Distributivity and specific indefinites

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In this paper, I study the interactions between the semantics of specific indefinites and the mechanisms that achieve distributivity. I argue that by assuming i) that specific indefinites can be interpreted as denoting skolemized choice functions, ii) that there are two distributivity operators (one that applies to predicates and one that applies to individual denoting expressions) and iii) that Chomsky's (1995) extension condition holds, one can account for the distribution of *dependent readings* for specific indefinites and some of the differences between quantifiers regarding their ability to take "inverse-scope". I also account for some previously unnoticed differences between implicit variables and pronouns with respect to binding.

1. Introduction

A sentence such as (1) has a reading according to which Pierre and Jean may have read a different book each, without there being any book read by both Pierre and Jean:

(1) Pierre et Jean ont lu un livre
Pierre and Jean have read a book

Beghelli & Stowell (1997) claim that this reading is compositionally derived from the presence of a covert floating quantifier; in their view, the semantic mechanism giving rise to that reading is the same as in (2):

(2) Pierre et Jean ont chacun lu un livre
Pierre and Jean have each read a book

This view, however, cannot be correct, as shown by the following contrast:

(3) Pierre et Jean ont lu un certain livre
Pierre and Jean have read a certain book
(a) available reading: a single book was read by the two
(b) *non-available reading: possibly a different book for each

(4) Pierre et Jean ont lu chacun un certain livre
Pierre and Jean have read each a certain book
(a) available: a single book was read by the two
(b) available: possibly a different book for each

(3) and (4) show that, contrary to Beghelli & Stowell's claim, the presence of a floating quantifier is not just a matter of phonetic realization, since it makes possible a reading ((4)b) not possible without it ((3)b)[1].

In this paper, I will account for this contrast and related data on the basis of an analysis of a) the semantics of specific indefinites (i.e. indefinite DPs of the form *un certain NP)* and b) the grammatical mechanisms that underlie distributivity. This analysis will turn out to make correct predictions with respect to the availability of inverse-scope readings and the interpretation of certain definite descriptions.

2. Specific indefinites as (skolemized) choice functions.

In the past years, several authors (Reinhart 1997, Winter 1997, Kratzer 1998, Mathewson 1998, Chierchia 2001) have suggested that specific indefinites denote *choice functions*. A choice function is a function which, when applied to a non-empty set, returns a member of that set.

This assumption enables us to predict that specific indefinites can take "long-distance" scope. For instance, (5) below has a reading which amounts to (5)a, in which the indefinite seems to scope over the if-clause, e.g. a scopal island. This reading is straightforwardly predicted by the choice-function account, which, at an informal level, gives us something like (5)b, paraphrased as (5)c.

(5) If a certain professor is talking, Peter will go to the conference
a. There is a professor such that, if he is talking, Peter will go to the conference
b. If f(professor) is talking, Peter will go to the conference
c. If the professor that is selected by the contextually determined choice-function f is talking, Peter will go to the conference[2]

The choice-function hypothesis, as such, can only predict readings in which the specific indefinite behaves as if it took maximal scope. Yet it has been

[1] Following standard practice, all the judgements given here are meant to be contrastive. Even though, for some speakers, the intended reading is not completely out for (3), it seems in any case to be much harder to get than it is with (4), and to require much more contextual clues.

[2] How the choice-function in question is in fact determined is far from clear. The function must in some sense depend on 'what the speaker has in mind' when using a specific indefinite. Everything I say in this paper is in fact compatible with an alternative analysis where the specific indefinite is a choice-function variable bound by an existential quantifier taking scope over the entire sentence, but with no possibility to bind it from an intermediate site, contrary to Reinhart (1997).

clearly established that specific indefinites can take "intermediate scope", i.e. they sometimes escape a scopal island while remaining at the same time within the scope of some higher operator. Reinhart (1997) argued that in order to account for this type of reading, one has to treat specific indefinites as denoting *choice-function variables* that need to be bound by an existential quantifier which can be inserted at different sites, *not necessarily at top-most level*. (6) below illustrates the phenomenon of "intermediate scope", with (6)a being the relevant reading, analysed by Reinhart as (6)b (existential closure above *every solution*, but below *every linguist*):

(6) Every linguist studied every solution that could solve a certain problem
   a. For every linguist y, there is a certain problem z, such that if w is a potential solution for z, then y studied w
   b. For every linguist y, there is a choice function f, such that if w is a potential solution to f(problem), then y studied w.

