

Negated definite conjunction and its implicatures¹

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Abstract. Two different readings are possible in English when a conjunction of definite objects is negated. It is argued in the present paper that different sets of alternatives are active in the two cases, but that this is only possible with the right interplay of the preceding context and the intonation contour of the sentence. Both readings result from exhaustification. However, the number of applications of the EXH operator is different in the two cases. This fosters discussion about the constitution of alternative sets, the exact role of focus, as well as triggers for (re-)exhaustification.

Keywords: conjunction, ambiguity, stress, alternatives, exhaustification, homogeneity.

1. Introduction

Two scope-taking expressions inside one sentence usually result in ambiguity. Furthermore, when one of the two expressions is member of a Horn (1972) scale, focus-related effects are not uncommon. The case in question is VP-internal definite conjunction under negation.

1.1. Ambiguous negated conjunction in English

A sentence like (1) can have two readings. It is possible to interpret it as (2a), where it is not the case that he visited both Colombia and Brazil, so he either visited Colombia or Brazil. But it is also possible to interpret (1) as (2b) where he didn't visit either of the two countries, i.e. he didn't visit Colombia and he didn't visit Brazil.

- (1) He didn't visit Colombia and Brazil.
- (2) a. He didn't visit both countries, but only one of the two.
b. He visited neither country.

The former reading (2a) is that of a conjunction in the scope of negation (3), whereas the latter logically corresponds to a conjunction that outscopes negation (4).

- (3) $\neg[C \wedge B]$
- (4) $[\neg C] \wedge [\neg B]$

The two readings correlate with different intonation patterns of the sentence. Stress on the connective *and* (5) is normally required for (2a), whereas the whole conjunction is stressed (6) for (2b). Negation is stressed in both patterns (5, 6), as well.

- (5) He didn't_F visit Colombia and_F Brazil $\neg[C \wedge B]$
- (6) He didn't_F visit [Colombia and Brazil]_F $[\neg C] \wedge [\neg B]$

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The major parameter thus seems to be whether secondary stress is placed on the connective *and* (5) or on the whole conjunction as a coordinated constituent (6). Unsurprisingly, the two intonation patterns are compatible with different continuations. Namely, when the stress is placed on the connective, the sentence is naturally followed by either an assertion of one (7a) or the other (7b) country having been visited. However, it is not felicitous to bring up a third, so far unmentioned country (7d) as a follow-up, or to ask a verification question about neither of the two countries having been visited (7e)².

- (7) He didn't visit Colombia and_F Brazil
- a. ✓ ... He visited (only/just) Colombia.
 - b. ✓ ... He visited (only/just) Brazil.
 - c. ✓ ... He visited either Colombia or Brazil, but I'm not sure which one he picked in the end.
 - d. # ... He visited Peru.
 - e. # Are you saying that he visited neither?

Conversely, when the whole conjunction is stressed (8), asserting that he visited only Colombia (8a) or only Brazil (8b) is infelicitous, whereas a continuation containing an alternative that is not found in either of the conjuncts (Peru in (8c)) or a hint at neither of the two countries being visited (8d) is now compatible with the initial utterance (8).

- (8) He didn't visit [Colombia and Brazil]_F
- a. # ... He visited (only/just) Colombia.
 - b. # ... He visited (only/just) Brazil.
 - c. ✓ ... He visited Peru.
 - d. ✓ Are you saying that he visited neither?

Such complementary continuations demonstrate that the two readings of negated conjunction are distinct and attestable independently from each other, even though an entailment relation exists between them: taken at face value, the strong, 'neither' reading (2b/4/6) entails the weak, 'not both' one (2a/3/5). A question emerges immediately: should the two readings be analyzed as two scopal orderings of conjunction with respect to negation (narrow in (2a)/(3) and wide in (2b)/(4))? The latter pattern (8) is, in fact, often identified as a product of a Homogeneity inference (Fodor, 1970; Löbner, 1987) of the form 'either he visited Brazil and he visited Colombia, or he didn't visit Brazil and he didn't visit Colombia', whereas stress on *and* (7) is brought into relation with *both* (Schein, 1986; Schwarzschild, 1994; Szabolcsi and Haddican, 2004), in charge of eliminating Homogeneity.

1.2. Alternatives and stress

Conjunction is a strong scalar element (9), and for this reason not associated with scalar inferences when appearing in Upward-Entailing (UE) environments (Chierchia, 2004).³

²For the 'Are you saying that ϕ ?'-test see Meyer (2013).

³A UE environment licenses inferences from sets to supersets, for ex. *He drank maté.* \Rightarrow *He drank tea.*

(9) < or, and > Horn scale

Namely, a positive episodic sentence containing a conjunction, such as (10), asymmetrically entails its minimal pair with a disjunction (11). Moreover, (10) also asymmetrically entails its individual conjuncts, the two sentences in (12).

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|------|---------------------------------|-----|
| (10) | He visited Colombia and Brazil. | C∧B |
| (11) | He visited Colombia or Brazil. | C∨B |
| (12) | a. He visited Colombia. | C |
| | b. He visited Brazil. | B |

In some nomenclatures (Chierchia, 2013), the former (11) would correspond to ‘scalar alternatives’ (due to lexical substitution), whereas the latter (12) correspond to the so-called ‘subdomain alternatives’ (due to structural derivation) to an assertion like (10). Now, when the conjunction is found in a Downward-Entailing (DE) environment⁴, like the scope of negation in (13), it no longer logically entails its scalar (14) or its subdomain (15) alternatives.

- | | | |
|------|--------------------------------------|--------|
| (13) | He didn’t visit Colombia and Brazil. | ¬[C∧B] |
| (14) | He didn’t visit Colombia or Brazil. | ¬[C∨B] |
| (15) | a. He didn’t visit Colombia. | ¬C |
| | b. He didn’t visit Brazil. | ¬B |

The conjunction is thus predicted to give rise to certain inferences when appearing in DE environments, although in its basic meaning *and* represents a strong element (9). As introduced in the preceding section (1.1), sentences like (13) seem to allow for two distinct interpretations, and stress placement (16) is a discriminating factor.

