

# Crossover Situations\*

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## Abstract

Situation semantics as conceived in Kratzer (1989) has been shown to be a valuable companion to the *e-type pronoun* analysis of donkey sentences (Heim (1990) and recently refined in Elbourne (2001b)), and more generally *binding out of DP* (BOOD; Tomioka (1999), Büring (2001)). The present paper proposes a fully compositional version of such a theory, which is designed to capture instances of Crossover in BOOD.

Keywords: binding, bound variables, cross-over, donkey sentences, e-type pronouns, genitive binding, inverse linking, paycheck pronouns, situation semantics

## 1 Introduction

In this paper I develop a compositional account of *binding out of DP* (BOOD; sometimes called *indirect binding*) which uses e-type pronouns and situation semantics. The paper proceeds as follows: I show how surprising cases of binding from inside DP (possessors and postnominal PPs) can be handled by analyzing the bound pronouns as e-type pronouns. The cross-over facts observed in these and similar constructions then follow as special cases of the standard cross-over facts (section 3), and can be accounted for by e.g. a treatment that restricts variable binding to higher arguments (exemplified in section 2). I then show how well-known shortcomings of such analyses

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can be remedied by invoking situations, as done in Heim (1990), which I integrate into the specific syntax-semantics mapping developed previously (section 4). This, finally, opens up the possibility of asking whether the binding of situation variables itself is subject to cross-over, a question answered in the affirmative in section 5, where I argue, following Elbourne (2001a), that certain dependent DPs need to be analyzed as containing bound situation variables, but no bound individual variables, and yet show cross-over effects. The resulting treatment also remedies certain inadequacies of the simple e-type analysis of BOOD regarding VP ellipsis, and sheds light on some surprising facts about apparently antecedent-less bound DPs.

## 2 An Argument-Based Account of Pronoun Binding and Cross-Over

An influential idea in generative grammar is that pronoun binding, or bound-variable anaphora, as it is sometimes called, always involves an argument slot binding (into) a lower coargument. Cross-over, on this view, is simply a consequence of the fact that the element that has ‘crossed over’ does not occupy an argument slot, and is hence incapable of binding variables (see e.g. the discussion and references in Bach and Partee (1980, 1984)). A very simple and natural implementation of this idea has been proposed by P. Jacobson (see Jacobson (1999, 2000) and the references therein) within a variable free categorial grammar. In the transformational literature, Tanya Reinhart, in Reinhart (1983) and other works, has presented what I take to be an elegant characterization of the Weak Cross-Over (WCO) generalization along these lines, which I will take as my point of departure:

- (1) Reinhart’s Generalization:  
Pronoun binding can only take place from a c-commanding A-position.

The crucial qualification here is ‘from an A-position’, which excludes binding from a position derived by *wh*-movement or quantifier raising. In the following, I will refer to this generalization as the *a-command* requirement on pronoun binding (where a-command = c-command from an A-position).

For the purpose of the discussion, I will implement this generalization in the following way: We introduce a *binding operator*  $\beta_n$ , which can be

optionally adjoined at LF.<sup>1</sup> This operator signals that the DP immediately c-commanding it binds any free occurrence of a pronoun indexed  $n$  within its c-command domain:<sup>2</sup>

- (2) a. pronoun binding (optional):  $\begin{array}{c} \diagup \quad \diagdown \\ \text{DP} \quad \text{XP} \end{array} \Rightarrow_{LF} \begin{array}{c} \diagup \quad \diagdown \\ \text{DP} \quad \text{XP} \\ \quad \quad \diagup \quad \diagdown \\ \quad \quad \beta_n \quad \text{XP} \end{array}$
- where  $n$  is an index, and DP occupies an A-position
- b.  $\llbracket \beta_n \text{ XP} \rrbracket^{w,g} = \lambda x. \llbracket \text{XP} \rrbracket^{w,g[n \rightarrow x]}(x)$

Given the (fairly standard) interpretation of the binding operator in (2b) (essentially the *derived VP rule* of Partee (1975), Sag (1976) a.m.o.) and the explicit stipulation that it can only be adjoined next to an A-position, we capture Reinhart’s a-command requirement (1).

Almost, that is, for we need to ensure that no other mechanism can bind a pronoun from an  $\bar{A}$ -position, the most obvious candidate being the rule that interprets operator-trace dependencies. For the sake of concreteness I will do this by formally distinguishing a *trace binding operator*  $\mu_n$  (mnemonic for ‘movement’; this is Heim and Kratzer (1998):186’s Predicate Abstraction rule):

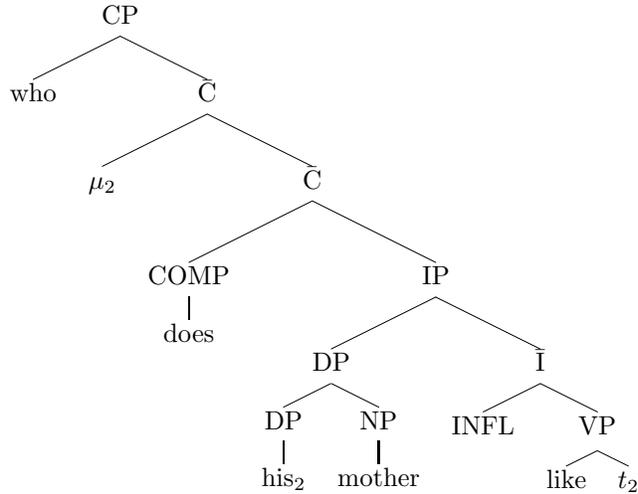
- (3) a. trace binding (obligatory):  $\begin{array}{c} \diagup \quad \diagdown \\ \text{DP}_n \quad \text{XP} \end{array} \Rightarrow_{LF} \begin{array}{c} \diagup \quad \diagdown \\ \text{DP} \quad \text{XP} \\ \quad \quad \diagup \quad \diagdown \\ \quad \quad \mu_n \quad \text{XP} \end{array}$
- where  $n$  is a movement index
- b.  $\llbracket \mu_n \text{ XP} \rrbracket^{w,g} = \lambda x. \llbracket \text{XP} \rrbracket^{w,g[t_n \rightarrow x]}$

