Présentation SynSem
Logic in Grammar (G. Chierchia, 2013)

Part II

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Contents

Introduction

1 Summary of the first presentation

1.1 DE vs. UE contexts

(1) Subsets/Supersets:

a. Every time I ate pizza, I got sick → Every time I ate pepperoni pizza, I got sick

b. I didn't eat pizza → I didn't eat pepperoni pizza
⇒ *subset inferences*

(2) a. Every time at lunch I ate pepperoni pizza → Every time at lunch I ate pizza
b. I eat pepperoni pizza → I eat pizza
⇒ *superset inferences*

Contexts which license subset inferences are called *Downward Entailing*, contexts which license superset inferences are called *Upward Entailing*.

NPIs, which are a type of *Polarity Sensitive Items*, are sensitive to DE contexts. This means that they will always be licensed in a DE context, but never in a UE context. This is the case for NPIs like *ever* (cf. (3)) and *any* (cf. (4)):

(3) a. Every [person who *ever* ate pepperoni pizza from that place]
Chaque [personne qui NPI manger-PAST pepperoni pizza de cet endroit]
[got sick]
[devenir-PAST malade]
« Chaque personne qui a mangé – ne serait-ce qu'une fois – une pizza au pepperoni venant de cet endroit est tombée malade. »

b. * Every [person who eats my pepperoni pizza] [will *ever* get sick]
Chaque [personne qui mange-3PS ma pepperoni pizza] [FUT NPI devenir malade]

c. Every [person who eats my pepperoni pizza] [won't *ever* get sick]
Chaque [personne qui mange-3PS ma pepperoni pizza] [FUT-NEG NPI devenir malade]
« Chaque personne qui mange ma pizza au pepperoni ne tombera jamais malade. »

(4) a. Every [student who still has *any* cookie in the oven] [should turn it off]
Chaque [étudiant qui encore a NPI cookie dans le four] [devrait éteindre le]
« Chaque étudiant qui a encore le moindre cookie dans le four devrait l'éteindre. »

b. * Every [student who has cooking skills] [still has *any* cookie in the oven]
Chaque [étudiant qui a cuisine talents] [encore a NPI cookie dans le four]

c. Every [student who has cooking skills] [won't buy *any* cookie from that
Chaque [étudiant qui a cuisine talents] [FUT-NEG acheter NPI cookie de cet
place]
endroit]
« Chaque étudiant qui a des talents de cuisinier n'achèterait pas le moindre cookie dans ce magasin. »

1.2 Scalar Implicatures

Recall that SIs don't behave the same when they are situated in a UE and in a DE context.

- Adding a SI to a sentence embedded within a UE context leads to something stronger than the original, hence is more informative.
- Adding a SI to a sentence embedded within a DE context leads to something weaker than the original, hence is less informative.

Maximize Strength: Don't add an implicature if it leads to weakening, unless you are forced to by the context.

Chierchia finds a distinction between the distribution of SIs and that of NPIs. SIs are OK in UE contexts, but not in DE contexts, whereas NPIs are OK in DE contexts, but not in UE contexts. The meaning of these Polarity Sensitive items must prevent them to be embedded in UE contexts because it would make the interpretation of the sentence less informative. It is then the exact opposite of what happens with SIs.

1.3 Extended Standard Grice Theory and properties of SIs

The *ESG* theory proposed by Chierchia can be stated as follows:

(5) **Extended Standard Grice:**
   a. At the root level, the Gricean reasoning is extensionally equivalent to exhaustifying the assertion with respect to a set of salient, relevant alternatives.
   b. Exhaustification can take place at embedded levels, subject to Maximize Strength.

1.4 Focus and covert *only*

2 Components of Chierchia's system

2.1 The syntax of exhaustification:

Recall that SIs come about through a covert operator that is used when lexically (or focus) activated alternatives are relevant to the conversational goals. Chierchia assumes that if the lexically induced alternatives are relevant/active, they must be factored into meaning through covert exhaustification, and vice versa: covert exhaustifiers are employed only when the alternatives of an alternative bearer are relevant.
Claim: Exhaustification takes place in syntax in terms of feature checking/agreement, with the following condition: Use an O operator iff there is a trigger in its scope with active alternatives.

A typical example to illustrate feature agreement:

(6) a. I think, therefore I am.
   b. I think, therefore $[_{vP}$ $I_{[1st\ p]}$ $[_{vP}$ $am_{[u\ p]}$]]

The first person pronoun in the second clause triggers person agreement on the verb: the feature [1st p] is semantically effective on the subject pronoun but not on the verb. The verb carries an unvalued person feature ([u p]) that needs to be checked by the feature [1st p]. The subject probes its c-command domain and targets the unvalued person feature on the verb, assigning it a value.