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|------|--|------------|
| (16) | a. He didn’t _F visit Colombia and _F Brazil | ‘not both’ |
| | b. He didn’t _F visit [Colombia and Brazil] _F | ‘neither’ |

F-marking is known to activate alternatives of the kinds exhibited in (14, 15) (Rooth, 1985, 1992; Krifka, 2007). Once alternatives are active, enrichment of the overall meaning ensues, through a purely pragmatic mechanism or syntactic, operator-driven exhaustification. Such an enrichment could then be the source of the two attested readings.

1.3. Empirical and theoretical issues

The aim of the present paper is to address the following questions.

1. What are the requirements of the two readings of negated definite conjunction with respect to contextual input?
2. In which way do intonation patterns condition the sets of alternatives?

⁴A DE environment licenses inferences from sets to subsets, for ex. *He didn’t drink tea.* ⇒ *He didn’t drink maté.*

3. What kind of meaning enrichment produces the two readings of negated definite conjunction?

It is observed that necessary antecedents of the two prosodic patterns, and therefore the two readings, are not the same – in one case the conjunction has to be previously made salient, whereas in the other previous mentioning of the individual conjuncts suffices. F-marking activates alternatives, and I will argue that its position determines their form: a scalar alternative is activated by the stress on the connective, whereas subdomain alternatives are activated either by default or by the presence of stress on the whole coordination. Obligatory exhaustification is the mechanism which derives both readings of negated definite conjunction in English. A silent operator EXH is employed with this purpose in both cases. The differences in derivation of the ‘not both’ and the ‘neither’ readings lie in the kind of alternatives that are supplied to the EXH operator and the number of applications of the latter. When stress is placed on the connective, the scalar alternative with disjunction is activated and the result of one round of exhaustification is the ‘not both’ meaning. Conversely, when stress is placed on the entire coordination, it is the subdomain alternatives that become active, and two rounds of exhaustification eventually yield the strengthened, ‘neither of the two’, meaning. The latter pattern thus represents an implicature-based account of Homogeneity, building on the proposal in Magri (2014) and modifying it. The dichotomy between the two patterns of negated definite conjunction in my account rests on scalar and subdomain alternatives not being available simultaneously. Finally, it is important to point out that only these two intonation patterns are investigated here, limited by the scope of the present paper. Other combinations are, of course, conceivable, but they will have to be left for future research.

The paper is structured as follows. The pattern with stress on the connective *and*, with its implications, is discussed in section 2. The pattern with stress on the coordination, including the derivation of the corresponding reading, is presented in section 3. Relevant predecessors in the literature on conjunction and homogeneity, as well as alternatives and (re-)exhaustification, are presented in section 4. A discussion of problems for the existing proposal, with some more general theoretical considerations, is provided in section 5, together with conclusions.

2. Stress on the connective

The pattern with stress on the connective comprises two occurrences of pitch accent: high pitch accent (H*) on the finite verb which carries the negative marker (*didn't* in (17)), and a secondary, fall-rise accent (L+H*) on *and*.⁵ The prosodic unit ends with a low phrase accent (‘L-’) and a low boundary tone (‘L%’).

(17) He didn't^{H*} visit Colombia and^{L+H*} Brazil^{L-L%}

This intonation pattern represents contrastive negation of the conjunction, and the latter ought to be present in the preceding discourse, as I will show now.

⁵The prosodic transcription is made in ToBI notation, where ‘H’ represents a high, and ‘L’ a low tone. ‘*’ signals that the tone in question is a pitch one, as opposed to boundary tones marked by ‘%’.

2.1. Preceding context

A negated conjunction with a rise-fall-rise contour cannot be uttered out of the blue. It also cannot follow just any discourse. The negated conjunction must be made salient in its positive form in the preceding context.

2.1.1. Example of a felicitous discourse

Scenario: *John decided to take some time off and go backpacking in the Americas. His friend Sue has travelled to virtually every country in the Americas, so she advised John while he was planning his trip. Bill and Mary are also John's friends, they know his interests and preferences, but did not get to talk to John about the details of his trip. Bill and Mary are having a conversation with Sue about their mutual friend John, unaware of the fact that Sue was involved in the planning of the trip.*

- (18) a. Bill: (I guess that) John went to Colombia and Brazil (because he was always fascinated by Amazonia).
 b. (Mary: He couldn't have missed Peru and the Machu Picchu!)
- (19) Sue: He didn't H^* visit Colombia and $L+H^*$ Brazil $L-L\%$

As (18) illustrates, a conjunction comprising the same conjuncts (*Colombia, Brazil*) has to be made contextually salient as a prerequisite for the rise-fall-rise contour in the sentence with contrastive negation (19). This is achieved with the turn in (18a). In addition, there can be further evocation of possibilities, like (18b), but need not.

2.1.2. Example of an infelicitous discourse

The overall scenario is the same as in the preceding section (2.1.1).

- (20) a. Mary: (I guess that) John visited Colombia (I know he loved watching Narcos).
 b. Bill: He (certainly) went to Brazil (he had always been fascinated by Amazonia).
 c. (Mary: He couldn't have missed Peru and the Machu Picchu..!)
- (21) Sue: # He didn't H^* visit Colombia and $L+H^*$ Brazil $L-L\%$

Mere invocation of the individual conjuncts does not create the right context for negated conjunction with stress on *and*, since presence of the left conjunct (*Colombia* in (20a)), followed by the right conjunct in the next conversational turn (*Brazil* in (20b)) did not make (21) felicitous. The outcome would be the same for a context from which the two conjuncts are entirely absent, i.e. not made salient at all. We thus see that the prosodic pattern must be licensed in the discourse, since the stressed connective seems to be dependent on another conjunction present in the context.

2.2. Stress and scalar alternatives

The rising pitch accent on the connective represents contrastive focus on conjunction in the scope of negation. As such, it is naturally followed by a *but*-phrase (22), and in fact it requires a continuation, the choice ranging among those discussed in section 1.1.

(22) He didn't^{H*} visit Colombia and^{L+H*} Brazil^{L-L%}... but only one of the two.