Other authors have suggested that instead of resorting to existential closure at an intermediate site, one should rather account for these readings by assuming that specific indefinites can also denote ***skolemized choice-functions***. A *skolemized choice function* (cf. Kratzer 1998, Mathewson 1998, Chierchia 2001) is a function that applies to two arguments, a set and an individual, and which returns a member of the set –possibly a different one for different individuals. The individual argument can be a bound variable. On this account, (6), on the intended reading, has the following (informal) representation :

(6) c. $\forall$y (linguist(y) $\rightarrow$ $\forall$ w (w could solve f(problem, y) $\rightarrow$ y studied w))

Under this view, the reading in (6)a, where the problem varies with the linguists, is not accounted for in terms of the relative scope of the universal quantifier and an existential quantifier, but in terms of a hidden operator-variable dependency. The choice-function itself, like a definite description, is essentially scopeless. This assumption somehow amounts to viewing specific indefinites as *implicit definite descriptions that can contain a bound variable*, an idea that gains some initial plausibility from the following example by Hintikka (1986):

(7) According to Freud, every man_i wants to marry a certain woman – his_i mother

Whether or not we want to allow intermediate existential closure of choice-function variables *à la* Reinhart,[3] there exist readings that cannot be predicted by using only this mechanism. Consider indeed the following scenario:[4] *John,*

[3] Chierchia (2001) argues that both skolemized choice-functions and Reinhart's intermediate existential closure are necessary in order to account for all the uses of specific indefinites.

[4] Philippe Schlenker, p.c.

Peter and Mary are students about to take a syntax exam. John hasn't understood what wh-movement is; Peter is unfamiliar with WCO, and Mary with Principle C. In order for the exam to be a success, each of them should study the topic he is unfamiliar with. With this in mind, one could describe the situation as in (8)a, or more explicitly, as in (8)b:

(8) a. If every student studies a certain topic, the exam will be a success
b. If every student studies a certain topic --namely, the one he is unfamiliar with--, the exam will be a success

On the intended reading, topics vary with students, but not arbitrarily. For the exam to be a success, it is not sufficient that every student studies whatever topic he likes; rather, each student should study *the* topic *he* is unfamiliar with. In such cases, I will say that the specific indefinite is interpreted as *dependent* on the universal quantifier. Existential closure *à la* Reinhart below *every student* only gives us (8)c, which is equivalent to (8)d, and is therefore clearly too weak.

(8) c. If for every student x, there is a choice-function f such that x studied f(topic), the exam will be a success.
d. If for every student x, there is a topic y that x studied, the exam will be a success.

What needs to be captured is the fact that while topics vary with students, which topic each student should study *depends* on the student in a specific way. The intended reading is paraphrased in (8)e:

(8) e. There is a way of associating each student S with a topic T_s such that if every student S studies T_S, then the exam will be a success.
f. If every student S studies f(topic, S), the exam will be a success.

(8)e is in fact what we get by analysing the specific indefinite as denoting a skolemized choice-function whose individual argument is a variable bound by the universal quantifier, as in (8)f. I am therefore going to assume that specific indefinites can always denote contextually determined skolemized choice-functions (as well as non-skolemized ones).

3. A second puzzle

An interesting observation, which is connected to the puzzle with which I started is that specific indefinites cannot be dependent on every quantifier.

(9) If many students study a certain topic, the exam will be a success
(a) There is a certain topic –for instance wh-movement- such that if many students study this very topic, the exam will be a success.

(b) (impossible reading) *There is a way of associating students with topics such that if there are many students who each study the topic associated to them, the exam will be a success

(10) If all the students study a certain topic the exam will be a success
(a) There is a certain topic –for instance wh-movement- such that if all the students study this very topic, the exam will be a success.
(b)*There is a way of associating students with topics such that if all the students study *their* topic, the exam will be a success

This contrast among quantifiers (every, each vs. many, all) is similar to the one exemplified by (11) and (12) below, which is itself reminiscent of our initial contrast between the two sentences in (3) and in (4) -- since in both cases, insertion of a floating quantifier makes available a reading in which the specific indefinite is somehow dependent on the quantifier.