Adopting feature agreement in the system, Chierchia assumes that any scalar term carries a complex feature made up of two unvalued component [uσ, uD] (henceforth [σ, D]), which corresponds intuitively to the strictly scalar and the Domain-alternatives respectively. The notion of Domain-alternatives (henceforth D-alternatives) was introduced by Sauerland (2004). His claim was the following: as disjunction corresponds to an existential quantification of over {p,q}, each individual disjunct {p,q} is also among the alternatives for [p$\vee$ q]. $\rightarrow$ D-alternatives are all the subdomains of the domain of disjunction/existential quantification.
Then, an exhaustifying operator O probes for the complex feature [σ, D] in order to determine its restriction. There are three types of restrictions:

1. σA ranging over strictly scalar alternatives. $\rightarrow O_{\sigma A}$ looks for strictly scalar alternatives and assigns value "+" to the feature σ.

2. (Exh-)DA ranging over (possibly pre-exhaustified) D-alternatives $\rightarrow$ $O_{(Exh-)DA}$ looks for D-alternatives and assigns "+" to the feature D.

3. ALT ranging over the total set of alternatives $\rightarrow$ O_{ALT} looks for the total set of alternatives and simultaneoulsy checks σ/D.

In the absence of a c-commanding suitable operator, the complex feature gets value "-" by default, signaling that the alternatives are inactive.

We will now illustrate how this works for some sentences.

(7) a. i. $O_{\sigma A}$ [I will see Mary $or_{[+\sigma,-D]}$ Sue]
ii. Interpretation: I will see Mary or Sur but not both.
b. i. [I will see Mary $or_{[-\sigma,-D]}$ Sue]
ii. Interpretation: I will see Mary or Suror possibly both.
c. #O_{ALT}[I will see Mary $or_{[+\sigma,+D]}$ Sue]
d. * $O_{\sigma A}$ [I will see Mary $or_{[-\sigma,-D]}$ Sue]

(7a) is syntactically well formed and transparently corresponds to the interpretation with the SI: the relevant set of alternatives is ALT= {⟦p∨q⟧, ⟦p∧q⟧} where p= I will see Mary, and q= I will see Sue. Therefore, $O_{\sigma A}$ [I will see Mary $or_{[+\sigma,-D]}$ Sue]= O_{ALT}⟦p∨q⟧= ⟦p∨q⟧∧¬ ⟦p∧q⟧
(7b) is syntactically well formed and no implicature are derived: the speaker is ignorant or the alternatives are irrelevant to the conversational goals.
(7c) is syntactically well formed but contradictory: as both D-alternatives and σ-alternatives are exhaustified, the relevant set of alternatives is ALT={⟦p∨q⟧, ⟦p∧q⟧, p, q}. Therefore, O_{ALT}⟦I will see Mary $or_{[+\sigma,+D]}$ Sue⟧= O_{ALT}⟦p∨q⟧= ⟦p∨q⟧∧¬ ⟦p∧q⟧∧¬p∧¬q. → Contradiction.
(7d) is syntactically ill-formed because $O_{\sigma A}$ must assign value "+" to the feature σ.

2.2 Grammaticality and (un)formativity

As argued in section 1, a sentence like (8a) where a NPI appears in a non-DE context is contradictory. It thus should have the same status as the sentence in (8b).

(8) a. *There are any cookies left.
b. Right now, it is raining and it is not raining.

However, the deviance of (8a) is perceived differently from that of (8b): (8a) is perceived as grammaticaly deviant whereas (8b) is not perceived as such; it is a sentence that taken literally cannot be true. How can we explain that?

Key concept belonging to the historical debate on analyticity (Carnap, 1934; Quine, 1960):

(9) **L-analiticity:** A sentence is logically true or false iff its truth (or, respectively, falsehood) depends solely on 'logical' words, and the way they are put together in a sentence.

For example, a contradiction of the form $p \wedge \neg p$ is L-analytic because its falsehood depends on the meaning of $\wedge$ and $\neg$ and how they are put together, regardless the meaning of p.
Claim: L-analyticity plays a fundamental role in the semantics of natural language, once we see how to separate expressions that are L-analytic just because of the role played by grammatical formatives from other tautologies.

