consider the second aim of this paper and to collect some empirical data on the elaboration of EN.

### 3 A preliminary eye-movement study

In this section we will sketch the preliminary results of an eye-movement experiment designed to investigate the processing of SNEG sentences (see Greco *et al.*, Submitted, for a more detailed discussion).

It is well known that affirmative and negative sentences are processed differently. For example, Kaup, Lüdtke & Zwaan (2005) proposed that subjects elaborate negative sentences by means of a twofold process requiring two mental representations, whereas affirmative sentences just need one. They developed a sentence-picture verification task in which participants were presented with either affirmative or negative sentences (e.g., *The elephant is / is not above the giraffe*) and with two cards either matching the current state of affairs – an elephant above a giraffe in the affirmative case and an elephant below a giraffe in the negative one – or not – an elephant below a giraffe in the affirmative case and an elephant above a giraffe in the negative one. They asked participants to evaluate whether the objects depicted in the cards were mentioned in the sentence. A variable latency of 750 msec and of 1500 msec was introduced between the sentences and the cards. Results show that after 750 msec, the affirmative sentences require shorter reaction time in the matching scenario than in the mismatching one, while negative sentences displayed the contrary pattern, indicating that at that early latency negation has not been elaborated yet; after 1500 msec, participants valued both the affirmative and negative sentences with shorter reaction time in the matching scenario than in the mismatching one. According to the authors (see also later works in Kaup, Lüdtke & Zwaan 2006, 2007), this pattern may be taken into account by assuming that negative sentences (e.g., *The elephant is not above the giraffe*) require the elaboration of both the contrafactual state of affairs (an elephant above the giraffe) and the effective negative meaning (an elephant below the giraffe). Clearly, these two representations are not required by affirmative sentences (e.g., *The elephant is above the giraffe*), which just need one mental representation equivalent to their meaning<sup>3</sup>.

These differences between affirmative and negative sentences are crucial in order to investigate the processing of SNEG sentences; more specifically, starting from the syntactic theory we discussed above, we expect that (i) individuals will show a comparable behavior in affirmative and SNEG sentences – integrating the visual and the linguistic information early on in sentence processing – whereas (ii) they will show a different pattern with negative sentences – integrating the visual and the linguistic information later on in the sentence.

Crucially, since SNEGs are limited to those cases in which speakers are struck by unexpected facts, all the sentences in our data set will refer to unexpected events.

<sup>3</sup> It has also been proposed that the discourse context may influence the elaboration of negation possibly making the process of negative sentences similar to the one of affirmative sentences (see, among others, Wason 1965, Villiers & Flusberg 1975, Kaup 1997, Glenberg *et al.* 1999, Lüdtke & Kaup 2006, Giora *et al.* 2007, Ferguson, Sanford & Leuthold 2008). We will not deepen this issue here, leaving a more detailed discussion in Greco *et al.* (Submitted).

We tied the notion of expectedness to that of typicality: the more atypical an event for a given situation, the more unexpected its realization, and *vice versa* (McCloskey 1980, Pérez *et al.* 2015). For example, if a castle is considered a more atypical place in which a student may live in compared to an apartment, then the sentence “The student lives in a castle” will be considered more unexpected than the sentence “The student lives in an apartment”. In our study, all the target sentences will follow the structure of “S/he lives in a castle”.

### 3.1 The experimental design

34 Italian native speakers participated to this eye-movements study in which we employed a visual world paradigm (see Altmann & Kamide 2007 for a discussion on this paradigm).

In the experimental session participants were seated in a quiet room in front of a screen. They were told that they would hear some stories via headphone and simultaneously they would see some photos on the screen. The experimental trials were presented to participants divided in three conditions. All were short everyday-life stories (e.g., Next year Luke will take the driving license. To practice, yesterday he drove a vehicle at his uncles' house.) introducing a specific semantic category (e.g., a vehicle). After that, participants listened to the target sentence that could be either affirmative (e.g., *Il ragazzo ha guidato un trattore* translated as ‘The boy drove a tractor.’), negative (e.g., *Il ragazzo non ha guidato un trattore* translated as ‘The boy did not drive a tractor ’) or SNEG (e.g., *Il ragazzo non ha guidato un trattore?!* translated as ‘That the boy drove a tractor was a surprise!’). In the meantime, four pictures were shown on a computer screen. Two of the objects presented on the screen belonged to the same semantic category introduced in the story (e.g., a tractor and a car as examples of vehicles) and two did not (e.g., a table and an apple). Moreover, one of the two objects belonging to the semantic category introduced in the story was highly typical/expected for the category under discussion (e.g., the car); the other one was highly atypical/unexpected (e.g., the tractor). By doing so we provided a linguistic context in which the mentioned object (e.g., the tractor) co-occurred with an alternative (not-mentioned) one (e.g., the car), providing all the information participants needed to correctly interpret affirmative, SNEG, and negative sentences (in this case, the interpretation would be that if the boy did not drive a tractor, he drove a car). We recorded the eye-movements during these trials. Finally, a set of fillers was implemented in our data set: they were structurally identical to the experimental items but they always referred to the expected object (e.g., the car in the previous example). The total number of items was 100 (60 experimental trials and 40 fillers). Here some other examples of items:

Real-life stories	Target Sentences		Pictures
This summer Luke went on	Il ragazzo ha usato una bicicletta.	The boy used a bike.	1) bike (unexpected) 2) car (expected)

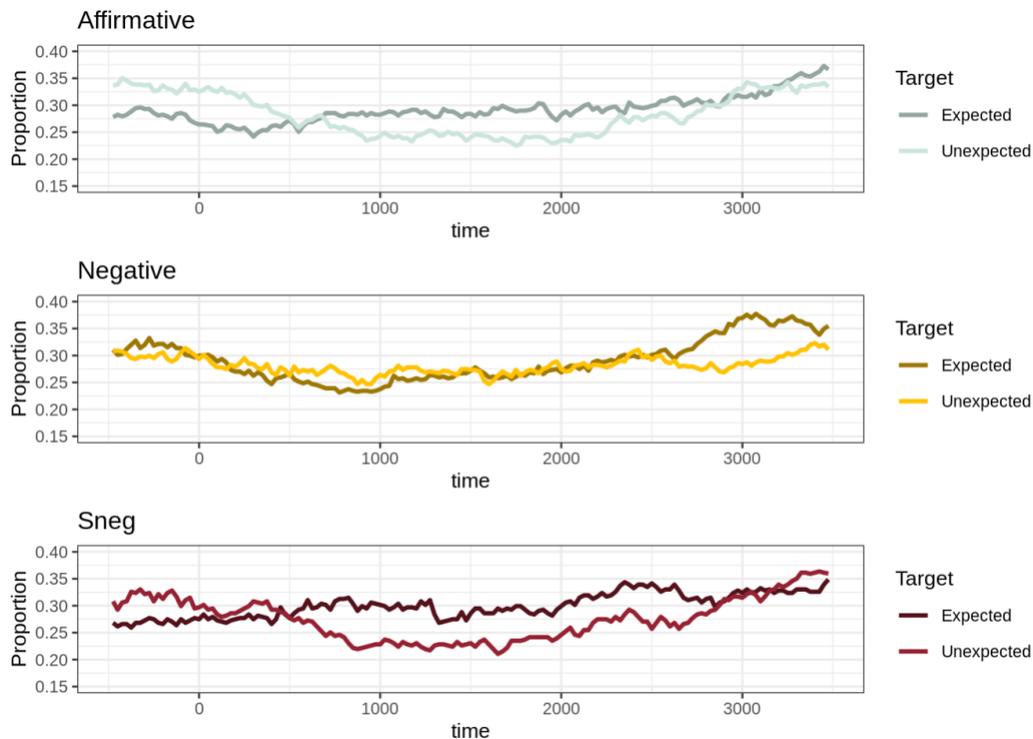
holiday with his friends. To go from Milan to Naples he used a present he received from his father.	Il ragazzo non ha usato una bicicletta.	The boy did not use a bike.	3) button (unrelated) 4) apple (unrelated)
	Il ragazzo non ha usato una bicicletta?!	The fact that the boy used a bike was a surprise!	
Looking out the window Luke realized it was raining hard. Therefore, leaving the house he took with him something for shelter.	Il ragazzo ha preso un mantello.	The boy took a cloak.	1) cloak (unexpected) 2) umbrella (expected) 3) dresser (unrelated) 4) tape (unrelated)
	Il ragazzo non ha preso un mantello.	The boy did not take a cloak.	
	Il ragazzo non ha preso un mantello?!	The fact that the boy took a cloak was a surprise!	
Mary just came out from a real estate agency. With satisfaction, he bought a building for the holidays.	La ragazza ha acquistato una torre.	The girl bought a tower.	1) tower (unexpected) 2) house (expected) 3) toothbrush (unrelated) 4) horn (unrelated)
	La ragazza non ha acquistato una torre.	The girl did not buy a tower.	
	La ragazza non ha acquistato una torre?!	The fact that the girl bought a tower was a surprise!	