Note that crucially, the assignment function  $g$  has a sorted domain: indices, as found on pronouns, versus indexed traces; that way it is possible that  $g(t_n) \neq g(n)$ , and accordingly  $\llbracket t_n \rrbracket^{w,g} \neq \llbracket \text{pron}_n \rrbracket^{w,g}$ , for a given integer  $n$ . The standard WCO contrast between, say, (4) and (5) is thus captured via the full LFs given below:

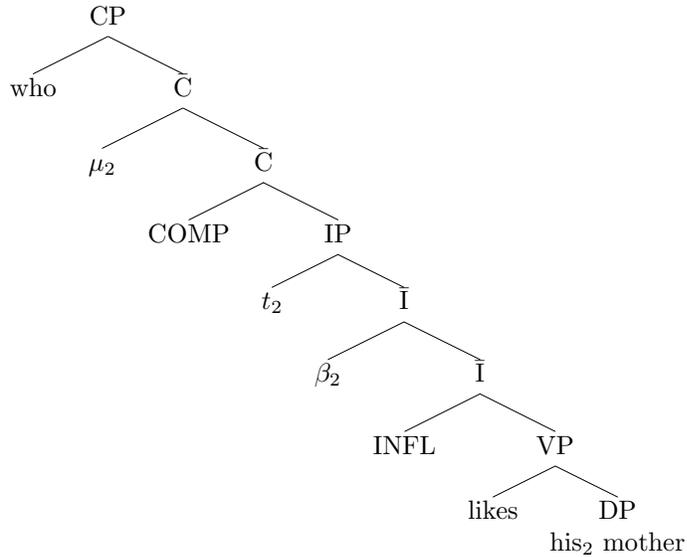
<sup>1</sup>Friends of surface indexing may also think of this rule as transferring an index from the DP to a binder, similar to Heim and Kratzer (1998)’s treatment of movement.

<sup>2</sup>Throughout this paper I will use  $x$  for individual variables (type  $e$ ),  $P$  for property variable (type  $\langle e, t \rangle$ ),  $R$  for relations ( $\langle e, \langle e, t \rangle \rangle$ ),  $p$  for propositions ( $t$ ),  $G$  for generalized quantifiers ( $\langle e, t \rangle$ ),  $s$  for situations,  $T$  as a variable over types, and greek letters for variables of flexible type. Where necessary, variables will be subscripted to distinguish them.

(4) Who<sub>2</sub> does his<sub>2</sub> mother like t<sub>2</sub>?



(5) Who<sub>2</sub> t<sub>2</sub> likes his<sub>2</sub> mother?



(4), despite the coindexing, does *not* yield a bound interpretation for the pronoun *his<sub>2</sub>*, because  $\mu_2$  binds traces only; *his<sub>2</sub>* is interpreted as a free variable. For *his<sub>2</sub>* in (4) to be bound, a  $\beta_2$  operator would have to be inserted; but adjunction of  $\beta_2$  to  $\bar{C}$  is not permitted, since SpecC is an  $\bar{A}$ -position.

In contrast to that, (5) has *his<sub>2</sub>* semantically dependent on *who*, because the trace of *who* binds it via the adjoined  $\beta_2$ . This adjunction is licit, since the trace occupies an A-position (if you believe that *who* in (5) hasn't moved

at all, the analysis gets even simpler; I just wanted to illustrate how a moved item can bind via its trace position in general).

To put the gist of this treatment as a slogan:  $\bar{A}$ -dependencies and pronoun-binding dependencies are strictly distinct.<sup>3</sup> This is diametrically opposed to treatments as diverse as Montague (1974) and Heim and Kratzer (1998):ch.5, in which pronoun binding is taken as a side effect of  $\bar{A}$ -trace binding, but in keeping with the papers alluded to at the very beginning of this section. Independent of the specific implementation offered in this section, the present paper can be seen as an exploration of how this general line of analysis can be made to account for certain examples that are known to challenge it.

It bears mentioning that an implementation of WCO that restrict pronoun binding to (higher) argument positions, including the one given here, is extremely local, in the following semi-technical sense: It merely regulates whether one object — here: the  $\beta$  prefix — can be combined with another  $\alpha$  — here:  $\bar{I}/\bar{C}/VP$  — by looking at the properties of  $\alpha$  itself (whether it is an argument taking expression). It crucially doesn't look 'into'  $\alpha$ , in particular at the potential bindee and its configuration relative to  $\beta$  (in fact no reference to chains or indices is made at all). This kind of locality sets the present proposal, together with a conceptually similar one in Jacobson (1999) (where pronoun binding is a semantic operation on predicates) apart from the more common indexing or linking based approaches (Chomsky, 1976; Higginbotham, 1983; Koopman and Sportiche, 1983; Safir, 1984, to name just a few). I submit that locality is a desirable property, since it resonates well with the idea endorsed in Categorical Grammar and more recently certain 'minimalist' versions of the Principles & Parameters Theory that the internal structure of constituents, once they have been constructed, is opaque to further grammatical operations, and that, accordingly, there can't be 'filters' on complete representations.

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<sup>3</sup>Maybe there is a more principled reason why binding from an  $\bar{A}$ -position cannot bind pronouns, namely that the traces of  $\bar{A}$ -movement are of a semantic type other than  $e$ , so that no binding of an individual variable can occur as a 'side effect' of  $\bar{A}$ -trace binding (as has been suggested recently in Ruys (2000)). This would avoid the stipulated restriction on  $\beta$ -adjunction to  $A$ -positions. I will not speculate on this further, but everything that follows is compatible with such a refinement.

### 3 The E-Type Analysis of BOOD

We will now show that the cross-over account developed in the previous section correctly carries over to cases of *binding out of DP* (BOOD) such as donkey anaphora, genitive binding, and inverse linking.

#### 3.1 Donkey Sentences and Donkey Cross-Over

Donkey sentences like (6) have been analyzed using *e-type* pronouns (Chierchia, 1995; Evans, 1980; Heim, 1990; Neale, 1990, a.o.), as well as *unselective binding* (Heim, 1982). We will now briefly show that the e-type analysis naturally fits with the account of cross-over given above (the same is presumably true for unselective binding approaches, though a considerable amount of details needs to be filled in):<sup>4</sup>

- (6) Every farmer who owns a donkey beats it.