Grammar-internal contradictions vs. non-grammar internal contradictions:
The distinction between the functional skeleton of the clause and its lexical material is central to the definition of L-trivitality.
Consider the following examples, for which we have the same perception as in (8):

(10) a. *Some student but John smokes.
b. John smokes and doesn't smoke.

While (10a) is perceived as grammaticaly deviant, (10b) is not perceived as such.

(11) **G-triviality:** A sentence Φ is G-trivial iff for any situation s and model M, $[\![\Phi']\!]^{M,s}$= same (where same is either 1 or 0) and Φ' is obtained by an arbitrary substitution of its lexical terminal nodes.

→ A sentence is defined as G-trivial if it is true or false, regardless of how the lexical terminals are replaced in the structure; G-trivial sentences are only based on the functional lexicon.
Going back to the examples in (10):

- (10a) is G-trivial: [some P but x Q] is contradictory no matter how we substitute P and Q in it.
- But (10b) is not G-trivial: there are substitutions of P in [x P and not P] that do not give rise to a contradiction (for example, if we substitute the two occurrences of P with distinct lexical items).

(12) **Tautologies/Contradictions (L-triviality):** A sentence Φ is tautologous/contradictory iff for any situation s and model M, $[\![\Phi']\!]^{M,s}=1/0$ where Φ' is obtained from Φ by a uniform[1] substitution of its lexical terminal nodes.

→ L-trivial sentences are based on the functional lexicon and whether occurences of lexical materials are the same or different.
We can thus conclude that (10b) is L-trivial: with a uniform substitution of P in [x P and not P], this sentence is contradictory.

The distinction between G-triviality and L-triviality can explain the different perceptions we had for the sentences in (8):

- *There are any cookies left.* ((8a)) is perceived as grammaticaly deviant because it is G-trivial (and L-trivial): the fact that it is contradictory is only based on the functional lexicon.
  → Grammar-internal contradiction.
- *Right now, it is raining and it is not raining.* ((8b)) is not perceived as grammaticaly deviant because it is L-trivial, and not G-trivial: the fact that it is contradictory is based on the functional lexicon and whether occurrences of lexical materials are the same or different.
  → Non-grammar internal contradiction.

3 The Derivation of NPIs

3.1 NPIs and Indefinites

If you look at minimal pairs of sentences in (13), where one contains a NPI like "*any*" or "*ever*", and the other a plain indefinite ("*a*") or a bare noun (singular or plural), you can perceive a difference in strength/emphasis: sentences with NPIs feel more emphatic, or less exception tolerant than sentences with indefinites/bare nouns.

(13) a. i. I do not like republicans.
ii. I do not like any republican.
b. i. I will never vote for a republican.
ii. I will never vote for any republican.
c. i. I do not vote republican.
ii. I do not ever vote republican.

It is possible to have this intuition reinforced when you look at the behaviour of NPIs vs. indefinites in situations where you add contrastive stress. Look at the two dialogues in (14).

(14) a. Dialogue I
i. A: Do you have an egg?
ii. B: No.

[1] A substitution is uniform if distinct occurrences of an item v are replaced by the same item v'.

iii. A: Maybe a pickled one?
iv. B: I don't have **ANY** egg.

b. Dialogue II
i. A: Do you have any egg?
ii. B: No.
iii. A: Maybe a pickled one?
iv. B: *I don't have **AN** egg.

The last sentence of (14a) is grammatical whereas the last one of (14b) is not.

Both indefinites and NPIs are interpreted as existentials; "*any*" is similar to "*a*"/"*some*", and "*ever*" is similar to "*sometimes*". If you look at a possible semantic value for sentences (13a), the truth conditions seem to be the same, regardless of the presence or absence of a NPI:

(13a′) $\neg\exists x \in D$ [republican(x) $\wedge$ I like x]

So, what is the difference between *any* and *a*? Chierchia claims that they are not interpreted exactly in the same way because they are not *restricted to the same **domains***.

(15) a. There aren't $[_{\text{NP, D}}$ cookies] left.
$= \neg\exists x \in D$ [cookies(x) $\wedge$ left(x)]
There aren't things [*in the usual places in the kitchen*] which are cookies and are left (uneaten)[2].

b. There aren't $[_{\text{DP, D}'}$ any cookies] left.
$= \neg\exists x \in D'$ [cookies(x) $\wedge$ left(x)]
There aren't things [*in the usual or unusual places in the kitchen*] which are cookies and are left (uneaten).

c. D $\subseteq$ D′

In (15), the domains associated with *any* and *a* are not the same: the domain associated with the NPI is *broader* than the domain associated with the indefinite; the set contains more elements. Moreover, every element in the domain of indefinites is also in the domain of NPIs (this is expressed formally in (15c).