In more formal terms, what the presence of the stress on the connective does is that it triggers the scalar alternative with disjunction *or*, obtained by replacing *and* with its scalemate. As discussed in section 1.2, the scalar alternative (23b) is logically stronger than the assertion (23a), as the former entails the latter (23c). A scalar implicature thus arises when the stronger alternative is negated (23d), and added to the assertion (23e). A standard, (neo-)Gricean approach (Grice, 1989; Krifka, 1995) could capture this, via a purely pragmatic mechanism (Szabolcsi and Haddican, 2004).

- (23) a. Assertion: $\neg(C \wedge B)$
 b. Scalar Alternative: $\neg(C \vee B)$
 c. $\neg(C \vee B) \Rightarrow \neg(C \wedge B)$
 d. Scalar Implicature: $\neg(\neg(C \vee B))$
 e. \rightsquigarrow He visited either Colombia or Brazil.

This is an instance of a so-called indirect implicature (Chierchia, 2004), where a strong scalar element eventually gives rise to a weak meaning (23e) in the scope of a DE operator. Implicatures are known to be defeasible, however, this inference cannot be canceled, as the unavailability of the continuations in (24) signals.

- (24) He didn't visit Colombia and^F Brazil
 a. # ... Actually, he visited neither country.
 b. # ... In fact, he only went to Peru, in the end.

The two follow-up assertions (24) would correspond to the basic inference of the sentence, i.e. the assertion (23a) without the scalar implicature (23d), thus compatible with a 'neither' interpretation. Crucially, both are infelicitous. On the other hand, ignorance inferences may, but need not be attested, as illustrated in (25).

- (25) He didn't visit Colombia and^F Brazil
 a. ... He visited (only/just) Colombia. / ... He visited (only/just) Brazil.
 b. ... He visited either Colombia or Brazil, but I don't know which one he chose.

The continuations in (25a) show that ignorance inferences by which 'the speaker doesn't know/believe that John didn't visit Colombia' and 'the speaker doesn't know/believe that John didn't visit Brazil' need not arise, whereas the follow-up in (25b) shows that (25) is not incompatible with them.

2.3. Obligatory exhaustification

Indefeasibility of the scalar implicature points to obligatory exhaustification. In other words, some mechanism must ensure that the scalar alternative always gets negated. Moreover, the implicature is preserved even inside DE environments, such as the restrictor of the universal quantifier in (27).

Scenario: *Students doing the Latin American History curriculum must travel to some countries in the region, at their choice.*

- (26) Mary: I guess that most students tried to go to Colombia and Brazil (because these are neighboring countries, but with different colonial background)...
- (27) Sue: Well, everyone who didn't visit Colombia and Brazil...
- (28) a. Sue: ... visited (just/only) Colombia. / ... visited (just/only) Brazil.
b. Sue: # ... went only to Peru.

Infelicity of continuations compatible with 'neither' interpretations in matrix contexts, as well as in embedded ones, means that the presence of the scalar implicature must be provided by a grammatical device which can be applied locally, if need be. The mechanism is thus the following: focus on the connective activates the scalar alternatives with disjunction (Krifka, 2007; Fox and Katzir, 2011). Once active, alternatives must be exhausted. A silent operator EXH is inserted for this purpose (Fox, 2007; Chierchia, 2013). EXH_{IE} negates all alternatives which are members of the set of innocently excludable alternatives ALT_{IE} (29). Such alternatives must meet two conditions (30): to not be entailed by the assertion and to not have their negation, when added to the assertion, entail another alternative from the set, as shown in (31).

- (29) $\llbracket EXH_{IE} \phi \rrbracket = \phi \wedge \forall \psi \in ALT_{IE}(\phi): \neg \psi$ (Meyer, 2015: 494)
- (30) $\psi \in ALT_{IE}(\phi)$ iff $\psi \in ALT(\phi) \ \& \ \neg(\phi \Rightarrow \psi) \ \& \ \neg \exists \chi \in ALT(\phi) \ \& \ \phi \wedge (\neg \psi) \Rightarrow \chi$ (idem)
- (31) a. $\neg(C \wedge B) \wedge \neg \neg C \Rightarrow \neg B$
b. $\neg(C \wedge B) \wedge \neg \neg B \Rightarrow \neg C$

By (30, 31), neither of the two subdomain alternatives of negated conjunction ($\neg C$; $\neg B$) would make it into ALT_{IE} , since negating $\neg C$ together with the assertion entails $\neg B$ (31a), and the same goes for $\neg B$ (31b). This means that, even if subdomain alternatives were active, they would not be added to the computation. Now, one application of EXH_{IE} disambiguates in favor of a logically weaker reading (32), since 'either C or B' is weaker than 'neither C nor B'.

- (32) $EXH_{IE}(\neg(C \wedge B)) = \neg(C \wedge B) \wedge \neg(\neg(C \vee B)) = (C \vee B) \wedge \neg(C \wedge B)$
- (33) He visited Colombia or Brazil, but not both.

The resulting interpretation with the obligatory indirect implicature thus corresponds to a reading that could be expressed by an unembedded exclusive disjunction (33).⁶ This is in full compliance with the (un)availability of different continuations, shown in sections 2.1.1 and 2.1.2, as well as (24, 25).

⁶For negated stressed *or*, see Meyer (2015); Fox and Spector (2018).

To summarize, the combination of a contextually salient conjunction and negation with focus on the connective inevitably activates the scalar alternative with disjunction. No other alternatives are activated, i.e. individual conjuncts do not enter the computation as subdomain alternatives. EXH operator is inserted at the root of the clause, yielding the ‘not both’ interpretation.

3. Stress on the whole conjunction

As shown in (34), the intonation contour of a pattern with negated unstressed *and* comprises the primary high pitch accent on negation and a secondary one on the conjunction, more precisely, it marks the second member of the coordination.

(34) He didn't^{H*} visit [Colombia and Brazil]^{H*-L%} $[\neg C] \wedge [\neg B] \Leftrightarrow \neg [C \vee B]$

The ‘neither’ reading that (34) gets can correspond either to a conjunction scoping over negation or to a disjunction in the scope of negation (due to one of de Morgan’s equivalences). This version of negated conjunction is often considered to be marginal or even unacceptable in English (Szabolcsi and Haddican, 2004). This might seem so when the pattern is taken in isolation, without an appropriate context. However, with the right contextual embedding, the ‘neither’ reading is available for negated definite conjunction, just like the ‘not both’ reading has been shown to be available only following an occurrence of a positive conjunction in the preceding discourse. In other words, neither of the patterns is available freely. Now, the presence of focus activates alternatives, as before. The difference is that this time no scalar alternative is activated, since there is no focus on the connective *and*. But individual conjuncts must be contextually salient, which facilitates retrieval of subdomain alternatives from the coordinative structure (Sauerland, 2004; Katzir, 2007; Fox and Katzir, 2011; Singh et al., 2016).