(11) If Pierre and Jean have **each** read a certain book, the exam will be a success

(12) If Pierre and Jean have read a certain book, the exam will be a success

The following reading is available for (11) but not for (12): "There is a way of associating Pierre on the one hand, and Jean on the other hand, with a book (possibly different ones for each) such that if Pierre and Jean have each read the book associated with each of them, the exam will be a success". From now on, I will say that in cases like (4) and (11), as opposed to (3) and (12), the subject is able to *distributively bind* the implicit variable of the specific indefinite.

4. Distributivity
4.1. Two distributive operators

We now need to understand how the semantic mechanisms that achieve distributivity, the semantics of quantifiers and that of specific indefinites conspire to yield the contrasts described above. In this section, I will posit two distributivity operators: one applies to predicates –e.g it turns a predicate into a distributive predicate-, while the other one applies to individual-denoting expressions and is spelt out as a floating quantifier, like *chacun* in French.

Sentences are interpreted with respect to a model whose domain is a *join semi-lattice*. Individuals in this domain are either *atomic* or *complex*. The *join* operation that yields a complex individual when applied to two individuals, atomic or complex, is denoted by the sign '+'. An *individual denoting expression*, typically a proper name or the conjunction of several proper names, is an expression of type *e*, e.g. whose denotation is a member of the domain, atomic or complex. The word *and*, when applied to two individual-denoting

expressions, creates an expression whose denotation is the sum of the denotations of each conjunct[5]: $[\![$Pierre et Jean$]\!]^{M}$ =Pierre+Jean
I now turn to distributivity. (13) below has two readings, given in a. and b.

(13) Pierre et Jean ont soulevé le piano
Pierre and Jean have lifted the piano
(a) collective reading: Pierre and Jean have lifted the piano together
(b) distributive reading: Pierre lifted the piano on its own, and so did Jean

When the object contains an indefinite expression, as in (1), the distributive reading entails that the subject takes "distributive scope" over the indefinite – unless the indefinite scopes above the subject:

How is distributivity achieved ? There are two theoretical options :
A) A distributive operator turns the *VP* into a *distributive* predicate (Schwarzschild 1995, Lasersohn 1995, among many others)
B) A distributive operator applies to the *subject* (Heim, Lasnik & May 1991, Landmann 1996, among others)

I will hereafter assume that we need both option A) and option B), but that option B) is overtly signalled by the presence of floating *chacun*: on the one hand, a silent distributive operator, call it $DIST_{pred}$ applies to predicates, and, on the other hand, an overt one, floating *chacun*, applies to individual-denoting expressions[6]. This hypothesis, combined with the skolemized choice-function approach of specific indefinites, is the key to my account of the puzzle illustrated by examples 1-4.

A) $[\![DIST_{pred}]\!] = \lambda P.\lambda\alpha$ *.for any atomic member* β *of* α*,* $P(\beta)$

Applied to a predicate P, $DIST_{pred}$ returns a predicate that is true of a given individual X if and only if P is true of each atomic member of X. In the case of (1), where *un* is interpreted as normal existential quantification, we get the reading where the book read may be different for Pierre and for Jean as follows:

(1') $[\![$Pierre et Jean ont lu un livre$]\!]$= 1
a. $[\![$Pierre et Jean$]\!]$.$[\![$$Dist_{pred}$(lire un livre)$]\!]$=l
b. ($[\![Dist_{pred}]\!]$ $[\![$lire un livre$]\!]$). (Pierre+Jean) = 1

[5] Hereafter, I will omit the superscript 'M'. Furthermore, we assume that all expressions are interpreted with respect to a partial assignment function. When no assignment function appears as a superscript, the assignment function used is the empty one. Only expressions that contain no free variables can be interpreted with respect to the empty assignment function. Note also that proper names are used in the meta-language as names for the elements of the domain to which proper names, as linguistic expressions, refer.
[6] As pointed out by a reviewer, I only consider here pure distributive and pure collective readings, ignoring the well-documented so-called intermediate readings (see, among others, Landmann 2000, Lasersohn 1995, Schwarzschild 1996). More work is needed in order to incorporate these readings into the present account.