3.2 Derivation of NPI *any*

3.2.1 The Claim

Any carries an inherent focal feature F (that remains phonologically unrealized) which signals that it is associated with a set of alternatives constrained as follows:

(16) a. $[\![\text{There aren't any}_{F,D} \text{ cookies left.}]\!] = \neg\exists x \in D$ [cookies(x) $\wedge$ left(x)]
b. ALT = $\{\neg\exists x \in D'$ [cookies(x) $\wedge$ left(x)]: D′$\subseteq$ D $\}$
c. $[\![\text{any}_{F,D}]\!] = \lambda P.\ \lambda Q.\ \exists x \in D\ [P(x) \wedge Q(x)]$
d. $[\![\text{any}_{F,D}]\!]^F = \{\lambda P.\ \lambda Q.\ \exists x \in D'\ [P(x) \wedge Q(x)] : D' \subseteq D\ \}$

This focal feature on *any* is the lexical property that distinguishes it from plain existentials; it means that the alternatives with which a statement involving *any* can be contrasted involve existentials with smaller domains.

Then, the semantic value for *any* in (16c) (when it does not bear the feature F) is equivalent to that of indefinites, and the semantic value of *any* in (16d) (with F) is the one we want for this lexical item as a NPI.

[2]In italics and between brackets is indicated what the contextually relevant domain for the sentence is. For example, the contextually relevant domain for (15) is a set formally described as: {x: x is in the usual places in the relevant kitchen}

Let's look at the derivation of *any* in (17):

(17) a. A: Do you have an$_{D_1}$ egg?
b. B: No, I don't have **ANY**$_{D_2}$ egg.

Contrastive stress on *any* is a way of spelling out its inherent focal feature, which is associated with subdomain alternatives. We have the following:

(18) a. $[\![$I don't have an$_{D_1}$ egg$]\!] \in [\![$I don't have any$_{F,D_2}$ egg$]\!]^F$
b. $[\![$I don't have an$_{D_1}$ egg$]\!] \in \{\neg\exists x \in D'\ [(x)\text{egg} \wedge \text{I have } x] : D' \subset D_2\}$

The domain variable associated with "*an egg*", marked as D_1, must range over some subset of the one associated with "*any egg*", marked as D_2. *Any* acts as a "domain widener".

3.2.2 *Any* in DE contexts

If *any* always activates alternatives, it must be associated with an alternative sensitive operator, like O (silent *only*). The logical form for (19a) is (19b):

(19) a. There aren't any$_{F,D}$ cookies left.
b. O$_C$ [There aren't any$_{F,D}$ cookies left]

As we've seen in the previous talk, an operator like O_C (or its overt counterpart "*only*") exhaustify away alternatives *only if* they are not entailed by the proposition. Recall that the alternatives for (19a) all come with a domain which is a subset of the domain associated with the NPI:

(20) a. $[\![(19a)]\!] = \neg\exists x \in D[\text{cookies}(x) \wedge \text{left}(x)]$ $[D =$ *things in the kitchen*$]$
b. ALT $= \{\neg\exists x \in D'[\text{cookies}(x) \wedge \text{left}(x)] : D' \subseteq D]\}$
$=$ {there are no cookies left in the oven, there are no cookies left on the kitchen table, there are no cookies left in the fridge, ...}

As you can see, all the alternatives *are* entailed by the proposition:

(21) There are no cookies left in the kitchen $\rightarrow$ [there are no cookies left in the oven $\wedge$ there are no cookies left on the kitchen table $\wedge$ there are no cookies left in the fridge $\wedge$ ...]

Hence covert *only* won't exhaustify them away. If there is no exhaustification, the meaning of a sentence like (19a) is exactly how we put it in (20a).

This is the case for every other appearance of "*any*" in a DE context (as in (22)): since DE contexts always license subset inferences, the alternatives will always be entailed by the proposition, then the operator O_C will never exhaustify them away.

(22) a. Every student who took *any* linguistic class qualifies.
b. Do you have *any* programming skills?
c. If I eat *any* cookie, I will get fat.

3.2.3 Why *any* cannot appear in UE contexts

Now, let's turn to why NPIs like "*any*" cannot appear in UE contexts. In this case, the situation is different. If a sentence like (23a) were grammatical, it would be similar to a sentence with a plain existential, and its meaning would be (23b).