3.1. Preceding context

As already pointed out, a negated conjunction requires specific contextual conditions to be felicitously uttered. When no stress is placed on *and*, but the second conjunct bears high pitch accent, the preceding discourse ought to take a different form than the one of negated conjunction with a stressed connective.

3.1.1. Example of a felicitous discourse

- (35) a. Bill: (I guess that) John went to Brazil (because he has always been fascinated by Amazonia).
 b. Mary: He (certainly) visited Colombia (because I know he loved watching Narcos).
 c. (Bill: He couldn't have missed Peru and the Machu Picchu..!)
- (36) Sue: He didn't^{H*} visit [Colombia and Brazil]^{H*-L%}
- (37) a. ... But he did go to Peru.
 b. ... He visited Argentina instead.

This time, individual conjuncts need to be made salient in the preceding context. This is achieved with the two conversational turns in (35a) and (35b). A third alternative can be in-

voked, as in (35c). The negated conjunction with no stress on the connective (36) is now licensed. Since the sentence in (36) receives a ‘neither’ interpretation, the allowed continuations are the opposite of the ones with negated conjunction with a stressed connective. An utterance with a third, previously invoked (37a) or not (37b) alternative, one that does not correspond to either of the conjuncts is a felicitous follow-up.

3.1.2. Example of an infelicitous discourse

- (38) a. Bill: (I guess that) John went to Argentina (because he adores tango).
 b. Mary: He couldn’t have missed Peru and the Machu Picchu!
 c. Bill: (It is also possible that) he visited Chile, to see the Atacama desert...
- (39) Sue: # He didn’t H^* visit [Colombia and Brazil] H^*

If there is no previous mention of *Colombia* and of *Brazil*, the sentence in (39) cannot be felicitously uttered under the indicated prosody, since two names make up the conjuncts in (39). This is shown with the preceding context as in (38), where neither of the speakers invoked either of the countries. As shown before, only the continuations compatible with a ‘neither’ reading are felicitous. I now go on to reveal the cause.

3.2. No wide scope conjunction

One might suggest that this strong, ‘neither’ reading arises as a result of a different LF – one where the conjunction scopes over negation. This way, the ‘not both’ reading with the stressed connective would correspond to the surface scope interpretation ($\neg[C \wedge B]$), whereas the ‘neither’ reading would correspond to the inverse scope interpretation ($[\neg C] \wedge [\neg B]$). However, an inverse scope LF is not plausible because a sentence with an existential quantifier cannot receive an interpretation in which different people didn’t visit Colombia and Brazil (40).

- (40) Somebody didn’t visit Colombia and Brazil.
 \neq Somebody didn’t visit Colombia and somebody didn’t visit Brazil.

If the conjunction could outscope the negation, then an explanation would have to be found for the availability of binding from a subject negative quantifier into one of the conjuncts (41).

- (41) No mother $_i$ praised her $_i$ child and the teacher.

Moreover, the additive focus particle *either*, which appears in negative environments and requires a negative antecedent, cannot be attached only to the second conjunct (42a) with the same meaning as the clausal conjunction in (42b), where the presence of *either* is required.

- (42) a. # He didn’t visit Colombia and Brazil either.
 b. He didn’t visit Colombia and he didn’t visit Brazil ?*(either).

Empirical evidence thus suggests that the wide scope conjunction is not what yields the ‘neither’ reading. We have already seen that the ‘not both’ reading is also not easily maintained

with a simple narrow scope conjunction, since an extra mechanism is needed to derive its obligatory implicature. In fact, the same mechanism can be employed to derive the ‘neither’ reading. This time, nevertheless, the set of alternatives contains only individual conjuncts, as reflected already in the shape of the preceding context.

3.3. Subdomain alternatives and recursive exhaustification

Sections (3.1.1) and (3.1.2) illustrate the requirement of negated conjunction with an unstressed connective for appropriate antecedents. Namely, members of the coordination have to be contextually salient for a sentence with focus marked on the second member of the conjunction under negation to be acceptable. Crucially, this enables activation of so-called subdomain alternatives $\neg C$ and $\neg B$ to the assertion with negated conjunction. Since the connective *and* is this time not marked by focus, the scalar alternative with the disjunction is not activated. The conjuncts *Colombia*, *Brazil* are not each F-marked either, but their contextual salience, as well as the fact that they can be retrieved from the assertion itself, allows them to enter the implicature computation. Crucially, the formation of subdomain alternatives does not rely on accessing the lexicon (unlike with scales). Again, once active, alternatives have to be exhausted. Although neither of the subdomain alternatives is entailed by the assertion (43), they do not make part of the set of innocently excludable alternatives ALT_{IE} , since negation of either of them in conjunction with the assertion would entail the other alternative, as demonstrated in section 2.3. This makes one application of EXH_{IE} vacuous (44).

- (43) a. $\neg(C \wedge B) \not\Rightarrow \neg C$
 b. $\neg(C \wedge B) \not\Rightarrow \neg B$

(44) $EXH_{IE} \neg(C \wedge B) = \neg(C \wedge B)$

Such a result is unsatisfactory, since the presence of focus marking on the whole conjunction does not lead to any meaning enrichment whatsoever. But EXH_{IE} can be applied recursively. The input for iterated exhaustification is the set $ALT_{EXH_{IE}}$ (45) containing an already exhausted assertion, but also subdomain alternatives which have undergone one round of exhaustification (46).

(45) $ALT_{EXH_{IE}} = \{\neg(C \wedge B), \neg C \wedge \neg(\neg B), \neg B \wedge \neg(\neg C)\}$

What makes up the set in (45)? The exhaustification of the assertion is vacuous (46a), as already shown. But this is not the case with subdomain alternatives: they are logically independent of each other, so the first application of EXH does have an effect, as shown in (46b) and (46c).

