A Grammatical View of Exhaustification with Focus Movement: Evidence from NPI-Licensing[1]

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Abstract. This paper offers an explanation to the NPI-licensing effect of *only* by incorporating focus movement into the grammatical view of exhaustification. The core assumption is that focus movement is motivated if interpreting focus in-situ yields a G-triviality/contradiction.

Keywords: NPI, Focus movement, Exhaustification, Alternative Semantics, *Only*

1. Introduction

It is well-known that the emphatic expression *any* is licensed as a (weak) negative polarity item (NPI) under downward-entailing (DE) contexts (Fauconnier 1975, 1979; Ladusaw 1979), such as under negation or in the left argument of a universal quantifier, as exemplified in (1) and (2), respectively. A context is DE if it supports a downward inference; for instance, observe in (3) that a downward inference holds from a set to its subset in the left argument of the universal quantifier *every*, but not in the left argument of the existential quantifier *some*.

(1) a. John didn't read any papers.
    b. *John read any papers.

(2) a. Every student who has read any papers passed the exam.
    b. *Every student who has read some papers passed any exams.
    c. *Some student who has read any papers passed the exam.

(3) a. Every *student* passed the exam. $\rightarrow$ Every *smart student* passed the exam.
    b. Some *student* passed the exam. $\not\rightarrow$ Some *smart student* passed the exam.

The DE-based account is schematized as in (4), adopted from von Fintel (1999) and Gajewski (2007).[2]

(4) a. An NPI is grammatical iff it appears in a constituent that is DE w.r.t. this NPI.
    b. A constituent **A** is DE w.r.t. α of type δ iff the function $\lambda x.[\![\mathbf{A}[\alpha/\mathbf{v}_\delta]]\!]^{g[v_\delta \rightarrow x]}$ is DE.
    $[\mathbf{A}[\alpha/\mathbf{v}]$ is the result of replacing α with $\mathbf{v}$ in $\mathbf{A}.]$

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[2]'$\subseteq$' stands for cross-categorical entailment (von Fintel 1999).

(1) a. For p, q of type t: $p \subseteq q$ iff p is false or q is true.
    b. For f, g of type $<\sigma,\tau>$: $f \subseteq g$ iff for all x of type σ: $f(x) \subseteq g(x)$.
    In particular, for a, a' of type e: $a \subseteq a'$ iff for all P of type $<e,t>$: $\lambda P.P(a) \subseteq \lambda P.P(a')$.

c. A function f of type $<\sigma,\tau>$ is DE iff for all x and y of type σ s.t. $x \subseteq y$: $f(y) \subseteq f(x)$.

Klima (1964) firstly observed that the exclusive focus particle *only* can license NPIs. The emphatic expression *any*, for instance, can be licensed as an NPI in the right argument of NP-*only* or in the immediate scope of VP-*only*. Here and throughout the paper, I use CAPITAL letters to mark stressed items, and the F subscript to mark the semantic focus.

(5) Right argument of NP-*only*
   a. Only JOHN$_F$ read any papers.
   b. *JOHN$_F$ read any papers.

(6) Under VP-*only*
   a. Mary only gave any funding to JOHN$_F$.
   b. *Mary gave any funding to JOHN$_F$.

One empirical constraint for the NPI-licensing effect of *only* is that NPIs cannot appear within the semantic focus or any focus (F)-contained island (Wagner 2006 a.o.). In particular, NP-*only* does not license NPIs in its left argument, as shown in (7); and VP-*only*, for instance, cannot associate with or into an *any*P, as shown in (8): when VP-*only* directly associates with the determiner *any*, the entire DP *any paper*, or simply the NP complement *paper*, the NPI use of *any* is not licensed.

(7) *Only any students saw John.

(8) a. *John only read ANY$_F$ papers.
   b. *John only read [any PAPERS]$_F$, (he didn't read every book).
   c. *John only read any PAPERS$_F$, (he didn't read any books).

(8c) also illustrates the inviability of associating *only* into an NPI-contained island. According to Abels (2003), the complement of a phasal head (e.g. the D^0 *any*) cannot move by itself and strand its embedding phrase head; it always pied-pipes its phasal head. Therefore, the *any*P in (8c) exhibits an island effect, to the extent that *PAPERS* cannot be moved out of the *any*P.

The remainder of this paper is organized as follows. Section 2 and 3 will show that neither the F(ocus)-movement theory (Wagner 2006) nor the G(rammatical)-view of exhaustification can properly address the NPI-licensing effect of *only* by its own. Thus Section 4 will propose an alternative approach that incorporates features of both theories, built up upon an assumption that F-movement is motivated by the requirement of avoiding G-trivialities/contradictions.

2. The theory of F-movement

2.1. The SDE-condition

The invalidity of downward inferences under *only*, firstly indicated by Atlas (1993), casts a doubt to Fauconnier-Ladusaw's DE-based account of NPI-licensing. While the right argument of NP-*only* and the non-F-associated part of VP-*only* are eligible positions for licensing weak NPIs, these contexts do not support downward inferences, as shown in (9).

(9) a. Only JOHN$_F$ ate vegetables for breakfast . $\not\rightarrow$ Only JOHN$_F$ ate kale for breakfast.
b. John only ate VEGETABLES$_F$ for breakfast. $\not\rightarrow$ John only ate KALE$_F$ for breakfast.

Given this problem, von Fintel (1999) proposes that S(trawson)DE environments are sufficient for licensing weak NPIs. The SDE condition, as schematized in (10), grants all presuppositions of the consequence when the validity of a downward inference is assessed. Further, von Fintel (1999) shows that *only* is an SDE function: the complement of *only* is DE when the prejacent presupposition is satisfied, as illustrated by the reasoning in (11).

(10) A function f of type $<\sigma,\tau>$ is SDE iff
for all x and y of type σ such that $x \subseteq y$ and $f(x)$ is defined: $f(y) \subseteq f(x)$.

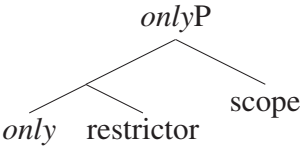
(11)

Kale is a vegetable.	$x \Rightarrow y$
John ate kale for breakfast.	$f(x)$ is defined
Only John ate vegetables for breakfast.	$f(y)$
$\therefore$ Only John ate kale for breakfast	$\therefore f(x)$

2.2. Wagner (2006)

Recall that *only* cannot license the NPI *any* when associated with or into the *any*P. The SDE condition, nevertheless, still cannot capture the asymmetry between the F-associated part and the non-F-associated part in the scope of *only*. To explain this asymmetry, Wagner (2006) adopts the SDE condition and proposes a theory of F(ocus)-movement.