(23) a. * There are any$_D$ cookies left.
b. $\exists x \in D$ [cookies$(x) \wedge$ left(x)] $[D =$ *things in the kitchen*$]$

However, the problem is that the meaning of *any* forces it to activate alternatives (represented in (24)), whose domain is a subset of the domain of the proposition.

(24) a. $\{\exists x \in D' \, [\text{cookies}(x) \wedge \text{left}(x)] : D' \subseteq D\}$
b. There are cookies left in the cupboard,
There are cookies left on the kitchen table,
There are cookies left in the oven, ...

Then, if you look at the logical form of (23a) (namely, (25)), you'll notice the presence of a covert "*only*" that will exhaustify away alternatives that are not entailed by the proposition.

(25) O_C [There are any_D cookies left]

Since every alternative for this sentence is *not* entailed by the proposition (see (26a)), all of them will be negated.

(26) a. There are cookies left in the kitchen $\nrightarrow$ [there are cookies left in the cupboard $\wedge$ there are cookies left on the kitchen table $\wedge$ there are cookies left in the oven $\wedge$ ...]

We end up with a meaning for the sentence "*There are any cookies left*" that is similar to what is expressed in (27).

(27) There are cookies left in the kitchen, **BUT**:
There are *no* cookies left in the cupboard, and
There are *no* cookies left on the kitchen table, and
There are *no* cookies left in the oven, ...

This sentence means that there are cookies left in the relevant domain (here the kitchen), but that there are no cookies left for every subdomain of the kitchen (no cookies in the cupboard, no cookies on the kitchen table, no cookies in the oven...). This is clearly a contradiction, and that's why NPI "*any*" *cannot* appear in UE contexts.

4 Weak vs. Strong NPIs

Recall that NPIs such as *any* and *ever* are always licensed in DE contexts, but never in UE contexts. There NPIS are called *weak NPIs*. Some NPIs, such as *in weeks* and *until* in English can only appear in a limited subset of DE contexts; they are called *strong NPIs*.

(28) a. i. John didn't see Mary **in weeks**.
ii. John didn't **ever** see Mary.
b. i. *If John has seen Mary **in weeks**, he will be upset.
ii. If John had **ever** heard about linguistics, he would be here today.
c. i. *At most five students have seen me **in weeks**.
ii. At most five students had **ever** heard about linguistic.

Although propositional negation, the antecedent of conditional and the quantifier *at most* are DE contexts, the NPI *in weeks* can only appear in the scope of the propositional negation ((28a-i)). It seems that being DE is not sufficient for licensing strong NPIs.
Zwarts(1996)'s generealization: Strong NPIs can only appear in Anti-additive (henceforth AA) contexts.

(29) Anti-additivity
Φ is anti-additive iff $\Phi(\alpha \vee \beta) \leftrightarrow \Phi(\alpha) \wedge \Phi(\beta)$

Being AA is stronger than being DE: every AA item is also DE, whereas many DE items are not AA.

(30) a. John doesn't smoke or drink. $\leftrightarrow$ John doesn't smoke and doesn't drink.
$\Rightarrow$ Sentential negation is an AA item.
b. At most five students smoke or drink. $\rightarrow$ At most five students smoke and at most five students drink.
$\Rightarrow$ The quantifier *at most* is only a DE item.

Three issues related to Zwarts's generalization inside Chierchia's system:

1. The property of being AA doesn't describe accurately the contexts that license strong NPIs; there are few cases in which AA seems not to be descriptively adequate.

   (31) a. i. Every red or blue book is on the table. ↔ Every red book is on the table and every blue book is on the table.
   ii. *Every person who has seen Mary in weeks is upset with her.
   b. i. No red or blue book is on the table. ↔ No red book is on the table and no blue book is on the table.
   ii. *No person who has seen Mary in weeks is upset with her. ???

   While the left arguments of the quantifiers *every* and *no* are AA, as schown in (31a-i) and (31b-i) respectively, they cannot licensed the strong NPIs *in weeks* ((31a-ii),(31b-ii)).

2. Presupposition triggers never license strong NPIs.

   (32) a. *Only John saw Mary in weeks.
   b. *John was surprised that he saw Mary in weeks.

   Therefore, while weak NPIs are licensed in the local scope of SDE operators (i.e. are sensitive to S-entailment), strong NPIs are licensed in the local scope of AA operators characterized in therms of classical entailment (i.e. are sensitive to plain entailment).