- (46) 1st round of exhaustification
 a. Assertion: $EXH_{IE} (\neg(C \wedge B)) = \neg(C \wedge B)$
 b. Subdomain alternative 1: $EXH_{IE} (\neg C) = \neg C \wedge \neg(\neg B)$
 c. Subdomain alternative 2: $EXH_{IE} (\neg B) = \neg B \wedge \neg(\neg C)$

We now have the input (45) for the second application of EXH_{IE} (47). The two rounds of exhaustification yield a strengthened, ‘neither’-like reading (47d). This is due to the fact that

exhaustified subdomain alternatives are stronger than the exhaustified assertion, so they get negated in the step in (47b). Logical equivalences allow the transformation of (47b) to (47c), and the latter is equivalent to a negated disjunction (47d).

(47) 2nd round of exhaustification

- a. $\text{EXH}_{IE}(\text{EXH}_{IE} \neg(C \wedge B)) = \text{EXH}_{IE} (\neg(C \wedge B)) \wedge \neg(\text{EXH}_{IE} \neg C) \wedge \neg(\text{EXH}_{IE} \neg B) =$
- b. $= \neg(C \wedge B) \wedge \neg(\neg C \wedge \neg(\neg B)) \wedge \neg(\neg B \wedge \neg(\neg C)) =$
- c. $= \neg(C \wedge B) \wedge (\neg C \rightarrow \neg B) \wedge (\neg B \rightarrow \neg C) =$
- d. $= \neg(C \vee B)$

Thus obtained strengthened meaning is equivalent to a conjunction of two negative statements, ‘He didn’t visit Colombia and he didn’t visit Brazil’. This means that the Homogeneity inference with negated conjunction comes about through the activation of alternatives and implicature computation, and not as a special presupposition. For this reason, the question in (48) is a felicitous follow up – namely, such locutions target implicatures computed in the grammar (Meyer, 2013).

- (48) Sue: He didn’t visit [Colombia and Brazil]^F $\neg C \wedge \neg B \Leftrightarrow \neg(C \vee B)$
 Mary: Are you saying that he visited neither?

Crucial ingredients of this proposal for deriving the strong reading of negated conjunction therefore are pre-exhaustified subdomain alternatives, in contrast to the pattern with focused *and*.

3.4. Summary

An exhaustification mechanism is needed to derive the readings of both of the prosodic patterns which constitute the minimal pair discussed in this paper. Presence of focus, on the connective or at the end of the conjunctive phrase, as well as contextual salience, activate different sets of alternatives. The difference between the two patterns then lies in the form of alternatives that are activated and the number of applications of the silent exhaustifying operator EXH.

Let us now show how this proposal draws and how it differs from the existing accounts of negated conjunction.

4. Definite conjunction in the literature

This section situates the current proposal for negated unstressed *and* in the context of research on definite conjunction, its relation to definite plurals, the behavior under negation, and two relevant approaches to these phenomena (Magri, 2014; Szabolcsi and Haddican, 2004).

4.1. Pluralities and Homogeneity

The behavior of negated definite conjunction with unstressed *and* was attributed to the Homogeneity inference. But the same effects have been observed for plural definites, which motivated a unified analysis (Hoeksema, 1983, 1988; Winter, 2001). Namely, definite conjunction (49a)

and plural definites (49b) both receive a universal/conjunction-like (49c) interpretation in positive contexts (49), but not in the scope of DE operators (50), where they display behavior of their weak scalemates and yield strong readings (50a, 50b), unlike the universals (50c).

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|------|----|---|------------------------------------|
| (49) | a. | He visited Colombia and Brazil. | \wedge |
| | b. | He visited the countries. | \forall |
| | c. | He visited both/each of the countries. | \forall |
| (50) | a. | He didn't visit Colombia and Brazil. | $\neg > \forall$ |
| | b. | He didn't visit the countries. | $\neg > \exists$ |
| | c. | He didn't visit both/each of the countries. | $\neg > \forall; * \neg > \exists$ |

Homogeneity is usually modeled as a presupposition, exemplified in (51).⁷

- (51) He visited Colombia and Brazil.
- 1 iff he visited both countries,
 - 0 iff he visited neither country,
 - # iff he visited one but not the other.

Crucially, it is possible to derive this inference using alternatives and exhaustification, which is what Magri (2014) proposes for plural definites, building on Spector (2007), as well as for definite conjunctions. The two implementations are different in that plural definites are assumed to have an existential-like basic semantics, which requires strengthening in UE contexts into a universal, whereas the take on unfocused *and* proceeds the opposite way. Namely, in an UE environment conjunction is already the strongest element, whence the parallelism with universals (49). However, in the scope of negation, a conjunction of definites needs to be strengthened from the 'not both' to the 'neither' reading. This is achieved via double exhaustification. Magri assumes that sentences with focused *and* and the ones with unfocused *and* under negation are scalar alternatives to each other, although there is a mutual entailment (52a). On the other hand, only focused *and* has the disjunction *or* as a scalar alternative (52b), according to him.

- (52) a. $\text{and}_F \Leftrightarrow \text{and}_{unF}$
 b. $\text{and}_F \Rightarrow \text{or}$

Magri derives Homogeneity of unstressed *and* in the scope of DE operators using only the alternatives defined in (52) and double exhaustification. For (50a) this roughly looks like (53).

- (53) $\text{EXH}(\text{EXH}(\neg(\text{Cand}_{unF}\text{B}))) = (\text{EXH}(\neg(\text{Cand}_{unF}\text{B})) \wedge \neg(\text{EXH}(\neg(\text{Cand}_F\text{B})))$
 $= \neg(\text{C} \wedge \text{B}) \wedge \neg(\neg(\text{C} \wedge \text{B})) \wedge \neg(\neg(\text{C} \vee \text{B})) = \neg(\text{C} \vee \text{B})$

⁷Homogeneity presupposition in Beck (2001) for distributive one-place predicates **P* and pluralities *A*:

- (1) a. $*P(A) = 1$ iff $\forall x[x \in A \rightarrow P(x)]$
 b. $*P(A) = 0$ iff $\forall x[x \in A \rightarrow \neg P(x)]$
 c. undefined otherwise

However, when unstressed *and* is inside non-monotonic environments, such as the scope of *exactly NP*, the Homogeneity inference disappears in the DE component of the non-monotonic meaning, given that the sentence is compatible with some of the other students visiting one or the other country (54). To remedy this, Magri introduces subdomain alternatives in the computation for unfocused *and* (54a), which eventually derives the attested interpretation (54c).