c. ((λP.λα.for any atomic member β of α, P(β)).⟦lire un livre⟧.(Pierre+Jean)=1

d. ((λP.λα.for any atomic member β of α, P(β)).(λx. ∃y book(y) & x read y)).(Pierre+Jean)) =1

e. (λα .for any atomic member β of α, ∃y, book (y) and β read y). (Pierre+Jean) = 1

f. For any atomic member β of Pierre+Jean, ∃y, book (y) and β read y

g. There is a book that Pierre read and there is a book that Jean read

B) *⟦chacun⟧ = ⟦$DIST_{indiv}$⟧ = λα.λP (for any atomic member β of α, P(β))*

Applied to an individual X, *$DIST_{indiv}$* yields a generalized quantifier denoting the set of predicates which are true of each atomic member of X. I assume, following Sportiche (1988), that *chacun* applies to the subject, with which it forms a single constituent at some level of representation. (2) is therefore interpreted as below:

(2') ⟦Pierre et Jean ont chacun lu un livre⟧= 1

a. ⟦$DIST_{indiv}$ (Pierre et Jean)⟧.⟦lire un livre⟧=1

b. ((λα.λP (for any atomic member β of α, P(β))).(Pierre+Jean)).(λx. ∃y book(y) and x read y)) = 1

c. (λP.for any atomic member β of Pierre+Jean, P(β)).(λx. ∃y book (y) and x read y)) = 1

d. For any atomic member β of Pierre+Jean, ∃y book (y) and β read y

e. There is a book that Pierre read and there is a book that Jean read

If there is no floating quantifier, the only way to achieve distributivity is to use *$DIST_{pred}$*.

4.2. Distributivity and dependent specific indefinites

Let us now turn to (3) and (4), repeated below as (14) and (15) :

(14) Pierre et Jean ont lu un certain livre
Pierre and Jean have read a certain book
(a) available reading: a single book was read by the two
(b) *non available reading: possibly a different book for each

(15) Pierre et Jean ont lu chacun un certain livre
Pierre and Jean have read each a certain book
(a) available: a single book was read by the two
(b) available: possibly a different book for each

What we must explain is why the implicit variable of the specific indefinite can be “distributively bound” in (15), but not in (14). I am adopting Heim &

Kratzer's (1998) mechanism for variable binding (though I will amend it in section 6): variable binding is the result a movement operation (QR). For a subject to bind a variable x occurring within a predicate, the subject must move up and leave a trace, which is identified with x and is abstracted over by a lambda operator at the level of the landing site of the subject:

(16) a. [Peter [thinks [he is intelligent]].
b. [Peter [λ_i [t_i [thinks [he_i is intelligent]]]]

- Rule of interpretation for λ: *for any assignment function g*[7] *(possibly empty), any index i and any phrase XP,* $[\![\lambda_i\ XP]\!]^g = \lambda x[\![XP]\!]^{g(i\rightarrow x)}$

In (14), the only way to get a dependent reading for the specific indefinite is to turn the VP into a distributive predicate thanks to $DIST_{pred}$ and ensure that its implicit variable is bound, as in (14'), where the index on *certain* represents the implicit variable:[8]

(14') [Pierre et Jean [λ_n [t_n [$DIST_{pred}$ (ont lu un $certain_n$ livre)]]]]

But this cannot give us the reading in question, because the index of the specific indefinite remains, so to speak, unaffected by $DIST_{pred}$. *Un certain livre* ends up being interpreted as *f(book, Pierre+Jean)*, which precludes co-variation:

$[\![(14')]\!]$=1 iff
a. $[\![$Pierre et Jean$]\!]$.$[\![\lambda_n[t_n[DIST_{pred}$(ont lu un $certain_n$ livre)]]$]\!]$ = 1
b. $[\![\lambda_n[t_n[DIST_{pred}$(ont lu un $certain_n$ livre)]]$]\!]$(Pierre+Jean) = 1
c. $\lambda x[\![[t_n$ [$DIST_{pred}$ (ont lu un $certain_n$ livre)]]$]\!]^{(n\rightarrow x)}$.(Pierre+Jean)= 1
d. λx ($[\![[DIST_{pred}$ (ont lu un $certain_n$ livre)]]$]\!]^{(n\rightarrow x)}$(x)).(Pierre+Jean) = 1
e. λx (($[\![DIST_{pred}]\!][\![$ont lu un $certain_n$ livre)$]\!]^{(n\rightarrow x)}$)(x)).(Pierre+Jean) = 1
f. λx(($[\![DIST_{pred}]\!]$(read f (book, x)))(x)).(Pierre+Jean) = 1
g. λx(($\lambda\alpha$ .for any atomic member β of α, β read f(book, x))(x)).(Pierre+Jean). = 1
h. λx(for any atomic member β of x, β read f(book, x)).(Pierre+Jean) = 1
i. For any atomic member β of Pierre+Jean, β read f (book, Pierre-et-Jean)
j. Pierre read f(book, Pierre-and-Jean) and Jean read f(book, Pierre-and-Jean))