Wagner assumes that *only* has two syntactic arguments, a syntactic restrictor and a scope. In particular, *only* is SDE in its the scope but not in its restrictor. For instance, when the prejacent presupposition of *only* is granted, a downward inference is supported in (12) but not in (13).



(12) Kale is a veg.
John ate kale.
Only JOHN$_F$ ate *vegs*.
$\therefore$ Only JOHN$_F$ ate *kale*

(13) Graduates are students.
Graduates ate kale.
Only *STUDENTS*$_F$ ate kale.
$\not\rightarrow$ Only *GRADUATES*$_F$ ate kale.

Further, Wagner assumes that VP-*only* association invokes a covert phrasal movement of the focused expression to the restrictor of *only*. For cases where *only* associates into an island, he assumes that F-movement is island-sensitive (cf. Rooth 1985; among the others) and that the expression undertaking F-movement is the minimal F-contained island (Drubig 1994). For instance, what gets F-moved in (14a) and (14)b should be the complex DP and the *when*-clause, respectively. This assumption predicts an *Island Restriction*: "Association with a constituent within an island cannot license an NPI in the same island." (Wagner 2006: 312)

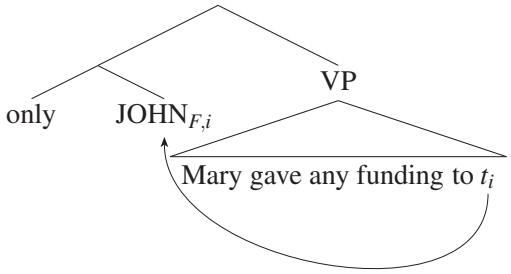
Moreover, since F-movement is a phrasal movement, this assumption also predicts a *Head Restriction*: "If *only* associates with the head of a constituent, it does not license an NPI in the complement of the head." Wagner (2006: ex. 42) For instance in (15), the F-moved element has to be the entire VP, including the *any*P.[3]

(14) a. Dr. Smith only rejected [the proposal that JOHN$_F$ submitted].
b. Dr. Smith only complains [when BILL$_F$ leaves the lights on].

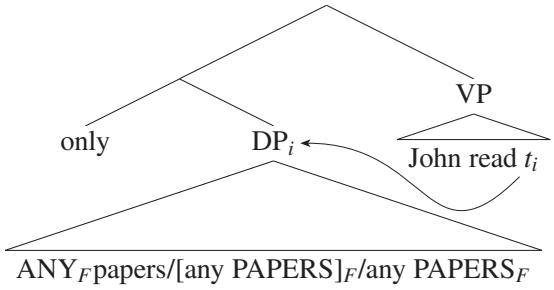
(15) *John only CUT$_F$ any vegetables.

This analysis immediately predicts that an NPI is not licensed in the immediate scope of VP-*only* if and only if this NPI appears within the F-moved constituent. This prediction is fully compatible with the observations with the VP-*only* in (6) and (8). In (6a), the focused NP moves alone to the restrictor of *only*, while the NPI *any* stays and gets licensed within the scope part, as illustrated in (16a). As for the ungrammatical sentences in (8), in contrast, the NPI *any* is part of the F-moved constituent and therefore is not licensed, as illustrated in (16b).[4]

(16) a. NPI is licensed



b. NPI is not licensed



2.3. Problems with the F-movement theory

2.3.1. NPI-licensing condition

Like the predecessors, Wagner (2006) does not explain why NPIs are not licensed in non-(S)DE contexts; saying that NPIs must appear in (S)DE contexts is still a description.[5] What's more,

[3]Jon Gajewski points out an insufficiency of this explanation to Wagner (2006: fn. 14): the object *any*P should be allowed to vacate the VP, and the remnant VP subsequently associate with *only*.

[4]In (8), the F-moved expression has to be the entire *any*P, regardless of whether *only* associates with the entire *any*P or with a sub-component of the *any*P. On the one hand, the D^0 *any* alone cannot take an F-movement, which is a phrasal movement. On the other hand, according to Abels (2003), the complement of D^0 cannot be moved out of the DP; therefore, when the NP complement of *any* is forced to take F-movement, the entire *anyP* gets F-moved.

[5]Hsieh (2012) develops an explanation to the NPI-licensing effect of *only* based on Wagner (2006). But it inherits the problems of the SDE condition and Wagner (2006).

recent works on NPIs point out empirical problems with the SDE condition and criticize that SDE is neither necessary nor sufficient for NPI-licensing. On the one hand, as Crnič (2011) indicates, another prototypical F-sensitive expression *exactly two* can also license NPIs in its left argument, but *exactly two* is non-presuppositional and hence cannot be SDE; therefore the SDE condition is unnecessary for NPI-licensing. On the other hand, the SDE condition appears to be insufficient. For instance, the left arguments of DPs like *the student* and *both students* are SDE, but these positions do not license NPIs, as shown in (18) (Gajewski 2011, Chierchia 2013).

(17) Exactly two students did any reading at all.

(18) a. * The student who had any linguistics did well.
   i. Presupposition: $|\text{students}_w| = 1$ ii. Assertion: $\text{students}_w \subseteq \text{did well}_w$
   b. * Both students who had any linguistics did well.
   i. Presupposition: $|\text{students}_w| = 2$ ii. Assertion: $\text{students}_w \subseteq \text{did well}_w$

2.3.2. Motivation of F-movement

Wagner (2006) argues that *only* presupposes an ∃-premise rather than the truth of its prejacent (Horn 1996, cf. Horn 1969). He schematizes the lexical entry of *only* as in (19), where the arguments f and P correspond to the syntactic restrictor/complement and the scope, respectively. The ∃-presupposition (19b) abstracts over the entire complement of *only*. Accordingly, (20) and (21) have the same semantic focus but different ∃-presuppositions. Here Wagner uses underlining to mark the syntactic complement/restrictor of *only*, ⌜corner symbols⌝ to mark the scope of *only*, and *italics* to mark the semantic focus.