- (54) Exactly one student visited Colombia and_{unF} Brazil...
And two other students visited only one of them.
- a. EXH($\exists!$ [Cand_{unF}B]) = $\exists!$ [C \wedge B] \wedge $\neg\exists!$ C \wedge $\neg\exists!$ B
 - b. = ($\exists!$ [C \wedge B] \wedge $\neg\exists$ 2[C \wedge B]) \wedge $\neg(\exists$ 1C \wedge $\neg\exists$ 2C) \wedge $\neg(\exists$ 1B \wedge $\neg\exists$ 2B)
 - c. = (\exists 1[C \wedge B] \wedge $\neg\exists$ 2[C \wedge B]) \wedge \exists 2C \wedge \exists 2B

Notice that only subdomain alternatives are present in (54a) because the alternative with focused *and* ($\exists!$ [Cand_FB]) cannot be excluded, since it has the same meaning as the prejacent ($\exists!$ [Cand_{unF}B]). Crucially, the inclusion of subdomain alternatives would not affect the derivation for unstressed *and* in DE environments (55), as acknowledged by Magri.

- (55) a. EXH(EXH(\neg (Cand_{unF}B))) =
 b. = EXH(\neg (Cand_{unF}B) \wedge \neg (EXH(\neg (Cand_FB))) \wedge \neg EXH(\neg C) \wedge \neg EXH(\neg B))
 c. = \neg (C \wedge B) \wedge \neg (\neg (C \wedge B) \wedge \neg (\neg C \vee B)) \wedge \neg (\neg C \wedge \neg (\neg (C \vee B))) \wedge \neg (\neg B \wedge \neg (\neg (C \vee B)))
 d. = \neg (C \vee B)

But there is no need to entertain the set of ‘scalar’ alternatives by assuming that negated conjunctions with focused (*and_F*) and with unfocused *and* (*and_{unF}*) are alternatives to each other, if subdomain alternatives are sufficient to derive the right meaning. The absence of the alternative with focused *and* from the computation for unfocused *and* in non-monotonic environments (54a) gave a satisfactory result (54c) on Magri’s account. Moreover, it was already shown in section 3.3 that the computation for unfocused *and* in DE contexts yields the right result with subdomain alternatives only. Thus, the proposal layed out in this paper builds on Magri’s account and modifies it, capitalizing on the distinction between scalar and subdomain alternatives. I assume that focus on the connective *and* activates alternatives which consist of its scalemate *or*. However, when *and* is not focused, alternatives are formed out of constituents of the conjunctive structure. This creates the split between the two prosodic patterns – one uses only scalar alternatives in the implicature computation, whereas the other uses only subdomain. This is compatible with different requirements for contextual salience: when the connective is not stressed under negation, only individual conjuncts, ideally along with some other alternatives, should be contextually salient; when the connective is stressed, an identical conjunction without negation should be present in the preceding context. Just like Magri’s, the present proposal derives Homogeneity entirely through implicature computation, and without stipulating a presupposition. Unlike Magri’s account, no radical assumptions are made about what can enter the set of alternatives available to EXH – since the ‘real’ scalar alternative with *or* is not part the alternative set for unfocused *and* anyway, ‘lexical’ replacement with focused *and* should not be allowed, either.

4.2. 'Expected both'

Szabolcsi and Haddican (2004) draw attention to the competition between negated unstressed *and* (56), negated unstressed *or* (57) and *neither...nor* (58).

- (56) He didn't visit Colombia *and* Brazil.
 (57) He didn't visit Colombia *or* Brazil.
 (58) He visited neither Colombia *nor* Brazil.

The three sentences have the same truth-conditions, namely, they read 'neither' instead of 'not both'. According to Szabolcsi and Haddican (2004), the difference is that (56) in addition carries an expectation that the subject would visit both Colombia and Brazil. In (58) Colombia and Brazil are discourse salient and under discussion, but no expectation is present, according to them. (57) is the most neutral version, as it does not display any of these effects. They further observe that the 'neither' reading is more readily available for stereotypical pairs (59a), although it is possible to create a context in which seemingly unrelated conjuncts (59b) are expected to hold, making the unstressed *and* with its 'neither' reading acceptable.

- (59) a. Mary didn't take math and physics.
 b. Mary didn't take hockey and algebra.

It is unclear what produces this 'expectation' and Szabolcsi and Haddican (2004) explored different possibilities as the potential source of such a requirement: the Homogeneity presupposition, negation itself, and the competition between connectives (56–58). However, it turns out that there need not be any real expectation that an alternative should hold – it suffices that the conjuncts are invoked in the preceding context, as shown in section 3.1.1. Now, one might say that a speaker would not bring up something in a conversation, if there is no expectation regarding it. In other words, it is hard to 'get rid' of the 'expectation' effect whenever an alternative is explicitly made salient... Unless it is overtly negated. Interestingly, this does not preclude a sentence with a negated unstressed *and* (61), as shown with the preceding context in (60).

- (60) a. Bill: (I guess that) John went to Brazil (because he is learning Portuguese).
 b. Mary: He (certainly) didn't visit Colombia (because he hates Shakira).
 c. (Bill: But I'm sure he didn't miss Peru and the Machu Picchu!)
 (61) Sue: He didn't^{H*} visit [Colombia and Brazil]^{H*-L%}

This shows that the two conjuncts need not be 'expected' to render the predicate true, it suffices that they are made contextually salient. However the 'expectation' requirement might seem, it likely results from one step in the second application of EXH (62) which comprises a biconditional: if he did not visit Colombia then he did not visit Brazil and vice versa.