**Table 1:** This is an example of some Items used in the experiment

### 3.2 Preliminary results and discussion

In the preliminary analysis shown here we compared the proportion of looks to Expected-Unmentioned (e.g., a car) and Unexpected-Mentioned objects (e.g., a tractor). This was done by calculating the odds of looking at one of the two relevant objects (separately for expected and unexpected objects), for each 25 ms time interval from the offset of the subject noun phrase (thus including the negative particle in Negative and SNEG sentences), up to 3500 ms. Figure 1 shows how the three sentences affect the probability of looks to the objects: the probability of looking at expected-unmentioned and unexpected-mentioned objects seem to differ between 1000 and 2000 ms in the affirmative and SNEGs sentences, and only later on, between 2500 to 3500 ms, in the negative ones. In both affirmative and SNEG sentences participants move away from the unexpected-mentioned object soon after the subject noun phrase, and towards the end of the epoch of interest (after 2000 ms – roughly corresponding to the offset of the object phrase) the

probability of looks to the unexpected–mentioned objects rapidly increases. Concerning the negative sentences, the differences in looks to the two referents emerge only very late, with expected–unmentioned objects looked at more often than unexpected–mentioned ones. Statistical analysis reported elsewhere (Greco *et al.*, Submitted paper) confirmed that SNEG and Affirmative sentences behave very similar, whereas Negative sentences showed a different behavior.



**Figure 1:** Fixation proportion to the expected (e.g., car) and to the unexpected (e.g., tractor) object in affirmative (*Il ragazzo ha guidato un trattore* translated as ‘The boy drove a tractor.’), negative (e.g., *Il ragazzo non ha guidato un trattore* translated as ‘The boy did not drive a tractor’) and SNEG (e.g., *Il ragazzo non ha guidato un trattore?!* translated as ‘That the boy drove a tractor was a surprise!’). Interestingly, in negative sentences participants tend to look away from both objects, very early in the sentence (before the object was mentioned) suggesting that negation also plays a role in the elaboration of the sentence in two distinct moments: soon after the negative particle and when the object “to be negated” is mentioned.

Starting from the theoretical syntactic analysis described in 2, we investigated the hypothesis that SNEGs are elaborated as affirmative clauses, despite the occurrence of the negative marker *not*. Overall, this is confirmed by the qualitative pattern of eye movement described here.

It is worth recalling that the unexpected object (e.g., the tractor) was the mentioned one in all the target sentences and, consistently, the subjects’ attention to it increased both in affirmative and SNEG cases, since the unexpected object realizes the actual meaning of the proposition. Conversely, this did not happen in negative sentences because of the negation. More specifically, in affirmative and

SNEG sentences participants built a representation of the most likely scenario early on (the vehicle the boy drove is a car), and the looks to the unexpected object (e.g. the tractor) first decreased, but then they rapidly increased when participants listened to such unexpected object, building the effective meaning of the sentence (The boy drove a tractor). This result confirms our first prediction.<sup>4</sup>

This ‘move away–turn back’ to the unexpected (mentioned) object did not happen in negative sentences. Crucially, in negative sentences, the looks to the expected (not-mentioned) object (e.g., the car) increased over the time, particularly with a late latency, confirming both our second hypothesis and the fact that negation displays a late integration.

#### 4 Concluding remarks

In this work we focused on a particular case of expletive negation, namely the *Surprise negation sentences* (SNEGs) (Greco 2019a-b). We started from a theoretical discussion on this phenomenon showing that SNEGs display some peculiar properties that seem to have no immediate explanation (such as the fact that they asymmetrically host discourse-related phenomena). To account for these properties in a unitary way, we followed Greco’s (2019) analysis where it was proposed that: (i) the Italian negative marker *non* (“not”), generally assumed to be merged in the TP-domain (Zanuttini 1997, Poletto 2008), can also be externally merged in the CP-domain (à la Laka 1990); (ii) when the head *non* (“not”) is merged, the v\*P-phase has already been closed; (iii) the entire TP is focalized. We also offered preliminary data from an eye movement study designed to investigate the hypothesis that SNEGs are interpreted as affirmative clauses, according to their syntactic and semantic derivation, rather than as negative ones based on their morphological information. Preliminary results show that the fixation patterns were very similar for affirmative and SNEGs, while differences were observed between negative vs. affirmative sentences. This suggests that the interpretation of negation in the mental representation of a sentence strictly depends on the specific syntactic derivation, as the theoretical analysis predicts.

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<sup>4</sup> This is also in line with the results showed in the eye-movements study employed by Orenes, Beltrán & Santamaría (2014).

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