(19) a. $[\![\text{only}]\!](f)(P) = \forall a \in C[P(a) \rightarrow P(f) \subseteq P(a)]$
   b. Presupposition: $\exists x.P(x)$

(20) With F-movement:
   a. John only ⌜played *basketball*⌝.
   b. Presupposition: ∃*x*. John played *x*.

(21) Without F-movement:
   a. John only ⌜played *basketball*⌝
   b. Presupposition: ∃*x*. John *x*-ed.

Next, adopting the *Maximize Presupposition Principle* from Heim (1991), Wagner assumes that F-movement is motivated to strengthen the ∃-presupposition of *only*: "F-movement minimizes the size the of the syntactic restrictor, which may have an effect on the strength of the statement that is grammatically encoded by the sentence." (Wagner 2006: 314) For instance, the ∃-presupposition of *only* in (20) is stronger than the one in (21), motivating an F-movement.

I argue that the motivation of F-movement and the semantics of *only* proposed by Wagner have two empirical problems. First, the semantics of *only* defined in (19) is too weak for cases like (22). It predicts (22) to be felicitous and true even if only John ate kale. To correctly predict the meaning of

(22), Wagner would have to assume that *only* presupposes not just an existential inference but also the truth of its prejacent. Such a move, however, would make the MP Principle inapplicable: the ∃-presupposition, regardless of its strength, collapses under the prejacent presupposition; therefore, the F-moved form (20) would not be more preferable than the unmoved form (21).

(22) Only [John and Mary]$_F$ ate kale.
   a. Presupposition: Someone ate kale.
   b. Assertion: Anyone who ate kale is part of *John+Mary*.

Second, the assumed motivation of F-movement is incompatible with the basic example (15), repeated in (23). Accordingly, with or without F-movement, the syntactic complement of *only* in (23) is always the entire VP, and the ∃-presupposition is always (23a); therefore, if F-movement were used only to strengthen the ∃-presupposition, it would NOT be motivated in (23).

(23) *John only ⌜ CUT$_F$ any vegetables⌝.
   a. Presupposition: ∃*x*. John *x*-ed.
   b. Assertion: If John did any action to any vegetables, that action is no more than cutting.

Further, a sentence of the form "John only CUT$_F$ *x*" is not just SDE but also strict DE with respect to *x*: it is SDE because the downward inference holds in the asserted part ((24a-ii) entails (24b-ii)); it is strict DE because the ∃-presuppositions of (24a-b) are identical.[6] Therefore, Wagner cannot explain the ungrammaticality of (23), regardless of which NPI-licensing condition he adopts.

(24) a. John only ⌜ CUT$_F$ vegetables⌝
      i. Presupposition: John did something.
      ii. Assertion: If John did any action to vegetables, that action is no more than cutting.
   b. ⇒ John only ⌜ CUT$_F$ kale⌝
      i. Presupposition: John did something.
      ii. Assertion: If John did any action to kale, that action is no more than cutting.

In addition to the empirical problems, the ∃-presupposition is defined unconventionally: it abstracts over the entire complement of *only*, not just the semantic focus (cf. Horn 1996). To this extent, the ∃-presupposition is isolated from other major semantic properties of focus, such as the semantic focus or the quantificational domain,[7] which makes the lexicon of *only* quite inconsistent.

[6] Wagner (2006: ex. 44b) himself writes the presupposition of (24b) as "John did something with kale", which however conflicts with his main assumption that the existential import abstracts over the entire complement of *only*.

[7] Wagner (2006) assumes that the semantic focus is obtained by contextually restricting the alternative set: alternatives to the entire syntactic complement are all considered; but the quantificational domain is contextually restricted, which helps to identify the semantic focus.

This inconsistency cannot be fixed under Wagner's basic framework. On the one hand, if the ∃-presupposition is generated by abstracting over the semantic focus, its strength would not be affected by F-movement. On the other hand, if the quantificational domain is generated by abstracting over the complement of *only*, exhaustification would lead to overly strong interpretations for sentences where *only* associates into an island. For instance in (25), due to the Left-Branch Extraction Constraint (Ross 1986), an F-movement theory requests the entire possessive NP *JOHN's advisors* to be F-moved. If the quantificational domain includes all the contextually relevant individuals, not just individuals that are someone's advisors, (25) would take the overly strong reading in (25b).

(25) Sue only ⌜ invited JOHN$_F$'s advisors ⌝.
   a. → Sue didn't invite **anyone's advisors** except John's advisors.
   b. ↛ Sue didn't invite **anyone** except John's advisors.

2.3.3. Association with licensed NPIs

Recall Wagner's prediction that an NPI is not licensed under *only* if it is part of the F-moved constituent. Conjoining this prediction with his claim that F-movement is mandatory for VP-*only* association, we get a stricter constraint stated as follows: VP-*only* cannot associate with an NPI or an NPI-contained island within which the NPI is not licensed. This constraint, however, is too strong for cases like (26), where *only* associates with the *any*P across another NPI-licenser (i.e. the clause-mate negation); the stricter constraint predicts (26) to take the LF in (27), under which the NPI *any* would not be licensed: the *any*P, as the minimal F-contained island, would be moved to the syntactic restrictor of *only*, a context that is non-SDE and cannot license NPIs.

(26) Mary only didn't give [any FUNDing]$_F$ to John. (She did her best to help him.)

(27) [only (any funding)$_i$ [Mary didn't gave t_i to John]] (×)

3. The G-view of exhaustification

3.1. The G-view of scalar implicatures

The G-view of exhaustification (Chierchia 2004; among the others) is firstly introduced to analyze scalar implicatures (SIs henceforth). This view argues that the phenomenon of SI is not purely pragmatic, based on the fact that SIs can be generated in embedding contexts.

The main idea of the G-view is as follows. First, propositions containing scalar items are associated with sets of alternatives, which are computed point-wise in the same way as the answer sets of questions (Hamblin 1973) and the alternative sets of focus (Rooth 1985, 1992). Next,

alternatives keep growing until factored into meaning via a covert exhaustivity operator O. The O-operator affirms the prejacent and negates all the alternatives that are not entailed by the prejacent, as schematized in (28).[8] Accordingly, an SI is a logic consequence of exhaustifying a sentence that contains a weak scalar item. For instance in (29), applying an O-operator over the *some*-sentence (notation: ϕ_{SOME}) affirms the prejacent ϕ_{SOME} and negates the stronger alternative ϕ_{ALL}, yielding the implicature $\neg\phi_{\text{ALL}}$.