- (62) ... = $\neg(C \wedge B) \wedge (\neg C \rightarrow \neg B) \wedge (\neg B \rightarrow \neg C) = \dots$

The ‘expected both’ effect thus seems to be a mere by-product of an independently needed implicature computation. In fact, the same mechanism which is responsible for the Homogeneity inference is also responsible for the ‘expectation’ and for the fact that it only shows up in DE contexts. The present proposal reverses the cause and the consequence: it is not the ‘expectation’ that somehow licenses the ‘neither’ reading in English, but the other way around. Crucially, it is not modeled as a special presupposition. Finally, the absence of ‘expected both’ with negated unstressed *or* is due to the absence of exhaustification. Nevertheless, the current proposal draws on similarities between negated unstressed *and* and *neither...nor*. Showing how exactly these two constructions are related is left for some other occasion.

5. Conclusions and further issues

5.1. Make up of alternative sets

As emphasized in the previous section, the two readings of negated definite conjunction result from two different alternative sets and from simple or recursive exhaustification (63).

	ALT	EXH
(63) not...and _F	$\neg(C\vee B)$	$1\times$
not...and _{unF}	$\neg C, \neg B$	$2\times$

In the case of focused *and*, the presence of high pitch accent on the connective activates the lexical substitution mechanism by which *and* gets replaced with its scalemate *or*. This generates the so-called scalar alternative ($\neg(C\vee B)$), in line with the usual approaches to focus and implicature. The activation of individual conjuncts as alternatives is undetectable in this case, since they would not enter the set of innocently excludable alternatives anyway. Nevertheless, the absence of stress on the conjuncts, as well as the presence of the non-negated version of the same conjunction in the preceding discourse make it imaginable that the subdomain alternatives are left idle in this pattern.

As for the pattern with unfocused *and*, the connective does not bear high pitch accent and it is often phonologically reduced (*'nd*). This is one of the reasons why the lexical substitution mechanism for generating alternatives is deactivated this time. Crucially, generating subdomain alternatives means retrieving the individual conjuncts from the structure and does not require access to the lexicon, unlike activating $\neg(C\vee B)$. Moreover, they represent terminal nodes in a focus-marked constituent ($[Colombia\ and\ Brazil]_F$), and they have been explicitly mentioned in the context (Katzir, 2007; Fox and Katzir, 2011). Singh et al. (2016) argue that matrix disjunctive sentences in the adult grammar of English get strengthened in strikingly different ways depending on whether the set of alternatives is closed under conjunction – when it is, simple exhaustification renders the scalar implicature (‘not both’), but when it is not, recursive exhaustification produces conjunctive readings (Free Choice). Furthermore, it is claimed that contextual pruning of alternatives, by which certain alternatives from the formal set can be eliminated, is not available because it can only apply to a subset of relevant alternatives, and relevance is closed under conjunction. The case of negated unstressed conjunction is parallel, since relevance of subdomain alternatives ($\neg C, \neg B$) entails the relevance of the scalar alternative $\neg(C\vee B)$, due to the presence of negation and de Morgan’s equivalence ($\neg(C\vee B) \Leftrightarrow \neg C \wedge \neg B$) which provides the closure under conjunction. However, if the conjunctive alternative is not in the set of formal alternatives, relevance and closure under conjunction do not matter.

5.2. Stress placement and quality

This proposal refers only to stress placement as a factor in the generation of alternatives, and leaves stress quality out of the equation, which raises questions. Namely, the fall-rise contour on *and* remains unexploited, although there are accounts that go in the direction of attributing a more compositional status to it (Meyer, 2015). Moreover, it is unclear why L-H* on *and* is required for activating the scalar alternative in this case, and under which circumstances a simple H* on *and* would be fit for the job.

Similarly, is the focus, i.e. high pitch accent on the whole conjunction really necessary in the other pattern? Or could it be an instance of second occurrence focus, realized by stress, but without a high pitch accent (Büring, 2016)? It is also reminiscent of Focus-projection rules, which could go either way here, given that they concern heads and their arguments. Crucially, the presence of focus on the whole conjunction could be an instance of broad focus, which does not necessarily prevent activation of scalar alternatives (Fox and Spector, 2018). Alternatively, a default prominence approach could be invoked (Arregi, 2016).

One important point that has been neglected throughout this paper is that the negation bears stress in both of the examined patterns. But the stress on negation turns out to be vital because, when it is removed from the pattern with the fall-rise on *and*, the whole sentence yields the ‘neither’ reading!

(64) He didn’t visit Colombia and $L+H^*$ Brazil $L-H\%$ ‘neither’

This shows that the obligatory scalar implicature that underlies the ‘not both’ reading of negated conjunction is dependent on the presence of stress on negation. In fact, Chierchia (2004) observed this as an indirect implicature, but without discussing the prosody. Szabolcsi and Hadican (2004) also reported about the scalar implicature and attributed it to the presence of stress on *and*. What this paper adds is that (i) the focus on the connective should be realized as the fall-rise contour, and (ii) that the negation also needs to be stressed. The latter is actually unsurprising in light of the fact that the conjunction was already given in the context, so the new information (negation) is F-marked (Schwarzschild, 1999). What has also gone unnoticed is that the pattern with unstressed *and* and the ‘neither’ reading require stress on negation in addition, otherwise degradedness ensues. Again, this reflects the need for contextual antecedents, identified as the ‘expectation’: negation is F-marked as new information, and what follows is given. Due to this, both patterns fall under the notion of contrastive negation.

5.3. The Symmetry Problem

In the pattern with unstressed *and*, where subdomain alternatives are active, if $\neg B$ is present in the computation, then B should be, as well: it is no more complex than $\neg B$, it can be structurally derived, and it was contextually salient (Fox and Katzir, 2011). The same goes for $\neg C$ and C. Moreover, the set of relevant alternatives should contain symmetric alternatives of the kind, as relevance is closed under negation. But this would prevent EXH from giving any palpable result. The standard view on symmetry is that it can be broken only formally, and not in the context. Thus for some reason, stress on negation seems to have an effect on two problematic symmetries: the one involving conjunction and the one involving negation.

5.4. Trigger for (double) exhaustification

Exhaustification by a silent operator inserted in the syntax is sometimes considered a controversial mechanism, and recursive exhaustification more often so. For negated focused *and*, the ‘Only Implicature Generalization’ Fox (2007) could be invoked, by which the insertion of EXH mimics the association of an overt focus particle (*only*) to an F-marked constituent. The high pitch accent on the connective thus licenses the insertion of the EXH operator.