According to the e-type analysis, the pronoun *it* in (6) is interpreted as ‘the donkey he owns’, which yields a reading in which the referent of *it* co-varies with farmers, as desired. Let us implement it by analyzing the configuration (7a) via the LF in (7b), which gets an interpretation equivalent to (7c) through contextual assignment of the ‘donkey of’ function to the variable  $R$  (this adopts the treatment of paycheck pronouns in Cooper (1979) and Heim and Kratzer (1998)):

- (7) a. every farmer who owns a donkey beats it  
b. [ every farmer who owns a donkey ] [  $\beta_2$  [ beats [ THE  $R(x_2)$  ] ] ]  
c. *every farmer who owns a donkey* beats **the donkey he owns**

Individual variables like  $x_2$  are assigned the syntactic category of pronouns, i.e.  $\llbracket x_n \rrbracket^{w,g} = g(n)$ , which means they can get bound by  $\beta$ , but not  $\mu$ . Crucially, the only object language variable that is bound in (7) is  $x_2$ , and it is bound by the subject DP *every farmer who owns a donkey*, not the embedded DP *a donkey*. We will henceforth speak of the embedded DP that

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<sup>4</sup>In what follows I will indiscriminately use the term e-type pronoun to refer to what have been called in the literature ‘donkey pronouns’, ‘pronouns of laziness’ and ‘paycheck pronouns’. Historically, the latter two stand for strict repetitions of their antecedent, while the former expands to a description which has to be ‘distilled’ from the clause containing the antecedent.



This generalization has been observed in the literature and implemented in the form of various stipulations on admissible indexings at LF (Haïk, 1984; Reinhart, 1987, a.o.). It follows directly, and without any further constraints on indexing, from the theory advanced in section 2.

### 3.2 Embedded Quantifier Binding

Other cases of binding out of DP, too, fall into place under the proposed analysis. Thus, if we follow a brief suggestion in Bach and Partee (1980, 1984) to treat cases of *genitive binding* as involving e-type pronouns, the correct cross-over pattern is immediately derived. Under this analysis, (10) has (10a) as its LF, and receives the interpretation (10b):

- (10) *Every boy's mother likes him.*  
 a. [every boy's mother]  $\beta_3$  likes [**the R/son of**  $x_3$ ]  
 b. *every boy's mother* likes **her son**

Note again that the container DP *every boy's mother*, rather than the embedded antecedent *every boy* does the binding here, and it does so from an A-position. As predicted, this binding is impossible if the DP containing *every boy* has to cross over the pronoun in order to bind it, i.e. would have to bind from an  $\bar{A}$ -position:

- (11) a. \**His friends like every boy's mother.* (*his* can't co-vary with boys/mothers)  
 b. [every boy's mother]  $(*\beta_4)$   $\mu_2$  [[[**the R/son of**  $x_4$ ]'s friends] like  $t_2$ ]

Extending beyond what is found in the literature, the approach also carries over to *inverse linking*, which shows the same cross-over pattern:

- (12) a. Somebody from every city hates its climate.  
 LF: [ somebody from every city ] [  $\beta_8$  [ hates **the R**  $x_8$ /**city** **they<sub>8</sub> are from**'s climate  
 b. \**Its climate is hated by everybody in some city.*  
 LF: [ everybody in some city ] [  $(*\beta_8)$   $\mu_6$  [ [ **the R**  $x_8$ /**city** **they<sub>8</sub> are from**]'s climate is hated by  $t_6$

Since the e-type approach to inverse linking and genitive binding has never been explored in the literature, I provide a more complete derivation for

these examples in the appendix. Note for the moment that, once again, the variable  $x_8$  is bound by the container DP *somebody from every city*, i.e. it ranges over people, not cities. That DP is in an A-position in (12a), but in an  $\bar{A}$ -position in (12b). Hence, pronoun binding is impossible in the latter case.

The e-type account of genitive binding and inverse linking thus directly derives the cross-over pattern. Although this pattern has been observed in the literature, where it has been christened *secondary weak cross over*, known attempts to implement it in the grammar are either empirically inadequate (May, 1988; Hornstein, 1995), as I intend to show in a separate paper, or have the status of mere additional stipulations regarding indexing or linking (Higginbotham, 1980a,b, 1983, 1987; Reinhart, 1987; Safir, 1984). The bottom line is that the fact that the possibility of co-variation with a quantified DP (*every city*) should depend on the position of a DP containing it (*somebody from every city*) is simply completely unexpected if you assume that that co-variation is a direct consequence of variable binding by *every city*. On the e-type view, on the other hand, the container DP *is* the binder, and the correlation between weak cross-over and secondary weak cross-over is explained immediately.

### 3.2.1 Appendix: Getting the DP Meanings Right

As said above, the analysis above assumes the following meaning for the subject DPs:

- (13) a.  $\llbracket \text{every boy's mother} \rrbracket^g = \lambda P. \text{ for every boy } x, \text{ the unique mother } y \text{ of } x \text{ has } P$   
 b.  $\llbracket \text{somebody from every city} \rrbracket^g = \lambda P. \text{ for every city } x, \text{ there is some person } y \text{ from } x \text{ such that } y \text{ has } P$

It is orthogonal to the analysis of cross-over how these meanings are derived, but for concreteness we will assume the following: *X's mother* is interpreted as ‘the mother of *X*’, i.e. genitive ‘*s*’ denotes a function that maps a relation,  $\llbracket \text{mother} \rrbracket^{w,g}$ , and an individual, the possessor, onto a generalized quantifier. This gives us a straightforward interpretation for simple cases like *Susie's mother*:

- (14) a.  $\llbracket \text{mother} \rrbracket^g = \lambda x \lambda y. y \text{ is a mother of } x$   
 b.  $\llbracket \text{'s} \rrbracket^g = \lambda R \lambda y \lambda P. \text{ there is an } x, x \text{ is the only element such that}$

$$(15) \quad \left[ \left[ \begin{array}{c} \text{DP} \\ \swarrow \quad \searrow \\ \text{Susie} \quad \text{D} \\ \quad \quad \swarrow \quad \searrow \\ \quad \quad \text{'s} \quad \text{NP} \\ \quad \quad \quad \quad | \\ \quad \quad \quad \quad \text{mother} \end{array} \right] \right]^g =$$