(28) $O(p) = p \wedge \forall q \in \text{ALT}(p)[p \not\subseteq q \rightarrow \neg q]$

(29) a. Some of the students came. $\rightsquigarrow$ Not all of the students came.
b. $\text{ALT}(\phi_{\text{SOME}}) = \{\phi_{\text{SOME}}, \phi_{\text{ALL}}\}$
c. $O(\phi_{\text{SOME}}) = \phi_{\text{SOME}} \wedge \neg\phi_{\text{ALL}}$

3.2. The G-view of NPIs

Chierchia (2006, 2013) extends the G-view of SIs to the issue of NPI-licensing with assumptions compatible with the Alternative Semantics (Rooth 1985, 1992, 1996) and the strict DE condition. He proposes that the NPI *any* is an existential indefinite like *some* but encoded with a grammatical feature [D]. This feature obligatorily activates a set of domain (D)-alternatives and must be checked off by a c-commanding O_D-operator.[9] Exercising an O_D-operator over a sentence containing an occurrence of *any* has consequences in both syntax and semantics: in syntax, it checks off the [D] feature in the lexicon of *any*, just like a regular feature-checking operation; in semantics, it affirms the assertion and negates D-alternatives that are not entailed by the assertion.

Consider the basic positive sentence (30) to see how the G-view captures the DE condition of NPI-licensing. With an indefinite $\exists$-expression *any*, (30) asserts the $\exists$-inference in (31b). Moreover, the [D] feature of *any* activates a set of D-alternatives, generated by substituting the total domain D with a subdomain D', as schematized in (31c). Crucially, the monotonicity pattern of the entire clause with respect to the NPI *any* is upward-entailing (UE), and hence the proper D-alternatives are not entailed by the assertion. Last, applying O_D negates all the proper D-alternatives, yielding

[8] Here and throughout the paper, the symbols O and p are sloppily used for both syntactic phrases and truth conditions. A stricter semantic representation for O is as follows, where S is the immediate c-commanded phrase of O.

(1) $[\![\overbrace{O \quad S}]\!]^{w,g} = [\![S]\!](w) \wedge \forall S' \in \text{ALT}(S)[[\![S]\!] \not\subseteq [\![S']\!] \rightarrow \neg[\![S']\!](w)]$

[9] A schematic example for the total domain D and its corresponding D-alternative sets is as follows. The the proper D-alternative set does not include the prejacent.

(1) a. Total-D: $\{a,b\}$ Assertion $= \exists x \in \{a,b\} f(x)$
b. Sub-D: $\{a,b\},\{a\},\{b\}$ D-ALT $= \{\exists x \in \{a,b\} f(x), \exists x \in \{a\} f(x), \exists x \in \{b\} f(x)\}$
c. Proper sub-D: $\{a\},\{b\}$ Proper D-ALT $= \{\exists x \in \{a\} f(x), \exists x \in \{b\} f(x)\}$

the exhaustivity inference (31d), which however contradicts to the assertion (31b), as shown in (31e). This contradiction is the source of the ungrammaticality of (30).[10]

(30) *John read any papers.

(31) a. O_D [John read any$_D$ papers]
b. Assertion: $\exists x \in D[P(x) \wedge R(j,x)]$
(John read some papers in the total domain D)
c. D-ALT = $\{\exists x \in D'[P(x) \wedge R(j,x)] \mid D' \subseteq D\}$
d. $\forall D'[D' \subset D \rightarrow \neg\exists x \in D'[P(x) \wedge R(j,x)]]$
(for any proper subdomain D', John read no paper in D')
e. $[\![(31a)]\!] = [\![(31b)]\!] \wedge [\![(31d)]\!] = \bot$
(# John read some papers in D, but he read no paper in any proper sub-domain D')

The contradiction in (31e) is essentially different from the one in (32). The one in (31e) makes (30) ungrammatical, while the one in (32) makes the utterance infelicitous but not ungrammatical. To tell them apart, Chierchia (2013) adopts the notions from Gajewski (2002) and describes the contradiction in (31e) as "G(rammatical)-triviality", a special case of L(ogical)-triviality.[11]

(32) # It is raining and it isn't raining.

Under the G-view, the contradiction in (31e) can be avoided if the O_D-operator is applied *immediately* over a constituent that is DE with respect to the NPI *any*. Consider the basic negative sentence (33) for example. By virtue of negation, all the D-alternatives are entailed by the assertion and therefore unexcludable. The O_D-operator, although is mandatorily present for the sake of checking off the grammatical feature [D], is semantically vacuous.

(33) John didn't read any papers.

(34) a. O [John didn't read any$_D$ papers]

[10] Consider the following mini model for a simpler illustration of this idea. Assume that the total domain D contains exactly two items, paper $p1$ and paper $p2$. The D-alternative set is thus schematized as in (1b), containing exactly three elements: the asserted proposition *John read a paper in* $\{p_1, p_2\}$ and the proper D-alternatives including *John read a paper in* $\{p1\}$ and *John read a paper in* $\{p2\}$. The proper D-alternatives are not entailed by the assertion. Therefore, applying an O_D-operator affirms the assertion and negates both proper D-alternatives, yielding the contradictory inference *John read* p_1 *or* p_2*, and he did not read* p_1*, and he did not read* p_2, as schematized in (1c).

(1) a. $D = \{p_1, p_2\}$
b. D-ALT $= \{R(j,p_1) \vee R(j,p_2), R(j,p_1), R(j,p_2)\}$
c. $R(j,p_1) \vee R(j,p_2) \wedge \neg R(j,p_1) \wedge \neg R(j,p_2) = \bot$

[11] L-trivialities are tautologies or contradictions in the traditional sense. While G-triviality means that a sentence receives the same value regardless of how the lexical terminals are replaced in the structure. For the purpose of this paper, it is enough to vaguely understand "G-triviality" as a type of L-triviality assessed at the grammatical level.

b. Assertion: $\neg\exists x \in D[P(x) \wedge R(j,x)]$
(John read no paper in the total domain D.)
c. D-ALT = $\{\neg\exists x \in D'[P(x) \wedge R(j,x)] \mid D' \subseteq D\}$
d. $[\![(33a)]\!] = [\![(33b)]\!] = \neg\exists x \in D[P(x) \wedge R(j,x)]$
(John read no paper in the total domain D.)