(15) on the other hand can be interpreted as corresponding to the following structure:

7 I use Heim & Kratzer's (1998) notation. For any assignment function g, g(i→x) refers to the assignment function defined as follows: for any j distinct from i, g(i→x)(j) = g(j) (if defined), and g(i→x)(i) = x. In particular, '(i→x)' denotes the assignment function identical to the empty one except over i, to which it associates x, i.e. '(i→x)' is defined only over i and (i→x) (i) = x.

8 Another possibility exists, which will be ruled out below on principled grounds:
[Pierre et Jean [$DIST_{pred}$ [λ_n [t_n (ont lu un $certain_n$ livre)]]]]

(15') [chacun (Pierre et Jean) [λ_n [t_n ont lu un $certain_n$ livre]]]

The predicate "to be an x such that x has read f(book,x)" is combined not with *Pierre et Jean*, but with *chacun (Pierre et Jean)*, i.e. will be interpreted as being true of Pierre on the one hand and Jacques on the other hand, i.e. as meaning "Pierre is such that he read f(book, Pierre) and Jacques is such that he read f(book, Jacques)":

$[\![(15')]\!]=1$

a. $[\![DIST_{indiv}(\text{Pierre et Jean})]\!].[\![\lambda_n\ [t_n \text{ ont lu un certain}_n \text{ livre}]]]\!] = 1$

b. $((\lambda\alpha.\lambda P(\text{for any atomic member } \beta \text{ of } \alpha, P(\beta)).(\text{Pierre+Jean})).\lambda x[\![[t_n[\text{ont lu un certain}_n \text{ livre}]]]\!]^{(n\to x)} = 1$

c. $((\lambda\alpha.\lambda P(\text{for any atomic member } \beta \text{ of } \alpha, P(\beta)).(\text{Pierre+Jean})).\lambda x([\![\text{ont lu un certain}_n \text{ livre}]]\!]^{(n\to x)}(x)) =1$

d. $((\lambda\alpha.\lambda P(\text{for any atomic member } \beta \text{ of } \alpha, P(\beta)).(\text{Pierre+Jean})).(\lambda x.\ x \text{ read } f(\text{book}, x)) =1$

e. $(\lambda P(\text{for any atomic member } \beta \text{ of Pierre+Jean}, P(\beta))).(\lambda x.\ x \text{ read } f(\text{book}, x))) =1$

f. For any atomic member β of Pierre+Jean, $(\lambda x.\ x \text{ read } f(\text{book}, x))(\beta) = 1$

g. For any atomic member β of Pierre+Jean, β read $f(\text{book}, \beta)$)

4.3 Constraining the application of $DIST_{pred}$

My analysis relies on an implicit assumption that a predicate of the form (17) cannot be constructed.

(17) [$DIST_{pred}$ [λ_n [t_n (ont lu un $certain_n$ livre)]]]

If it could, we would have gotten the absent reading of (14) in the following manner:

(18) $[\![$[Pierre et Jean [$DIST_{pred}$ [λ_n [t_n (ont lu un $certain_n$ livre)]]]]$]\!]$

a. $([\![DIST_{pred}]\!](\lambda x.x \text{ read } f(\text{book}, x))).(\text{Pierre+Jean})$

b. $\lambda\alpha(\text{for any atomic member } \beta \text{ of } \alpha, \beta \text{ read } f(\text{book}, \beta)).(\text{Pierre+Jean})$

c. For any atomic member β of Pierre-and-Jean, (read f(book, β))(β)

d. Pierre read f(book, Pierre) and Jean read f(book, Jean)

But predicates like (17), in which $DIST_{pred}$ is immediately followed by a λ-operator binding both a variable in subject position and a hidden variable inside the VP, can be blocked if we adopt the following assumption:

(19) Chomsky's (1995) extension condition: Any operation (be it merge or move) must extend the structure, i.e. every new node is inserted above the structure already built.