- a.  $[\lambda R \lambda y \lambda P. \text{there is an } x, x \text{ is the only element such that } R(y)(x) \text{ and } P(x)](\lambda x \lambda y. y \text{ is a mother of } x)(\text{Susie})$
- b.  $= [\lambda y \lambda P. \text{there is an } x, x \text{ is the only element such that } [\lambda x \lambda y. y \text{ is a mother of } x](y)(x) \text{ and } P(x)](\text{Susie})$
- c.  $= [\lambda y \lambda P. \text{there is an } x, x \text{ is the only element such that } x \text{ is a mother of } y \text{ and } P(x)](\text{Susie})$
- d.  $= \lambda P. \text{there is an } x, x \text{ is the only element such that } x \text{ is a mother of Susie and } P(x)$

If the possessor is a quantified DP, as in (66a), we face a type mismatch: The QDP *every boy* wants a  $\langle \text{et} \rangle$ -type argument, but *s' mother* is of type  $\langle e, \langle \text{et}, t \rangle \rangle$ . The type mismatch resembles that in transitive verb constructions with quantified objects, and is remedied by the same cure: a rule that allows generalized quantifiers to combine with any function of type  $\langle e, \langle \tau, t \rangle \rangle$ , which I call *argument saturation*:<sup>6</sup>

$$(16) \quad \text{argument saturation: } \left[ \left[ \begin{array}{c} \text{XP}_{AS^T} \\ \swarrow \quad \searrow \\ \text{DP} \quad \text{Z} \end{array} \right] \right]^g = \left[ \left[ \begin{array}{c} \text{XP}_{AS^T} \\ \swarrow \quad \searrow \\ \text{Z} \quad \text{DP} \end{array} \right] \right]^g =$$

$\lambda \psi. \llbracket DP \rrbracket^g(\lambda x. \llbracket Z \rrbracket^g(x)(\psi))$  (where  $\psi$  is a variable in  $D_T$  and  $Z$  is of type  $\langle e, \langle T, t \rangle \rangle$ )

We can now derive (13a) as in (17):

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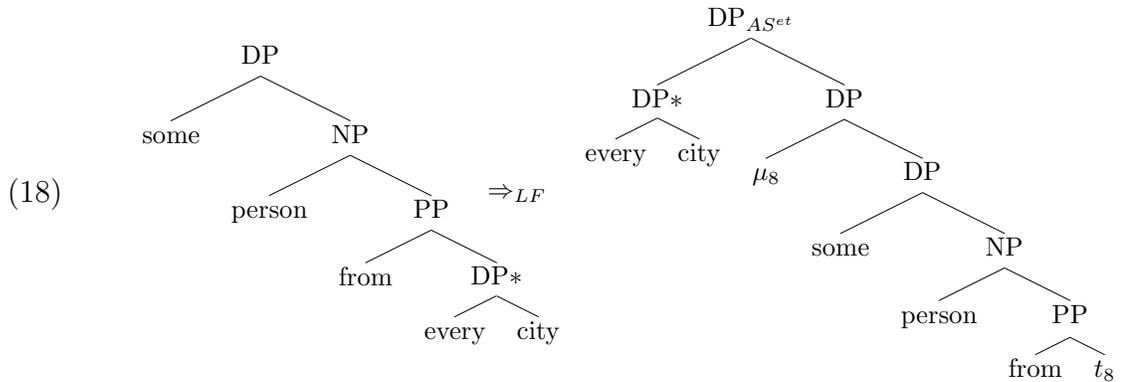
<sup>6</sup>This version of the rule is not fully generalized in that it allows one to skip one argument only (though one of an arbitrary type), but this is all we need in this paper. I use the subscript notation  $\text{XP}_{AS^T}$  for notational convenience; alternatively one could adjoin a type-lifting operator to the Z-argument in the rule, i.e.  $\llbracket DP Z \rrbracket_{AS^T}$  would be replaced by  $\llbracket DP [AS^T Z] \rrbracket$ , with the semantics for  $AS^T$  being  $\lambda \xi \lambda G \lambda \psi. G(\lambda x. \xi(x)(\psi))$ .

(17)  $\left[ \left[ \begin{array}{c} \text{DP}_{ASet} \\ \swarrow \quad \searrow \\ \text{DP} \quad \bar{\text{D}} \\ \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ \text{every boy} \quad \text{'s} \quad \text{NP} \\ \quad \quad \quad \quad \quad | \\ \quad \quad \quad \quad \quad \text{mother} \end{array} \right] \right]^g =$

a.  $\lambda P_2.[\text{every}(\text{boy})](\lambda z.[\lambda R\lambda y\lambda P.\text{there is an } x, x \text{ is the only element such that } R(y)(x) \text{ and } P(x)](\lambda x\lambda y.y \text{ is a mother of } x)(z)(P_2))$

b.  $\lambda P_2.[\text{every}(\text{boy})](\lambda z.\text{there is an } x, x \text{ is the only element such that } x \text{ is a mother of } z \text{ and } P_2(x))$

The derivation of inverse linking requires one additional step, namely scoping of the embedded DP over the determiner. For concreteness we will do this by quantifier raising, which targets the DP:



This phrase marker receives the desired interpretation: the movement binder  $\mu_8$  triggers abstraction over an individual variable, which makes the middle DP segment denote the same kind of function as *'s mother* above, which then combines with the adjoined QDP by argument saturation:

(19) a.  $\llbracket \text{some person from } t_8 \rrbracket^g = \lambda P.\text{there is an } x, x \text{ is a person and from } g(t_8) \text{ and } P(x)$

b.  $\llbracket \mu_8[\text{some person from } t_8] \rrbracket^g = \lambda x_1\lambda P.\text{there is an } x_2, x_2 \text{ is a person and from } x_1 \text{ and } P(x_2)$

c.  $\llbracket \text{every city} \rrbracket^g = \lambda P.\text{for every city } x, P(x)$

d.  $\llbracket [\text{every city } \mu_8[\text{some person from } t_8]]_{DP_{ASet}} \rrbracket^g = \lambda P_1.[\lambda P_2.\text{for every city } x_4, P_2(x_4)](\lambda x_3.[\lambda x_1\lambda P_3.\text{there is an } x_2, x_2 \text{ is a person and from } x_1 \text{ and } P_3(x_2)](x_3)(P_1))$