3.3. Extending the G-view to *only*

Krifka (1995), Lahiri (1998), and Chierchia (2013) extend the G-view of NPIs to the exclusive focus particle *only*. They adopt the lexical entry of *only* from Horn (1969), which assumes that *only* asserts an exhaustivity inference and presupposes the truth of its prejacent. The non-F-associated part of the asserted exhaustivity inference, crucially, is DE and hence is capable of licensing NPIs.

Under the schematic notations in Chierchia (2013), the *only*-sentence (35) takes the LF in (36a). This LF has two exhaustification operators, O_D and *only*, checking off the [D] feature of *any* and the [F] feature of the semantic focus, respectively. The prejacent presupposition and the asserted exhaustivity inference are schematized as in (36b) and (36c), respectively. The D-alternatives are generated from the assertion by replacing the total domain D with a subdomain D', as in (36d).

(35) Only JOHN read any papers.

(36) a. O_D [only [JOHN$_F$ read any$_D$ papers]]
b. Presupposition: $\exists x \in D[P(x) \wedge R(j,x)]$
(John read some paper in the total domain D.)
c. Assertion: $\forall y \in D_e\ [\underline{\exists x \in D[P(x) \wedge R(y,x)]} \rightarrow j \subseteq y]$
(For any individual y, if y read a paper in the total domain D, then y is John.)
d. D-ALT = $\{$only [JOHN$_F$ read any$_{D'}$ paper] : $D' \subseteq D$ $\}$
$= \{\forall y \in D_e\ [\exists x \in D'[P(x) \wedge R(y,x)] \rightarrow j \subseteq y] \mid D' \subseteq D\}$

The presupposed component (35b), as firstly argued by Gajewski (2011) and extended by Chierchia (2013), is irrelevant for assessing the [D] feature of a weak NPI like *any*.[12] The asserted component (36c) is DE with respect to the non-F-associated part (underlined), where the NPI *any* appears. Therefore, the NPI *any* is licensed in (35), as it would be in any DE contexts.

[12] Gajewski (2011) proposes that presuppositions and implicatures are relevant only for assessing the [D] feature of strong NPIs, not for that of weak NPIs. This proposal captures the contrast between weak NPI-licensing and strong NPI-licensing under *only*. For instance, *only* does not license the strong NPI *in years* in the non-F-associated part.

(1) *Only JOHN came in years.

The prejacent presupposition of *only* is purely UE, which, togethers with the asserted exhaustivity inference, makes the entire *only*-clause non-monotonic with respect to the strong NPI *in years*. Therefore, applying O_D to assess the [D] features in the presupposition and assertion yields a contradiction, making the strong NPI unlicensed.

In sum, the G-view provides an explanation to the DE condition of NPI-licensing: checking off the [D] feature of an NPI with a covert O_D-operator yields a contradiction/G-triviality iff the O_D-operator is applied immediately over a constituent that is non-DE with respect to this NPI. As for case of *only*, the G-view shows that the assertion of an *only*-clause is DE in the non-F-associated part, which therefore gets (weak) NPIs licensed.

3.4. Problems with the G-view

The G-view, however, is not the best solution. As a successor of Roothean Alternative Semantics, the G-view assumes that focus is interpreted in-situ and that F-alternatives are propositional. For both NP-*only* and VP-*only*, the G-view defines their quantificational domains as proposition sets.

(37) $[\![\text{only}]\!](p) = \forall q \in ALT(p)[q \rightarrow p \subseteq \boxed{q}]$

Nevertheless, the assumption that F-alternatives is propositional conflicts with the fact that *only* licenses weak NPIs. In (37), we can easily see that the boxed position for $\boxed{q}$ is non-DE. To be more accurate, consider a stricter schematic representation for the asserted component of the *only*-sentence (35). If the F-alternatives were propositional, then the asserted component of (35) would be schematized as follows.

(38) $\forall q \in \{\exists x \in D[P(x) \wedge R(y,x) \mid y \in D_e\}[\boxed{q} \rightarrow \boxed{\exists x \in D[P(x) \wedge R(j,x)]} \subseteq \boxed{q}]$

Here the quantificational domain of *only* is characterized as a set of propositions in the form of "*y* read a paper in the total domain *D*", where *y* is a contextually relevant individual. This schematic representation has three positions relevant to the assessment of the [D] feature (namely, containing an occurrence of *any*), each marked with a box. The first boxed position, as the restriction of a $\forall$-quantification, is DE; but the latter two boxed positions, as within the scope of the $\forall$-quantification, are UE. Therefore, under this representation, the entire assertion would be non-monotonic with respect to *any*, which however incorrectly predicts the NPI *any* to be unlicensed in (35).

Thus, to capture the NPI-licensing effect of *only*, the G-view has to give up its own convention and write the quantificational domain of *only* as a set of individuals, as we have seen in (35c), where only the restriction part of the $\forall$-quantification is relevant to the assessment of the [D] feature.

4. My analysis: grammatical view of exhaustification with F-movement

Wrapping things up, neither the F-movement theory nor the G-view can properly address the NPI-licensing effect of *only* on its own. On the one hand, the F-movement theory is lacking of an explanation to the NPI-licensing condition. On the other hand, the G-view does provide a plausible explanation to the licensing condition, but this explanation is viable only if the theory supports an operation (e.g. F-movement) that can split up the c-commanding domain of *only* and create a DE-

context. In such a case, a natural move would be to incorporate F-movement into the G-view. To integrate F-movement with the G-view, the only needed assumption is as follows.[13][14]

(39) **Motivation of F-movement**
The requirement of avoiding G-trivialities motivates F-movement.

The rest of this section is organized as follows. Section 4.1 to 4.3 will focus on three basic cases. Case 1 covers sentences without NPIs or with NPIs that are licensed by operators other than *only*. Discussions on Case 2-3 will explain the NPI-licensing effect of *only*, in particular, why *only* licenses NPIs, and why NPIs cannot appear within the semantic focus or an F-contained island. In section 4.4, I will move onto the so-called "Head Restriction".