(17) could only be constructed by inserting $DIST_{pred}$ between the moved subject and the trace it has left behind. Such an operation would violate the extension condition

5. Differences between Quantifiers and Inverse-Scope readings

In the introduction, I noticed that not all quantifiers are able to "distributively bind" the implicit variable of a specific indefinite:

(20) a. Chaque étudiant a étudié un certain problème
Each student has studied a certain problem
b. Tous les étudiants ont étudié un certain problème
All the students have studied a certain problem
c. Plusieurs étudiants ont étudié un certain problème
Several students have studied a certain problem
d. Plusieurs étudiants ont chacun étudié un certain problème
Several students have each studied a certain problem

(20)a can mean that for each student S there is a certain problem P_s such that each student S has studied P_s. Such a reading is not available with (20)b. Similarly, (20)c cannot mean that there is a group of students such that for each member S of this group, there is a problem P_s such that if each S has studied P_s. This reading becomes however available when a floating *chacun* is inserted as in (20)d. This set of facts can be accounted for by the following lexical entries for *chaque*, *tous les* and *plusieurs*:

a) ⟦chaque⟧= λP. λQ. for any atom x such that P is true of x, Q is true of x

(20)a can correspond to the structure in (21), whose interpretation is given below:

(21) [chaque étudiant [λ_n [t_n a étudié un certain_n problème]]]

⟦(21)⟧ = 1 iff for any atom A such that A is a student, ⟦[λ_n[t_n a étudié un certain_n problème]]⟧ (A)= 1, i.e. iff for any atom A such that A is a student, A studied f(problem, A).

b)⟦tous les⟧ = λP. λQ. the maximal individual X such that P holds of each atomic member of X is such that Q is true of X.

(20)b can correspond to the structure in (22), but the fact that $DIST_{pred}$ has been inserted is not enough to license the dependent reading:

(22) [tous les étudiants [λ_n [t_n $DIST_{pred}$ [ont étudié un certain_n problème]]]]

⟦(22)⟧ = 1 iff the sum of all the students, call it X, has the property denoted by "[λ_n [t_n $DIST_{pred}$ [ont étudié un $certain_n$ problème]]]", i.e X is such that all the members of X have studied f(problem, X).

c) ⟦plusieurs⟧= λP. λQ. there is an individual X which is the sum of at least two atoms which have the property P and such that Q is true of X.

(20)c, even if analyzed as (23), can have no reading where the implicit variable of the specific indefinite is "distributively bound" by the subject:

(23) [plusieurs étudiants [λ_n[t_n $DIST_{pred}$[ont étudié un $certain_n$ problème]]]]

⟦(23)⟧ = 1 iff there is an individual X which is the sum of at least two students and has the property denoted by "[λ_n [t_n $DIST_{pred}$ [ont étudié un $certain_n$ problème]]]" i.e. X is such that all the members of X have studied f(problem,X)

In (20)d, however, the presence of floating *chacun* allows the quantified subject to "distributively bind" the implicit variable of the specific indefinite. Assume indeed that (20)d. corresponds to a structure like (24):

(24) [plusieurs étudiants [λ_n [[(chacun t_n)] [λ_m [t_m ont étudié un $certain_m$ problème]]]]][9]

(24) is then interpreted as follows:

⟦(24)⟧ = 1 iff there is an individual X which is the sum of at least two students and has the property " [λ_n[[(chacun t_n)][λ_m[t_m ont étudié un $certain_m$ problème]]]]", i.e. such that any atomic member x of X is such that x studied f(problem, x)

This set of assumptions has direct consequences with respect to so-called *inverse scope* readings, illustrated by (25):

(25) Un étudiant a lu chaque livre
A student read each book
Possible reading : for each book, a student read it

Inverse scope is not an option for all types of quantified objects. In fact, in French, it is restricted to DPs headed by *chaque* or *chacun*. It turns out, however, that even if we assume that all quantified objects can undergo *quantifier raising (QR)*, only inherently distributive quantifiers like *chaque*-

[9] For this structure to be generated, one has to allow *chacun* and *plusieurs étudiants* to be base-generated together in the VP-internal subject position. [chacun[plusieurs étudiants]] is then adjoined to VP. Then *plusieurs étudiants* alone raises to a higher position.