=  $\lambda P_1$ .for every city  $x_4$ ,there is an  $x_2$ ,  $x_2$  is a person and from  $x_4$  and  $P_1(x_2)$ )

Note in closing that this analysis circumvents a certain embarrassment about the very *semantics* of these construction, in which a quantifier appears to bind a variable that is not contained in its sister (if you assume that *somebody from every city* and *every boy's mother* form constituents at LF (May, 1985, 1988, a.o.)), or only so after a movement that is otherwise highly unlikely and problematic (if you assume that *every city* and *every boy* are adjoined to S at LF (May, 1977; Hornstein, 1995) — see Larson (1987); May (1985); Heim and Kratzer (1998); Barker (2001) for arguments against this movement). On the present account, the subject DP remains a constituent at LF and denotes an ordinary generalized quantifier.

### 3.3 Other Cases of Binding out of DP

E-type analyses have been proposed for other BOOD constructions in the literature, notably in Tomioka (1997, 1999), which offers an analysis of sloppy identity without c-command in VP ellipsis, (20a), and focus co-variation without c-command, (20b), that involves the use of e-type pronouns (strike-out marks elided material):

- (20) a. The policeman who arrested John read him his rights, but [the policeman who arrested *Bill*] didn't ~~read *him* his rights~~.  
 b. It was only established that [the policeman who arrested *JOHN*] read *him* his rights.

Both types of examples receive the correct interpretation if *him* is expanded to *the R/person arrested by him* at LF, and the container DPs (bracketed in (20a) and (20b)) do the binding. While the compositional details of this construction are beyond the scope of the present paper,<sup>7</sup> we note that both these constructions show WCO-effects as well:

- (21) a. \*It was only established that *her* mother threatened every policeman who arrested *MARY*.

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<sup>7</sup>and may very well involve significant complications for the situation based theory to be put forward in the following sections (cf. the discussion in Elbourne (2001a):sec.7.2+3)

- b. \*The policeman who arrested her today, read Sue her rights. The one who did ~~arrest her~~ yesterday, read *MARY* her rights.

The star in both cases regards the indicated co-varying interpretation (where *her* = *Mary*). In both cases, the container DP fails to a-command the pronoun, explaining the unavailability of this reading.

This concludes the first part of this paper. We have shown that an e-type analysis of BOOD, in particular genitive binding and inverse linking, handles some of the most notorious counter-examples against the a-command account of cross-over, and in fact provide additional evidence for it. In the second part, we will show that this picture doesn't change under a semantically more complex, empirically more adequate account of e-type pronouns, which involves situations.

Note that the essential features of the account so far will carry over to any semantically refined version of the e-type approach, provided that this refined version still involves individual-variable binding of the sort used so far. The reason we bother about the details nonetheless is that arguably, *not* all cases of BOOD involve individual variable binding, as we will see. The refinement of the theory we are about to present captures cross-over effects in these case nonetheless, and moreover repairs some general inadequacies of the e-type approach (in VP ellipsis contexts).

In what follows, I will restrict my attention to donkey sentences, since these have received the most attention in the literature, and embedded quantifier binding (genitive binding and inverse linking), since these haven't been analyzed using e-type pronouns at all.

## 4 Enter Situation Semantics

As is well-known at least since the discussion in Heim (1982), the e-type analysis of donkey sentences in its simple form is haunted by what has come to be known as the *uniqueness problem*. In a nutshell, the problem is this: Given that the bound pronoun is analyzed as essentially a function from individuals to individuals, it follows that it will not be defined if no such functional mapping exists. Sentences like (22) from Rooth (1987) are predicted to be either false or undefined if there are mothers that have more than one son:

- (22) No mother with a teenage son will lend him the car on the weekend.

But this result is counter-intuitive. We clearly judge these sentences to be true just in case no boy, whether he has a brother or not, gets to ride the family car on weekends. The exact same problem shows up in cases of genitive binding, inverse linking, focus constructions, and VP-ellipsis. The following examples should be self-explanatory:

- (23) a. *Every boy's* mother likes *him*.  
 b. Some ally of *every country* betrayed *it*.  
 c. It was only established that the guy who married *APPOLONIA* was a bigamist and attempted to steal *her* money.  
 d. *Every boy's* father likes *him*, and *every boy's* grandfather does, too.

In all these cases, the intuitions are clear: There should be as many different cases as there are individuals that meet the scope of the quantifier with the wider scope, i.e. one per boy, country, wife, or (grand)son.<sup>8</sup>

#### 4.1 Adding Situations to the E-Type Analysis

Heim (1990), elaborating on Berman (1987) provides a situation semantics version of a paycheck account to donkey sentences which avoids the uniqueness problem. Simplifying considerably, she lets the container DP in donkey sentences, say *every man who owns a donkey*, quantify over an individual and a situation, here: minimal situations of a farmer and a donkey he owns. *Every farmer who owns a donkey beats it* is thus, to a first approximation, interpreted as ‘every minimal situation containing a farmer and a donkey owned by him is (or can be extended to) one in which he beats *the unique donkey he owns in that situation*’

Paul Elbourne, in a series of recent papers (Elbourne, 2000a,b, 2001b) elaborates on Heim’s proposal, pointing out among other things that the description ‘the unique donkey he owns in that situation’ above can simply be replaced by ‘the unique donkey in that situation’, given that we are talking about minimal farmer+donkey-he-owns situations anyway. Put in different

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<sup>8</sup>Note incidentally that (23b) also argues against an analysis of *it* as a numberless pronoun that denotes the sum of element standing in the pertinent relation, as suggested in Neale (1990); that would wrongly yield a reading according to which every country *x* has some ally that betrayed *all of x's allies*. To be sure, Neale doesn’t intend his analysis for these cases, but if we want to pursue a unified analysis, this case becomes relevant.

terms, Elbourne observes that the three variants in (24) are judged to have the same truth conditions (though they differ in their degree of naturalness):

$$(24) \quad \text{Every farmer who owns a donkey beats } \left\{ \begin{array}{l} \text{it} \\ \text{the donkey} \\ \text{the donkey he owns} \end{array} \right\}$$