4.1. Case 1: F-movement is not motivated

Under the motivation of F-movement assumed above, focus should be interpreted in-situ as long as interpreting it in-situ does not yield a G-triviality/contradiction. For instance in (40), the NPI *any* can be licensed in-situ by the clause-mate negation and hence the focus does not need to move.

(40) Mary only didn't give any$_D$ funding to JOHN$_F$
Only O_D **not** [Mary gave any$_D$ funding to JOHN$_F$]

Under the present analysis, F-movement is not motivated in (41), because interpreting focus in-situ does not yield a contradiction.

(41) Mary only didn't give [any FUNDing]$_F$ to John. She did her best to help him.

When focus is interpreted in-situ, F-alternatives are propositional. The asserted meaning of VP-*only* can be schematized as in (42), à la Rooth 1985. Here p stands for the complement of VP-*only*. $[\![p]\!]_f$ and $[\![p]\!]_0$ correspond to the *focus value* of p and the *ordinary value* of p, respectively.[15]

[13] It is worthy of noticing that G-triviality is assessed at LF, therefore the rule (39) only applies to movement at LF, not to movement in the overt syntax. For instance, it is not the source of the overt F-movement in Hungarian.

[14] A question arises as to why logical inferences motivate syntactic operations. I would link this question to the architecture of the universal grammar. Chierchia (2006, 2013) indicates that the structure-building apparatus (e.g. Merge, Move, Agree) and the inferential one are not radically different; "grammar only sees functional/logical material; logic sees functional/logical material and whether the lexical material is the same or different." (Chierchia 2013: 444) The notion of G-triviality, in particular, relates logic tightly to grammar, as a L-triviality taking effects in grammar.

[15] The ordinary value of p is simply the truth value of p; the focus value of p is a set of F-alternatives to p, built up compositionally from the focus value of the semantic focus, defined as follows.

(1) a. $[\![\alpha_F]\!]_f = D_{\text{type}([\![\alpha]\!]_0)}$
b. $[\![\alpha]\!]_f = \{[\![\alpha]\!]_0\}$
c. $[\![\alpha(\beta)]\!]_f = \{a(b) \mid a \in [\![\alpha]\!]_f, b \in [\![\beta]\!]_f\}$

(42) $[\![\text{only}]\!](p)(w) = \forall q \in [\![p]\!]_f[q(w) \rightarrow [\![p]\!]_0 \subseteq q] = \forall q \in [\![p]\!]_f[q(w) \rightarrow p \subseteq q]$
(Any true proposition within the focus value of p is entailed by the ordinary value of p.)

Consider the example (25) again, repeated below. The quantificational domain of *only* is the focus value of the prejacent VP, namely a set of propositions in the form of "Sue invited x's advisors". Exhaustifying over this domain yields the desired reading (43a), as schematized in (44).

(43) Sue only invited JOHN$_F$'s advisors.
  a. $\rightarrow$ Sue didn't invite anyone's advisors except John's advisors.
  b. $\not\rightarrow$ Sue didn't invite anyone except John's advisors.

(44) a. $[\![\text{Sue invited JOHN}_F\text{'s advisor}]\!]_0 = I[s,A(j)]$
  b. $[\![\text{JOHN}_F]\!]_f = D_e$
  c. $[\![\text{Sue invited JOHN}_F\text{'s advisor}]\!]_f = \{I[s,A(x)] \mid x \in D_e\}$
  d. $[\![(43)]\!] = \forall q \in \{I[s,A(x)] \mid x \in D_e\}[q \rightarrow I[s,A(j)] \subseteq q]$
  (For any true proposition q in the form of "Sue invited x's advisors", q is entailed by the prejacent that "Sue invited John's advisors.")

4.2. Case 2: F-movement is motivated

Recall the main problem of the G-view: if F-alternatives were propositional, an *only*-sentence with an NPI would be non-DE with respect to this NPI. Therefore, to capture the NPI-licensing effect of *only* in sentences like (45a-b), I assume that in those cases the semantic focus (or F-contained island, if any) has to be moved out of the VP, splitting the VP into two sub-constituents, namely the moved phrase, corresponding to the syntactic restrictor of *only*, and the remnant VP, corresponding to the scope of *only*. In particular, to distinguish between VP-*only* and NP-*only*, I assume that F-movement is covert in (45a) but overt in (45b).

(45) a. Mary only gave any funding to JOHN$_F$.
  [O_D [only (JOHN$_{F,i}$) [Mary gave any$_D$ funding to t_i]]] Covert F-movement
  b. Only JOHN$_F$ read any papers.
  [O_D [only (JOHN$_{F,i}$) [t_i read any papers.]]] Overt F-movement

As for the semantics of *only*, I follow Alternative Semantics and assume that the quantificational domain of *only* is the focus value of the F-moved phrase. A cross-categorical definition of *only* is given in (46), where f and g correspond to the unmoved and moved part, respectively.

(46) $[\![\text{only}]\!](f_{<\alpha,t>})(g_\alpha) = \forall g' \in [\![g]\!]_f[f(g') \rightarrow [\![g]\!]_0 \subseteq g']$

For instance in (47), F-movement is motivated to avoid contradictions. The Left-Branch Extraction Constraint requests the F-contained island, *JOHN$_F$'s advisors*, to be moved as a whole. Then the

quantificational domain of *only* would be the focus value of the moved possessive NP, namely the set of contextually relevant individuals who are someone's advisors.

(47) Mary only gave any$_D$ funding to JOHN$_F$'s advisors.
  a. $[\![\text{JOHN}_F\text{'s advisors}]\!]_f = \{A(x) : x \in D_e\}$
  b. $[\![\text{JOHN}_F\text{'s advisors}]\!]_0 = A(j)$
  c. $[\![(47)]\!] = \forall y \in \{A(x) : x \in D_e\}[I(s,y) \rightarrow A(j) \subseteq y]$
  (For anyone's advisors y, if Mary invited y, then y is/are John's advisors.)

4.3. Case 3: F-movement is unhelpful

Recall the fact that *only* cannot *directly* associate with an NPI or with/into an NPI-contained island without crossing another NPI-licenser. Relevant examples discussed above are collected in (48). I will show that the reason why NPIs are not licensed in the these examples is that F-movement cannot salvage their G-trivialities/contradictions.