DPs and *chacun*-DPs will be able to distribute over an indefinite subject. (25), after QR of *chaque livre*, will have the following representation:

(26) [chaque livre [λ_n [un étudiant a lu t_n]]]

The entry given above for *chaque* has the outcome that (26) is interpreted indeed as "for each book, a student read it". On the other hand, QR alone is not able to yield such an inverse-scope reading for (27), even if supplemented by $DIST_{pred}$:

(27) Un étudiant a lu tous les livres
A student read all the books

LF of (25) after QR of the object, assuming $DIST_{pred}$ is present:

(28) [tous les livres [λ_n [un étudiant [DIST_{pred} a lu t_n]]]]

The interpretation of (28) is: the individual X that includes all the books is such that there is a student s such that each atomic member of s read X. In order to get the inverse-scope reading, we should have inserted $DIST_{pred}$ between the moved QP and λ_n, thus violating the *extension condition*.

(29) * [tous les livres [DIST_{pred} [λ_n [un étudiant a lu t_n]]]]

6. Binding, pronouns and implicit variables

The choice function analysis for specific indefinites can be seen as treating them as definite descriptions in disguise. A phrase like "a certain X" is then seen as indicating that the speaker would have been able to use a definite description instead if she had wanted to. The skolemized version of specific indefinites would be the counterpart of a definite description that would contain a bound pronoun.

I therefore predict that definite descriptions containing an overt pronoun should behave like specific indefinites containing a hidden variable, i.e. they should not be able to be interpreted as dependent on a quantified subject unless the subject is a *chaque/chacun DP* or floating *chacun* is present.

(30) [Pierre et Marie]$_i$ ont pris leur$_i$ cheval et sont partis
Pierre and Marie took their horse and left

(30) is predicted to presuppose that Pierre and Marie own a horse in common, and to assert that they collectively took it. It shouldn't be able to describe a situation in which each of them took their own horse ("dependent reading"). That is because *leur$_i$ cheval* is basically interpreted as a Skolem function that associates each individual with his horse. In fact, possessive

pronouns can be seen as denoting a particular skolemized choice function: the function which, when applied to an individual x and a set S, returns the unique member of S that x owns.

Most speakers find indeed the dependent reading a little bit unnatural; they seem to prefer the use of a dependent plural instead of a singular definite description, as in (31):

(31) Pierre et Marie ont pris leurs chevaux et sont partis
Pierre and Marie took their horses and left

Yet the dependent reading is in fact attested for (30), and is perfectly natural in many contexts, which is a problem for my analysis. In order to solve it, I am going to make use of an additional assumption, which seems *ad hoc* but hopefully will make additional and unexpected predictions: I need to assume that *pronouns* get bound not thanks to QR and λ-abstraction, but by a special *binding operator* β (cf. Büring 2004a, 2004b) that can be inserted without any movement operation, and that is defined as follows:

(32) a. Rule of interpretation for β: If XP is of type <e, X> and i is an index, $[\![\beta_i XP]\!]^g = \lambda x([\![XP]\!]^{g(i\rightarrow x)}(x))$
b. Condition on β-insertion : β_i can be inserted at any time in a derivation provided it c-commands an overt pronoun P bearing the index i and no other β_i c-commands P from a lower position.

The condition on β-insertion is equivalent to a requirement that β be not inserted vacuously, i.e. bind a pronoun. (30) then can be analysed as:

(33) [[Pierre et Marie] [$DIST_{pred}$ [β_i [ont pris $leur_i$ cheval]]]]

$[\![(33)]\!] = [\![\text{Pierre et Marie}]\!].([\![DIST_{pred}]\!].[\![[\beta_i \text{ [ont pris leur}_i \text{ cheval]]}]\!])$
a. $([\![DIST_{pred}]\!].\lambda x([\![\text{ont pris leur}_i \text{ cheval}]\!]^{(i\rightarrow x)}(x)))$. (Pierre+Marie)
b. $([\![DIST_{pred}]\!].\lambda x((\text{TOOK x'S HORSE})(x)))$. (Pierre+Marie)
c. (λα. for any atomic member y of α, (λx. x TOOK x'S HORSE)(y)).(Pierre+Marie)
d. (λα. for any atomic member y of α, y TOOK y'S HORSE).(Pierre+Marie)
e. For any atomic member y of Pierre+Marie, y TOOK y'S HORSE
f. Pierre took Pierre's horse and Marie took Marie's horse

(33) does not violate the extension condition : no movement occurred: at the time β_i is inserted, it is inserted at the top of the tree, and $DIST_{pred}$ is itself inserted at the top of the tree after β-insertion.