In the case of unstressed *and*, the situation is trickier because not one, but two rounds of exhaustification need to be justified. F-marking on the whole conjunction triggers exhaustification which is, unless iterated, without effect. Fox and Spector (2018) Economy Condition precludes incremental weakening of the meaning, which eventually yields global weakening: ‘an occurrence of EXH is globally weakening in a sentence S if eliminating it does not alter or strengthen truth conditions, i.e. if S(A) entails S(EXH(A))’. In our case, double exhaustification prevents global weakening of the meaning. Recursive exhaustification thus allows to produce an actual contribution to the meaning and eventually avoid semantic vacuity of both a whole prosodic pattern and an operation that comes with it. Moreover, it seems to be a more general tendency that activation of subdomain alternatives and their membership in the ALT_{IE} goes hand in hand with recursive exhaustification (the only exception that comes to mind are Negative Polarity Items, as in Chierchia (2013)).

Finally, Fox (2007) lays out a functional motivation for exhaustification: an EXH operator is inserted in order to eliminate unwanted ignorance inferences otherwise derived by Gricean reasoning. In other words, it strengthens the meaning. As shown in the accounts of the two patterns studied here, ignorance inferences can be eliminated, and the purpose of EXH is fulfilled. Similarly, Singh et al. (2016) do not assume that such an exhaustification mechanism is present by default, but that a preference for a parse with EXH exists in order to provide a complete answer to the Question Under Discussion, which seems like a plausible incentive in both of our patterns with negated conjunction.

References

- Arregi, K. (2016). Focus Projection theories. In C. Féry and S. Ishihara (Eds.), *Oxford Handbook of Information Structure*, pp. 185—202. Oxford University Press.
- Beck, S. (2001). Reciprocals are definites. *Natural Language Semantics* 9, 69–138.
- Büring, D. (2016). *Intonation and Meaning*. Oxford: Oxford University Press.
- Chierchia, G. (2004). Scalar implicatures, polarity phenomena and the syntax/pragmatics interface. In A. Belletti (Ed.), *Structures and Beyond*, pp. 39–103. Oxford University Press.
- Chierchia, G. (2013). *Logic in Grammar. Polarity, Free Choice, and Intervention*. Oxford: Oxford University Press.
- Fodor, J. D. (1970). *The linguistic description of opaque contexts*. Cambridge, MA: MIT Thesis.
- Fox, D. (2007). Free choice disjunction and the theory of scalar implicature. In U. Sauerland and P. Stateva (Eds.), *Presupposition and implicature in compositional semantics*, pp. 71–120. New York, NY: Palgrave-Macmillan.
- Fox, D. and R. Katzir (2011). On the characterization of alternatives. *Natural Language Semantics* 19(1), 87–107.

- Fox, D. and B. Spector (2018). Economy and embedded exhaustification. *Natural Language Semantics* 26(1), 1–50.
- Grice, P. (1989). *Studies in the Way of Words*. Cambridge, MA: Harvard University Press.
- Hoeksema, J. (1983). Plurality and conjunction. In A. G. B. t. Meulen (Ed.), *Studies in Modaltheoretic Semantics*, pp. 63–83. Foris.
- Hoeksema, J. (1988). The semantics of non-boolean AND. *Journal of Semantics* 6, 19–40.
- Horn, L. (1972). *On the semantic properties of the logical operators in English*. Los Angeles, CA: UCLA Thesis.
- Katzir, R. (2007). Structurally-defined alternatives. *Linguistics and Philosophy* 30, 669–690.
- Krifka, M. (1995). The semantics and pragmatics of polarity items. *Linguistic Analysis* 25, 209–257.
- Krifka, M. (2007). Basic notions of information structure. In C.Féry and M.Krifka (Eds.), *Interdisciplinary Studies on Information Structure* 6, pp. 13–55. Potsdam: Universitätsverlag.
- Löbner, S. (1987). The Conceptual Nature of Natural Language Quantification. In I. Rusza and A. Szabolcsi (Eds.), *Proceedings of the '87 Debrecen Symposium on Logic and Language*, Budapest. Akadémiai Kiadó.
- Magri, G. (2014). An account for the homogeneity effects triggered by plural definites and conjunction based on double strengthening. In S. P. Reda (Ed.), *Pragmatics, Semantics and the Case of Scalar Implicatures*, pp. 99–145. Palgrave-Macmillan.
- Meyer, M.-C. (2013). *Ignorance and Grammar*. Cambridge, MA: MIT Thesis.
- Meyer, M.-C. (2015). Redundancy and embedded exhaustification. In S. D'Antonio, M. Moroney, and C.-R. Little (Eds.), *Semantics and Linguistic Theory (SALT)*, Volume 25, Stanford University, pp. 491–511. LSA and CLC Publications.
- Rooth, M. (1985). *Association with Focus*. Amherst, MA: University of Massachusetts.
- Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics* 1, 75–116.
- Sauerland, U. (2004). Scalar implicatures in complex sentences. *Linguistics and Philosophy* 27, 367–391.
- Schein, B. (1986). *Event Logic and the Interpretation of Plurals*. Cambridge, MA: MIT Thesis.
- Schwarzschild, R. (1994). Plurals, presuppositions and the sources of distributivity. *Natural Language Semantics* 2(3), 201–248.
- Schwarzschild, R. (1999). Givenness, avoidf and other constraints on the placement of accent. *Natural Language Semantics* 7(2), 141–177.
- Singh, R., K. Wexler, Astle-Rahim, K. Andrea, Deepthi, and D. Fox (2016). Children interpret disjunction as conjunction: Consequences for the theory of scalar implicature. *Natural Language Semantics* 24, 305–352.
- Spector, B. (2007). Aspects of the pragmatics of plural morphology: On higher-order implicatures. In U. Sauerland and P. Stateva (Eds.), *Presuppositions and Implicatures in Compositional Semantics*. Palgrave-Macmillan.
- Szabolcsi, A. and B. Haddican (2004). Conjunction meets Negation: A Study in Cross-linguistic Variation. *Journal of Semantics* 21(3), 219–249.
- Winter, Y. (2001). *Flexibility Principles in Boolean Semantics*. Cambridge, Massachusetts: MIT Press.