3. As the distribution of weak NPIs does in this system, the distribution of strong NPIs must fall out from thier lexical semantics and the way it interacts with independent elements that may be present in their structure. 3 possibilities within this system to explain the distribution of strong NPIs:

   - some common feature in the lexical meaning of strong NPIs;
   - the type of alternatives strong NPIs activate;
   - the type of exhaustification strong NPIs invoke.

⇒ How can we understand the distinction between weak and strong NPIs within this exhaustification-based system?
General idea: Meaning has several dimensions: 1 - a pure truth conditional component; 2 - a presuppositional component and 3 - an implicature component.

(33) a. Not every student of John's drink.
   b. i. Truth conditions: $\neg\forall x$[student of j(x)→drink(x)]
   ii. Implicature: ∃x[student of j(x) ∧ drink(x)]
   iii. Presupposition: ∃x[student of j(x)]

Claim: Strong NPIs, as weak NPIs, activate logically stronger alternatives, but While weak NPIs just need to exhaustify the truth-conditional component of meaning, strong NPIs need to be exhaustified with respect to all the dimensions of meaning.

Illustration with the strong NPI *in weeks*:
To begin with, Chierchia assumes that *in XPs* is an event modifier meaning something like 'over a temporal span lasting one or more XPs'.

(34) a. *Joe met Mary in weeks.
   b. ∃e[met_w(e,j,m)∧cul(e)∧τ(e)⊂ WEEKS] with cul=culminated, τ(e)=the temporal span of e and ⊂ stands for temporal inclusion
   c. There is a culminated event of Joe meeting Mary whose temporal span is included in a period of one or more weeks long.

(34b): Truth-conditions of (34a).
Now, as *in weeks* in an NPI, it is the weak element of a range of grammatically determined alternatives.

(35) Alternatives:
   a. Joe met Mary in D, where D is a time interval smaller than *weeks*.
   b. $\exists$e[met$_w$(e,j,m)$\wedge$cul(e)$\wedge\tau$(e)$\subset$ D]

Notice that as the alternatives of the form ((35b)) entail ((34b)), if we fulfill the usual exhaustification, we would expect *in weeks* to behave as weak NPIs. However, recall that *in weeks* need to be exhaustified with respect to the presuppositions and the implicatures of its environment.

1. Role of presuppositions: To introduce, the π operator indicates that a proposition is spliting into its content component $^{\alpha}$p and its presuppositional component $^{\pi}$p, as the following example shows.

   (36) π(only John said something in weeks)=John said something in weeks $\wedge\forall$ x[x said somthing in weeks $\rightarrow$ x=John]

   Claim: Strong NPIs occuring in a proposition p are exhaustified relative to $\pi(p)$. If the NPI occurs in a non-DE context in $\pi(p)$, the result of exhaustification will be G-trivial, as the following example shows:

   (37) O$^{s}{}_{ALT}$(only John said something in weeks$_{+D}$)=only John said something in weeks $\wedge\ \forall p \in$ ALT[π(p) $\rightarrow$ π(only John said something in weeks) $\subseteq$ π(p)]

   To follow, the presupposition-enriched assertion with its alternative:

   (38) John said something in weeks $\wedge\forall$ x[x said something in weeks $\rightarrow$ x=John]
   $\Uparrow$ $\Downarrow$ John said something in D $\wedge\forall$ x[x said something in D $\rightarrow$ x=John]
   where D$\subset$WEEKS

   None of the alernatives to the enriched assertion is entailed by it. Therefore, they must all be false (when exhaustification). But this is in contradiction with the assertion $\rightarrow$ (37) is G-trivial. This account extends to all proppositional triggers(left argument of *every*, conditionals, factives like *be sorry*, *regret*. accouting thus for their failur to license strong NPIs. Conversely, a sentence such as *John didn't see Mary in weeks.* has no relevant presupposition. Hence exhaustification of *John didn't see Mary in weeks* presents no problem and the sentence will be ruled in. $\Rightarrow$ Contrast between Strong vs. Weak NPIs:

   (39) a. Strong exhaustification:
   O$^{s}{}_{ALT}[\Phi_w]$=$\Phi_w \wedge \forall p \in$ALT $[\pi(\mathrm{p})_w \rightarrow \pi(\lambda w \Phi_w) \subseteq \pi(\mathrm{p})]$
   b. eak exhaustification:
   O$^{w}{}_{ALT}(\Phi_w)$=$\Phi_w \wedge \forall p \in$ ALT $[^{\alpha}\mathrm{p}_w \rightarrow {}^{\alpha}\lambda w \Phi_w \subseteq {}^{\alpha}\mathrm{p}]$

2. Role of implicatures: Recall (?) that each scalar element, such as *few*, has both σ- and D-alternatives. Consider the sentence in (40a) and its total set of alternatives.