He suggests that if we assume the plain definite *the donkey* rather than the definite with a bound pronoun in it to be the LF representation for the e-type pronoun, we can formulate a simple condition on the occurrence of e-type pronouns, namely: an antecedent with identical descriptive content (or, put syntactically, identity of NPs). This not only provides a simple rule to retrieve the content of an e-type pronoun, it also naturally and correctly limits the occurrence of e-type pronouns to environments in which there is a suitable NP ‘antecedent’.<sup>9</sup>

For example, it has been observed that we can have an e-type interpretation for *it* in *everyone who has a guitar should bring it* but not in *every guitarist should bring it*; predicting this difference has been dubbed the ‘problem of the formal link’ (Kadmon, 1987; Heim, 1990). According to Elbourne, the generalization is simply that we need to interpret *it* as ‘the guitar’, which is possible only if an NP *guitar* exists in the linguistic context.

The question I want to address now is if and how such a situation semantic analysis of donkey sentences, and BOOD more in general, is still compatible with the story about cross-over told in the previous part of this paper. More precisely, we can ask the two questions: Can the individual-binding mechanism used be carried over to a semantics with situations? And do we need to add additional mechanisms to regulate situation binding? I will provide a formalism in which both questions receive a positive answer, and in which, moreover the binding of situation variables in general is treated in complete parallelism to that of individual variables.

Neither Heim (1990) nor Elbourne (2001b) concern themselves with the compositional interpretation of these examples. That is, they leave open the question what the denotation of the CDP is in isolation, by what exact

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<sup>9</sup>This then turns the e-type analysis almost back into a pronoun of laziness (or: paycheck) analysis, since now the pronoun *is* taken to simply go proxy for a literal repetition of a preceding constituent, though this constituent is taken to be an NP, not a DP, as in Geach’ original discussion (cf. note 4 above).

rules it combines with the rest of the sentence, and how situation variables are indexed and bound. Since all these questions will ultimately become relevant to the analysis of (secondary) cross-over, let us try to answer them at the outset. The implementation I will suggest differs in its net results from the existing proposals, in a way that is, I think, advantageous. The following should therefore not be read as a literal exegesis of Heim’s or Elbourne’s proposals.

## 4.2 Situations and Types

As a first step, we need to add a set  $S$  of situations to our ontology, together with a partial ordering  $\leq$ , meaning ‘part of’. A subset of the set  $S$  of situations is the set of worlds, i.e. those situations which are not proper parts of other situations. Each situation  $s$  is part of exactly one world (namely  $\iota s' \in S[s \leq s' \text{ and } \forall s'' \in S, \text{ if } s' \leq s'', \text{ then } s' = s'']$ ). which we notate as  $w_s$  (‘the world of  $s$ ’), cf. Kratzer (1989)).

Our semantic types will remain standard, but the domain of type  $t$  is now  $\{0,1\}^S$ , i.e. a sentence denotes (the characteristic function of) a set of situations (called a *proposition*), a VP denotes a function from individuals and situations to truth values (e.g.  $VP'(x)(s) = 1$  iff  $x$  beats the unique donkey in  $s$ ), and so forth. Accordingly, we don’t need a world index on the interpretation function, which is then plain  $\llbracket \cdot \rrbracket^g$ . I will write e.g.  $\lambda x \lambda s \dots$  to name a function of type  $\langle \text{et} \rangle$ , and similarly for other types ending in  $t$ , and I will freely refer to functions as sets, e.g. speak of a VP denotation as a set of individual+situation pairs etc.

A DP (type  $\langle \text{et}, t \rangle$ ) then denotes a function from  $\langle \text{et} \rangle$  type functions to  $t$  type functions, which means a function from sets of situation+individual pairs to propositions. Consider a simple example, together with the truth conditions we want to assign it:<sup>10</sup>

- (25) a. every man sleeps  
 b. for every  $x, s_b$  such that  $s_b$  is a minimal situation of  $x$  being a man, there is an extended situation  $s_e, s_b \leq s_e$  such that  $x$  sleeps in  $s_e$

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<sup>10</sup>The technical use of the term situation might be confusing at first, since it is intuitively unclear what e.g. a minimal situation of being a man would look like. As I lack the space to go into the foundations of situation semantics here, I have to refer the reader to Kratzer (1989) and the references therein.

Note that we need to distinguish two situations here, which are called  $s_b$  and  $s_e$ , mnemonic for ‘base situation’ and ‘extended situation’, in (25). The base situation relates to the restriction of the quantifier; in (25), base situations are minimal situations that contain a man and absolutely nothing else. Since such a situation contains no sleeping, we need to extend the base situations when it comes to evaluating the consequent.

Assuming that an intransitive V denotes a simple set of situations as in (26a), we therefore introduce into the syntactic representation an operator  $\leq$ , which adjoins to VP, and whose denotation, to a first approximation, is (26b):<sup>11</sup>

- (26) a.  $\llbracket \text{sleeps} \rrbracket^g = \lambda x \lambda s. x \text{ sleeps in } s$   
 b.  $\llbracket \leq \rrbracket^g = \lambda P \lambda x \lambda s_b. \text{there is an } s_e, s_b \leq s_e, \text{ and } P(x)(s_e)$

$\llbracket_{VP \leq} \llbracket_{VP \text{ sleeps}} \rrbracket \rrbracket$  no longer maps an individual  $x$  onto the set of situations in which  $x$  sleeps, but onto the set of situations that can be *extended* to one in which  $x$  does, (27a), which then combines with the subject as in (27b) and (27c):

- (27) a.  $\llbracket \llbracket_{VP \leq} \llbracket_{VP \text{ sleeps}} \rrbracket \rrbracket^g = \lambda x \lambda s_b. \text{there is an } s_e, s_b \leq s_e, \text{ and } x \text{ sleeps in } s_e$   
 b.  $\llbracket \text{every man} \rrbracket^g = \lambda P \lambda s. \text{for all } x, s_b \text{ such that } s_b \text{ is a minimal situation of } x \text{ being a man, } P(x)(s_b)$   
 c.  $\llbracket \text{every man } \llbracket_{VP \leq} \llbracket_{VP \text{ sleeps}} \rrbracket \rrbracket^g = (25b)$

Before going on, let us ask: Couldn’t we avoid  $\leq$  in the syntax and assume instead of (27a) and (27b) that VP denotes (26a) and the DP denotes something like (28), yielding the same net effect?