(48) a. *John read only ANY$_F$ papers.
  b. *John read only [any PAPERS]$_F$, (he didn't read every book).
  c. *John read only any PAPERS$_F$, (he didn't read any books).
  d. *Mary only gave a book to John [because BILL$_F$ gave any book to him].

Consider (48b) for example, where *only* associates with the entire *any*P. To pursue a stipulation-free analysis, I will consider all possible syntactically well-formed LFs, including LFs where the [D] feature of *any* is assessed by a covert O_D, as well as LFs where the [D] feature is assessed by overt *only*, as structured in (49) and (50), respectively.

(49) **Assessing [D] with O_D**
  a. O_D [only [John read [any$_D$ PAPERS]$_F$]] Without F-movement
  b. O_D [only (any$_D$ PAPERS)$_{F,i}$ [John read t_i]] With F-movement

(50) **Assessing [D] with *only***
  a. only [John read [any$_D$ PAPERS]$_F$] Without F-movement
  b. [only (any$_D$ PAPERS)$_{F,i}$ [John read t$_i$]] With F-movement

Let us start with the option that only the covert operator O_D can assess a [D] feature. If the *any*P is interpreted in-situ, as in (51a), then the [D] feature of *any* would be assessed within the boxed part, which is within the scope of a $\forall$-quantification and is non-DE. Then applying O_D over the *only*-clause to check off the [D] feature would yield a semantic contradiction. Alternatively, if the focused *any*P is F-moved, it would be interpreted under the immediate scope of O_D, a context that

is also non-DE. The main difference between (51) and (52) in semantics is that the quantificational domain of *only* is a set of propositions in (51) but a set of generalized quantifiers in (52).[16]

(51) a. O_D [only [John read [any$_D$ PAPERS]$_F$]]

b. Assertion: $\forall q \in \{Q(\lambda x.R(j,x)) \mid Q \in D_{<et,t>}\}[q \rightarrow \boxed{\exists x \in D[P(x) \wedge R(j,x)]} \subseteq q]$

(52) a. O_D [only (any$_D$ PAPERS)$_{F,i}$ [John read t_i]]

b. Assertion: $\forall Q_{<et,t>}[Q[\lambda y.R(j,y)] \rightarrow \boxed{\lambda S.\exists x \in D[P(x) \wedge S(x)]} \subseteq Q]$

Now move onto the option that the overt exclusive particle *only* can check off any alternative-related features, including the [D] feature. In such a case, the O_D-operator ought to be eliminated from the LF of a *only*-sentence, because there is no unchecked [D] left for O_D. This option has not been considered by the canonical G-view. But in theory, there is no reason to rule it out.

First, consider the possibility of interpreting *any*P in-situ. Under the LF (53a), the *only*-sentence presupposes its prejacent as in (53d) and asserts the exhaustivity inference as in (53e). The quantificational domain of *only* consists of F-alternatives and D-alternatives: F-alternatives are in the form of "John read X", where X is a generalized quantifier; D-alternatives are in the form of "John read a book in D'", where D' is a subset of the total domain D. The asserted exhaustivity inference entails the negation of all the proper D-alternatives, yielding the inference *John didn't read any paper in any proper subdomain* D', as in (53f). This inference, however, contradicts the prejacent presupposition *John read a paper in the total domain* D, predicting the NPI *any* to be unlicensed.[17]

(53) a. only [John read [any$_D$ PAPERS]$_F$]

b. $ALT_F = \{Q[\lambda x.R(j,x)] \mid Q \in D_{<et,t>}\}$

c. $ALT_D = \{\exists x \in D'[P(x) \wedge R(j,x)] \mid D' \subseteq D\}$

d. $\exists x \in D[P(x) \wedge R(j,x)]$ Presupposition

e. $\forall q \in ALT_{F,D}[\exists x \in D[P(x) \wedge R(j,x)] \not\subseteq q \rightarrow \neg q]$ Assertion

f. $\Rightarrow \forall D'[D' \subset D \rightarrow \neg\exists x \in D'[P(x) \wedge R(j,x)]]$
(John didn't read any paper in any proper subdomain D')

[16] Individuals of type e can also be type-shifted into generalized quantifiers.

[17] Consider the mini-model below for a simpler illustration of (53). Assume that the total domain D contains exactly two papers, p_1 and p_2. The D-alternative set thus contains three propositions, *John read* p_1 *or* p_2, *John read* p_1, and *John read* p_2, as in (1b). The exhaustivity assertion negates both proper sub-D alternatives, yielding the inference *John didn't read* p_1 *or* p_2 in (1c), which contradicts the prejacent presupposition *John read* p_1 *or* p_2 in (1d).

(1) a. $D = \{p_1, p_2\}$

b. D-ALT $= \{R(j,p_1) \vee R(j,p_2), R(j,p_1), R(j,p_2)\}$

c. Assertion entails: $\neg R(j,p_1) \wedge \neg R(j,p_2)$

d. Prejacent Presupposition: $R(j,p_1) \vee R(j,p_2)$

This reasoning also applies to the LF in (54), where the *any*P takes covert F-movement to the complement of *only*: the exhaustivity assertion in (54e) entails the inference in (54f), which contradicts the prejacent presupposition in (54d). The major difference between the schematic derivations in (53) and (54) is the semantic type of their alternatives: in (53), all the alternatives are propositions; but in (54), all the alternatives are generalized quantifiers. In particular, the D-alternatives in (54c) are existential quantifiers quantifying over papers in a subset domain D'.

(54) a. [only (any$_D$ PAPERS)$_{F,i}$ [John read t$_i$]]
b. $ALT_F = D_{<et,t>}$
c. $ALT_D = \{\lambda S.\exists x \in D'[P(x) \wedge S(x)] \mid D' \subseteq D\}$
d. $\exists x \in D[P(x) \wedge R(j,x)]$ Presupposition
e. $\forall Q \in ALT_{F,D}[Q \not\subseteq \lambda S.\exists x \in D[P(x) \wedge S(x)] \rightarrow \neg Q[\lambda y.R(j,y)]]$ Assertion
f. $\Rightarrow \forall D'[D' \subset D \rightarrow \neg\exists x \in D'[P(x) \wedge R(j,x)]]$
(John didn't read any paper in any proper subdomain D')

To sum up, if *only* associates with an *any*P, all the syntactically well-formed LFs of (48b) yield a G-triviality; therefore the NPI *any* is not licensed in (48b). First, if the [D] feature of *any* is assessed by a covert O_D, then the G-triviality would be a logical consequence of the affirmed exhaustivity assertion and the negated proper D-alternatives. Second, if the [D] feature is assessed by overt *only*, then the G-triviality would result from the contradiction between the prejacent presupposition of *only* and the negation of the proper sub-D alternatives.