   (40) a. Few people saw Mary in weeks.
   b. NO$_D$ in W $\Rightarrow$ FEW$_D$ in W $\Rightarrow$ NOT ALL$_D$ in W
   $\Downarrow$ $\Downarrow$ $\Downarrow$
   NO$_{D'}$ in W $\Rightarrow$ FEW$_{D'}$ in W $\Rightarrow$ NOT ALL$_{D'}$ in W
   c. O$_{ALT}$(few$_{+D}$ people saw Mary in weeks$_{+D}$)=few$_D$ people saw Mary in weeks $\wedge\neg$NO$_{D'}$ in W' (for any D', W') = few$_D$ people saw Mary in weeks $\wedge$ some$_{D'}$ people saw Mary in W' (for any D', W')
   d. O$_{ALT}$ (no$_{+D}$ people saw MAry in weeks$_{+D}$)= ...

Rows: σ-alternatives, the columns D-alternatives (dont celle activée par *in weeks*.
Exhaustification in (40c): The whole first column is entailed by the assertion. Therefore, the result, that in any D',W' (including the smallest ones) there have to be people in D' that saw Mary in W', which contradicts the assertion. → G-trivial Conversely, the exhaustification in (40d): the sentencce entails everything, therefore the exhaustification is vacuous and the sentence is grammatical.

⇒ Strong NPIs must be exhaustified by considering the total ALT of scalar and domain alternatives.
Strong NPIs carry a feature that can be checked only by O_{ALT}, i.e. an exhaustification whose restriction includes the whole set ALT of grammticaly determined alternatives.
Difference between strong and weak NPIs.

(41) a. i. $O_{\sigma A}$ O_{DA} [$Few_{[+\sigma,+D]}$ people saw $any_{[+\sigma,+D]}$ movies recently]
ii. # O_{ALT} [$Few_{[+\sigma,+D]}$ people saw Mary *in* $weeks_{[+\sigma,+D]}$]
b. i. $O_{\sigma A}$ O_{DA} [$No_{[+\sigma,+D]}$ people saw $any_{[+\sigma,+D]}$ movies recently]
ii. # O_{ALT} [$No_{[+\sigma,+D]}$ people saw Mary *in* $weeks_{[+\sigma,+D]}$]

Weak NPI allow separate exhaustification of D- and σ-alternatives. In (41a-i) and (41b-i) we first exhaustify relative to the D-alternatives. The result is fine because when this occurs the prejacent is DE with respect to the position of the NPI. Then the scalar implicature is added. Strong NPIs do not have this option: O_{ALT} must be used, which activates the relevant feature on any intervening XP. This forces exhaustification of both σ- and D-alernatives, which only works with end-of scale XPs. We assume furthermore, that O_{ALT} always factors in presuppositions as in (39a): thus, $O^s{}_{ALT}$=O_{ALT} and $O^w{}_{ALT}$=$O_{\sigma A}/O_{DA}$. The former looks at presupposition+assertion while the latter just at the assertive component.

5 The Free Choice uses of disjunction

The following sentence has two salient readings, (42a) and (42b):

(42) You may take ice cream or cake. ◇[p∨q]
where p=you may take ice cream and q=you may take cake
a. You are allowed to take ice cream and you are allowed to take cake. $\diamond p \wedge \diamond q$
b. You are allowed to take ice cream and you are also allowed to take cake but you are not allowed to take them both. $\diamond p \wedge \diamond q \wedge \neg\diamond$[p∧q]

In each interpretation, *or* conveys *and*: each disjunct is understood as an admissible way of respecting the permission. This phenomenon, well-known as *FC effect*, occurs in this sentence, because a modal element takes scope over disjunction[3].
The same phenomenon occurs in the following sentence, containing the NPI *any*: (43) is interpreted as saying that each cake is an admissible way of respecting the permission (interpretation in (43b)).

(43) You may take any cake.
a. ◇[c_1∨c_2∨c_3∨...]
You are allowed to take cake 1 or cake 2 or cake 3...
b. $\diamond c_1 \wedge \diamond c_2 \wedge \diamond c_3 \wedge ...$
You are allowed to take cake 1 and you are allowed to take cake 2 and you are allowed to take cake 3...