A tentative motivation for distinguishing between the mechanism of binding for pronouns and for other variables is the following: if "covert" variables[10] cannot be bound by the β–operator, we predict dependent readings to be more restricted not only for specific indefinites, but also for other expressions that contain a hidden variable, such as certain **definite** descriptions. Imagine for instance the following scenario:

John and Peter live far from each other. There is a wild cat living in John's neighbourhood, and another wild cat living in Peter's neighbourhood.

Consider now the following pair:

(34) a. John et Peter ont adopté le chat
John and Peter have adopted the cat
b. John et Peter ont chacun adopté le chat
John and Peter have each adopted the cat

(34)a does not make clear sense in this context: which cat did they adopt? (34)b, on the other hand, can be interpreted as meaning that *they each adopted the cat that lives in their respective neighbourhood*. Let us assume definite descriptions come with an implicit restriction on the relevant domain of quantification. Then *the cat* denotes the unique cat in C, where C is the set of individuals that are contextually relevant. Assume further that this "implicit restriction" can be relativized to individuals, i.e. *the cat* denotes the unique cat in C(x), where C(x) is the set of individuals that are contextually relevant with respect to a certain individual x. Now x is an implicit variable that can be bound under exactly the same conditions as the implicit variable of a skolemized choice function. Assuming that we insert $DIST_{pred,}$ (34)a will have the following logical form, which does not allow this implicit variable to be distributively bound by the subject:

(35) [[John et Peter] [λ_n [t_n $DIST_{pred}$ (ont adopté [le chat C(n)])]]]]

(34)b will be represented as (36), which indeed corresponds to the dependent reading :

(36) [chacun (John et Peter) [λ_n [t_n (ont adopté [le chat C(n)])]]]

On the other hand, (37) is perfectly fine :

(37) John et Peter ont adopté le chat qui vit à côté de leur maison
John and Peter have adopted the cat that lives near to their house

[10] « Covert variables », here, are meant to refer to anything that does not belong to the lexical category of pronouns. From this perspective, PRO and pro (in pro-drop languages) do not qualify as covert variables, while traces and contextual variables do. Büring (2004 a, 2004 b) implements another constraint on β–insertion, to the effect that a moved quantifier is unable to bind a pronoun by means of the β-operator, which accounts for WCO effects.

This is because the overt pronoun triggers β-insertion, which, when followed by the insertion of $DIST_{pred}$, generates the dependent reading without violating the extension condition.

A comparable example can be built with relational nouns, like *voisin*, *neighbour*. Assume that Pierre and Jacques are neighbours, and both have a (different) cat:

(38) a. #Pierre et Jacques ont rencontré le chat du voisin
Pierre and Jacques have met the neighbour's cat
b. Pierre et Jacques ont chacun rencontré le chat du voisin
Pierre and Jacques have each met the neighbour's cat

While (38)a is odd unless it is known that there is a third neighbour who has a cat, (38)b is natural and can be understood as meaning that Pierre met Jacques's cat and Jacques met Pierre's cat[11].

7. Conclusion

The analysis developed in this paper is based on three assumptions: a) specific indefinites denote choice-functions or skolemized choice-functions – an hypothesis that is independently motivated; b) there exist two distinct distributivity operators, a covert one which applies to predicates, and an overt one, realized as a floating quantifier, that applies to individual-denoting expressions in subject position; c) pronouns and implicit variables get bound by different mechanisms. Binding of implicit variables involves movement, while binding of pronouns does not.

These assumptions were embedded within a derivational model of syntax in which the *extension condition* holds, and were stated in terms of a theory of the syntax/semantics interface *à la* Heim & Kratzer (1998).

This approach was shown to account for the distribution of dependent readings for specific indefinites, for some of the differences between various quantifiers regarding the availability of inverse scope, and for the different behaviour of pronouns and implicit variables with respect to distributivity and binding.

[11] A reviewer finds the data in (38) objectionable, and furthermore notes that replacing *voisin* (neighbour) with *ami* (friend) or *frère* (brother), which are also relational nouns, makes both sentences (a) and (b) odd. I agree with the latter observation, but I don't think it undermines my point; for some unknown reason, not all relational nouns can be used without an explicit specification of their two arguments; my claim is only that for those which can, I expect a contrast similar to the one in (38). A genuine counterexample to this claim would be a pair in which the two sentences are appropriate, or in which the (a)-example is more appropriate than the (b)-example.

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