- (28)  $\llbracket \text{every man} \rrbracket^g = \lambda P \lambda s. \text{for all } x, s_b \text{ such that } s_b \leq s \text{ is a minimal situation of } x \text{ being a man, there is an extended situation } s_e, s_b \leq s_e \text{ such that } P(x)(s_e)$

For simple examples this doesn’t make any difference. But for the donkey examples it does. Recall that the correct truth conditions for these examples in a situation  $s$  go like (29):

- (29) for every  $x, s_b$  such that  $s_b \leq s$  is a minimal situation of  $x$  owning a

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<sup>11</sup>Note that  $\leq$  in the metalanguage, the mereological part-of relation, is not identical to, nor the interpretation of,  $\leq$  in the object language.

donkey, there is an extended situation  $s_e, s_b \leq s_e$  such that  
 $x$  beats in  $s_e$  the unique donkey  $x$  owns in  $s_b$

Note that within the core VP meaning (underlined), there are two different situation variables,  $s_e$  and  $s_b$ , both of which, according to (28), would be introduced by the DP meaning. Accordingly, the DP can't be interpreted as in (28). Rather, it would have to take as its argument a function from a situation and an individual to propositions, and the VP would, consequently, have to denote a function of that kind, something like (30) (this kind of function doesn't have a type in our system):

$$(30) \quad \llbracket \text{beats the donkey he owns} \rrbracket^g = \lambda x \lambda s_b \lambda s_e . x \text{ beats in } s_e \text{ the unique donkey } x \text{ owns in } s_b$$

The alternative introduced first doesn't have to assume this. All denotations remain standard (standard, that is, under the new type-domain assignment). This is an argument from simplicity: If we can assume that DPs and VPs have a standard denotation, we should happily do so, and not have to worry about when and why DPs and VPs come to acquire more complex, essentially ternary, meanings.<sup>12</sup>

Below, we will present a second, empirical argument: We will show that, descriptively, a DP within the predicate can never be indexed  $s_e$ . This can be modelled rather naturally by assuming that only  $s_b$ , but not  $s_e$  are introduced by a DP.

### 4.3 The meaning of *the donkey* and *it*

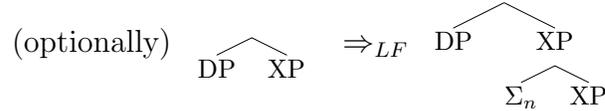
Turning now to the DPs, these will have an additional situation index, which, like an index on an ordinary pronoun, can be bound or free. We will write these as situation indices  $\sigma_0, \dots, \sigma_n$  on determiners, and signal binding of this

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<sup>12</sup>Similar considerations apply to approaches on which the argument to DP denotes a function from assignment functions to  $\langle e, t \rangle$ -type meanings; though technically, on such an approach, the DP can bind any number of variables (situation or individual) within its complement while maintaining one and the same type, it effectively relegates the task of semantic types — to 'traffic rule' semantic composition — to a theory of indexing (note that in principle, any constituent could be made to denote a function from assignments to propositions on that account, since these can cash out as effectively  $n$ -ary place relations for any  $n$ ). Such an approach is not only semantically more cumbersome, it is diametrically opposed to the project underlying the present paper, to minimize the role of indexing procedures in the grammar, and keep grammatical rules local.

situation variable by an s(ituation)-binder prefix  $\Sigma_n$ ; this will be referred to as *s(ituation)-binding*, as opposed to *i(ndividual)-binding*:

(31) a. situation binding (preliminary):



where  $n$  is any index

b.  $\llbracket \Sigma_n \text{XP} \rrbracket^g = \lambda x \lambda s. \llbracket \text{XP} \rrbracket^{g[\sigma_n \rightarrow s]}(x)(s)$

The domain of assignment functions is extended to contain a special set of variables,  $\sigma_1 \dots \sigma_n$ , which are mapped onto situations, i.e. for all  $n, g(\sigma_n) \in S$ . To a first approximation, the meaning of *the*, as seen in overt definite DPs, as well as e-type pronouns at LF, is (32); the two different readings for a donkey sentence are represented in (33):

(32)  $\llbracket \text{the}_{\sigma_n} \rrbracket^g = \lambda P' \lambda P_2 \lambda s. P_2(\text{the unique } x \text{ such that } P'(x)(g(\sigma_n)))(s)$

(33) Every boy who grew up with a donkey  $\Sigma_3[\leq$  will like

- a.  $\llbracket \text{the}_{\sigma_3} \text{ donkey/animal} \rrbracket$  (s-bound reading)  
 b.  $\llbracket \text{the}_{\sigma_4} \text{ donkey/animal} \rrbracket$  (anaphoric/free reading)

An s-bound definite as in (33a) represents the run-of-the-mill donkey sentence, in which the donkey co-varies with boys (or rather: boy+donkey situations). A definite with a free s-variable as in (33b) represents an anaphoric, unbound reading, on which the donkey is the unique donkey in a contextually given situation  $g(\sigma_4)$ , and doesn't co-vary with boys.<sup>13</sup> Such a reading is for example plausible in a context where we wonder whether the boys in the summer camp will like the donkey I just bought.

This account then lets even unbound definites as in (33b) refer, anaphorically if you will, to a unique donkey in a particular situation (here:  $g(\sigma_4)$ ), rather than an absolutely unique donkey. I don't see any reason to exclude this, given the well-known fact that unbound definites don't have to refer to absolutely unique individuals, and in fact rarely do.<sup>14</sup> But we also want to

<sup>13</sup>That is, in this representation,  $\Sigma_3$  binds vacuously.