4.4. The "Head Restriction"

The present analysis can easily capture the "Head Restriction". In (55), although the *any*P can vacate from the VP before the [D] feature gets assessed, it can and can only be raised to the place sandwiched between O_D and *only*, which is still non-DE. In contrast, the conditional (56) is DE in its antecedent; therefore, once the *any*P undertakes QR over *only*, the whole conditional would be DE with respect to the NPI.

(55) *John only CUT$_F$ any vegetables.
[O_D [any$_D$ vegs]$_i$ [only [John CUT$_F$ t_i]]]

(56) If John only CUT$_F$ any vegs (and didn't STEAM$_F$ any vegs), Mary would be unhappy.

Note that the NPI *any* is not licensed once if the *any*P cannot take quantifier raising over *only*, even if the *only*-sentence is uttered as the antecedent of a conditional or in some other DE context. For instance, the NPI *any* is not licensed in (57), a conditional where *only* associates into an *any*P. First, the determiner *any* cannot take F-movement alone, ruling out the possibility in (57a). Second, since an *only*-associated focus cannot be moved from beneath *only* (Tancredi 1990), the F-contained *any*P cannot raise over *only*, ruling out the possibility in (57b).

(57) *If John only invited [anyone's ADVISORS$_F$], the students would be unhappy.

a. If John only invited [anyone's] ADVISORS$_F$, ... (×)

b. If John only invited [anyone's ADVISORS$_F$], ... (×)

5. Conclusions

The goal of this paper has been to explain the NPI-licensing effect of *only*. I incorporated F-movement into the G-view of exhaustification with a simple assumption that F-movement is motivated by the requirement of avoiding contradictions.

References

Abels, K. (2003). *Successive cyclicity, anti-locality, and adposition stranding*. Ph. D. thesis, University of Connecticut.

Atlas, J. D. (1993). The importance of being 'only': Testing the neo-Gricean versus neo-entailment paradigms. *Journal of Semantics 10*(4), 301–318.

Chierchia, G. (2004). Scalar implicatures, polarity phenomena, and the syntax/pragmatics interface. In A. Belletti (Ed.), *Structures and beyond*, Volume 3, pp. 39–103. Oxford: Oxford University Press.

Chierchia, G. (2006). Broaden your views: Implicatures of domain widening and the logicality of language. *Linguistic inquiry 37*(4), 535–590.

Chierchia, G. (2013). *Logic in grammar: Polarity, free choice, and intervention*. Oxford: Oxford University Press.

Crnic, L. (2011). *Getting even*. Ph. D. thesis, MIT.

Drubig, H. B. (1994). *Island constraints and the syntactic nature of focus and association with focus*. Universitäten Stuttgart und Tübingen in Kooperation mit der IBM Deutschland GmbH.

Fauconnier, G. (1975). Polarity and the scale principle. In R. E. Grossman et al. (Ed.), *Proceedings of CLS*, Volume 11, pp. 188–199.

Fauconnier, G. (1978). Implication reversal in a natural language. In F. Guenthner and S. J. Schmidt (Eds.), *Formal semantics and pragmatics for natural languages*, pp. 289–301. Dordrecht: Reidel.

von Fintel, K. (1999). NPI licensing, strawson entailment, and context dependency. *Journal of Semantics 16*(2), 97–148.

Gajewski, J. R. (2002). L-analyticity and natural language. Manuscript, MIT.

Gajewski, J. R. (2007). Neg-raising and polarity. *Linguistics and Philosophy 30*(3), 289–328.

Gajewski, J. R. (2011). Licensing strong NPIs. *Natural Language Semantics 19*(2), 109–148.

Hamblin, C. L. (1973). Questions in Montague English. *Foundations of Language 10*(1), 41–53.

Heim, I. (1991). Artikel und definitheit. In A. v. Stechow and D. Wunderlich (Ed.), *Semantik: ein internationales Handbuch der Zeitgenössischen forschung*, pp. 487–535. Berlin: de Gruyter.

Horn, L. (1969). A presuppositional analysis of *only* and *even*. In R. I. Binnick, A. Davison, G. Green, and J. Morgan (Eds.), *Proceedings of CLS*, Volume 5, pp. 98–107. Chicago: CLS.

Horn, L. R. (1996). Exclusive company: *Only* and the dynamics of vertical inference. *Journal of Semantics 13*(1), 1–40.

Horn, L. R. (2009). 'Only' XL: The assertoric asymmetry of exponibles. In E. Cormany, S. Ito, and D. Lutz (Eds.), *Proceedings of SALT*, Volume 19, pp. 198–222.

Klima, E. S. (1964). Negation in English. In J. Fodor and J. Katz (Eds.), *The Structure of Language*, pp. 246–323. Englewood Cliffs, NJ: Prentice Hall.

Krifka, M. (1995). The semantics and pragmatics of polarity items. *Linguistic Analysis 25*(3-4), 209–257.

Ladusaw, W. A. (1980). *Polarity Sensitivity as Inherent Scope Relations*. Ph. D. thesis, University of Texas, Austin.

Lahiri, U. (1998). Focus and negative polarity in Hindi. *Natural Language Semantics 6*(1), 57–123.

Rooth, M. (1985). *Association with focus*. Ph. D. thesis, University of Massachusetts, Amherst.

Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics 1*(1), 75–116.

Rooth, M. (1996). Focus. In S. Lappin (Ed.), *The Handbook of Contemporary Semantic Theory*, pp. 271–297. Oxford: Blackwell Publishers.

Ross, J. R. (1986). *Infinite syntax*. Norwood: Ablex Publishing.

Tancredi, C. (1990). Not only EVEN, but even ONLY. Manuscript, MIT.

Wagner, M. (2006). Association by movement: Evidence from NPI-licensing. *Natural Language Semantics 14*(4), 297–324.