[3]Notice that this phenomenon can also take place when disjunction occurs under modals of necessity ((1a) is understoof as (1b)):

(1) a. For this class, you must write a paper or run an experiment. □ [p∨q]
b. For this class, you are allowed to write a paper and you are allowed to run an experiment. $\diamond p \wedge \diamond q$

⇒ Signature property of the FC effect:

(44) $\diamond[a_1 \vee a_2 \vee a_3 \vee ...] \Rightarrow \diamond a_1 \wedge \diamond a_2 \wedge \diamond a_3 \wedge ...$

It is important to notice that the FC effect tends to disappear under negation (and in any DE contexts):

(45) You cannot have ice cream or cake. $\neg\diamond[p \vee q]$

a. You cannot have ice cream and you cannot have cake. $\neg \diamond p \wedge \neg \diamond q$ $(=\neg\diamond[p \vee q])$

b. $\neg[\diamond p \wedge \diamond q]$

(45) is interpreted as (45a) and not as (45b), which is the expected interpretation with a FC effect. Nevertheless, notice that this interpretation, *It is not the case that you are both allowed to have ice cream and allowed to have cake*, is weaker than the interpretation in (45a).
⇒ We can observe a parallel between the distribution of SIs, which are hard to process in DE contexts and the FC effect, which tends to disappear in these contexts. This suggests that the FC effect is an implicature of sort.

Going back to the example (42), we will discuss how FC disjunction is derived.

(46) a. You may take ice cream or cake.

b. Extended scalar alternatives (where p = *you may take ice cream* and q = *you may take cake*):

$\diamond[p \vee q]$

$\diamond p$ $\diamond q$ ⇒ D-alternatives

$\diamond[p \wedge q]$ ⇒ σ-alternatives

If we exhaustify the assertion with respect to this set of alternatives, we get a contradiction:

(47) $O_c(\diamond[p \vee q]) = \diamond[p \vee q] \wedge \neg\diamond p \wedge \neg\diamond q \wedge \neg\diamond[p \wedge q]$

Nevertheless, the alternatives against which the assertion (46a) is assessed are not exactly those in (46b). To illustrate, if you ask someone informed, which of the propositions in (46b) is true, you would interpret his answer exhaustively.

(48) a. A: Which of the propositions in (46b) is true? ⇔ What are you allowed to eat from the set {the cake, the ice cream}?

b. B: You are allowed to eat the ice cream. ⇔ $\diamond p$

We interpret B's answer as: You are allowed to eat the ice cream and you are not allowed to eat the cake. ⇔ $O(\diamond p) = \diamond p \wedge \neg\diamond q$.

Therefore, the alternatives that have to be considered for the assertion in (46a) are the exhaustified alternatives, as follows:

(49) Exh-ALT:

$O_{ALT}\diamond p$ $O_{ALT}\diamond q$ ⇒ D-alternatives

$O_{ALT}\diamond[p \wedge q]$ ⇒ σ-alternatives

Notice that the exhaustification of $\diamond[p \wedge q]$ is vacuous, because the scalar alternative is the strongest member of the alternative set.
Now, if we exhaustify (46a) with respect to these exhaustified alternatives, we obtain the following derivation:

(50) a. $O_{Exh-ALT}(\diamond[p \vee q]) = \diamond[p \vee q] \wedge \neg O_{ALT}\diamond p \wedge \neg O_{ALT}\diamond q \wedge \neg O_{ALT}\diamond[p \wedge q]$

b. i. $\neg O_{ALT}\diamond p = \neg[\diamond p \wedge \neg\diamond q] = [\diamond p \rightarrow \diamond q]$

ii. $\neg O_{ALT}\diamond q = \neg[\diamond q \wedge \neg\diamond p] = [\diamond q \rightarrow \diamond p]$

iii. $\neg O_{ALT}\diamond[p \wedge q] = \neg\diamond[p \wedge q]$

c. $O_{Exh-ALT}(\diamond[p \vee q]) = \diamond[p \vee q] \wedge [\diamond p \rightarrow \diamond q] \wedge [\diamond q \rightarrow \diamond p] \wedge \neg\diamond[p \wedge q]$

(50c) says that one of $\diamond$p or $\diamond$q is true and, if one of the two is true, the other also must be true, which is equivalent to $\diamond p \wedge \diamond q \wedge \neg\diamond[p \wedge q]$.
$\Rightarrow$ One of the prominent reading of *You may take ice cream or cake.* is derived: you are not allowed to take both, but each one is an available option.

Conclusion

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