<sup>14</sup>Perhaps the technique of indexing definites to contextually given situations can even be extended to offer a general account of anaphoric definites in terms of anaphoric situations, while maintaining a general uniqueness semantics for definite DPs, or, put differently, offer an alternative way of encoding domain restriction effects, by saying that *the donkey*

have non-anaphoric, non-bound definites as well, i.e. ones that do refer to the unique N in the world. For this purpose we introduce a special subscript  $\sigma_0$ , such that  $the_{\sigma_0}$  is interpreted relative to  $w_s$ . This index will show up on *truly unique*, non-anaphoric or *absolute definites* such as *the goddess of beauty* or *the tallest mountain on earth* etc.

In introducing situation indices on DPs, we have forgone a different, equally obvious option, namely to say that definites are ‘automatically’ evaluated at the local situation index, which will be the bound index in the scope of a situation quantifier, and the matrix index otherwise. DPs would then be like, say verbs, which also don’t bear any specific situation index, but get automatically interpreted relative to the local index. The following meaning for *the* would accomplish this effect:

$$(34) \quad \llbracket \text{the} \rrbracket^g = \lambda P' \lambda P_2 \lambda s. P_2(\text{the unique } x \text{ such that } P'(x)(s))(s)$$

I think, however, that there are reasons to disprefer this option. For one thing, bound definites and anaphoric/absolute definites can occur in the same structural domain, e.g. *the donkey* (bound) and *the market* (anaphoric) in (35):

$$(35) \quad \text{Every farmer who owns a donkey brings the donkey to the market.} \\ \text{LF: [every...]} \Sigma_1 \text{ [ brings [ the}_{\sigma_1} \text{ donkey ] to [ the}_{\sigma_2} \text{ market ] ]}$$

Since both definites are within the scope *every farmer who owns a donkey*, it is hard to see how they could be interpreted with respect to different situations if interpreted as in (34), whereas indexing represents this straightforwardly, as shown in the LF in (35). To pursue this argument is tricky, however, since a certain amount of ambiguity can probably be derived by scoping the DP at LF (e.g. moving *the market* above the subject DP). While I believe that the rather great flexibility of DPs to choose their situation index make a scoping approach rather unpromising, I will therefore not pursue this argument any further.

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refers to the unique donkey in a specific, anaphorically given situation, rather than the unique donkey out of a specific, anaphorically given set of individuals (it is, however, fully compatible with the idea that *in addition*, the common noun denotation the determiner combines with can be contextually restricted). I will leave the exploration of this possibility for further research.

A second argument is more conceptual in nature. A meaning along the lines of (35) yields *non-persistent* propositions. For example, a simple sentence like *the donkey is paranoid* would denote the following proposition:

- (36)  $\lambda s$ . there is an  $x$  which is the unique donkey in  $s$  and  $x$  is paranoid in  $s$

This set will contain all situations which contain a paranoid donkey and possibly other things, *but not a second donkey*. In a world  $w$  which has two donkeys, one or both of which are paranoid, (36) will contain a number of situations  $s \leq w$ , but not  $w$  itself (or any situation  $s', s \leq s' \leq w$  which contains more than one donkey). Such a proposition is called *non-persistent* (a persistent proposition is one that contains for every situation  $s$  in it also all  $s'$  for which  $s \leq s'$ ).<sup>15</sup>

Kratzer (1989) argues that persistence is a desirable property for propositions to have, and that quantifier meanings should be construed so as to yield persistent propositions. Transposing her proposal for *every* to the case of *the* would mean to replace *the unique donkey in  $s$*  in (36) by *the unique donkey in  $w_s$* , where  $w_s$  is the maximal situation (=the world) of which  $s$  is a part. This, however, cannot be the hard-wired meaning for *the*, for it makes every definite an absolute one, in our terminology, excluding bound and anaphoric uses. Giving DPs a bindable situation index, as proposed here, lets us have the cake and eat it, too. The index *can* be bound by a  $\Sigma$ , be indexed to a contextually given situation, or be indexed  $\sigma_0$ , in which case we achieve Kratzer's absolute uniqueness. In either case, the resulting proposition will be persistent.

The third argument for indexing DPs for situations is empirical, and relates directly to BOOD. If a definite/e-type pronoun can always be interpreted at the local index, there should be a scoping on which it is embedded under the situation extension operator. This effect is irrelevant for true donkey sentences; *every man who owns a donkey beats it* could, under the alternative,

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<sup>15</sup>It is not clear to me whether Heim or Elbourne allow such propositions. The question is whether e-type pronouns, on Heim's account, can ever occur unbound, and whether the actual definite determiner share the relevant properties with the definite determiner in e-type pronouns, on Elbourne's account. At least the latter seems reasonable, given the near-complete parallelism between e-type pronouns and definite DPs that Elbourne points out. In that sense, these approaches might then yield, or rather, allow for, non-persistent propositions as well.

index-less theory using (34), be represented by either LF in (37):

- (37) a. every man who owns a donkey [ [ the donkey ] [  $\leq$  [ beats  $t$  ] ] ]  
 b. every man who owns a donkey [  $\leq$  [ beats [ the donkey ] ] ]

Construal (37a) is interpreted identical to a bound construal: *the donkey* is interpreted relative to the base-situation, introduced by the subject. (37b) is structurally different — *the donkey* is interpreted relative to the extended situation — but arguably yields the same truth conditions, due to the following conspiracy: the extended situation  $s_e$  must contain a unique donkey (uniqueness requirement of the definite DP), but it must also be an extension of the base situation, which already contained a donkey; therefore, the unique donkey in  $s_e$  must be the same as the donkey in  $s_b$  (cf. the argument in Elbourne (2001a):260f).

Nonetheless, admitting LFs like (37b) opens Pandora’s box, as it were, for other cases. Consider (38):

- (38) a. Every man in Athens worships the goddess.  
 b. LF: every man in Athens [  $_{VP^*} \leq$  [  $_{VP}$  worships the goddess ] ]

If we interpret *the goddess* at the local evaluation index, the lower VP will denote (39a), and the upper VP\* (39b):

- (39) a.  $\lambda x \lambda s_e . x$  worships in  $s_e$  the unique goddess in  $s_e$   
 b.  $\lambda x \lambda s_b .$  there is a situation  $s_e, s_b \leq s_e$  such that  $x$  worships in  $s_e$  the unique goddess in  $s_e$

Suppose now that every man in Athens worships two or more goddesses, but there is no goddess worshipped by every man. In such a situation, (38) is actually predicted to be true, since for each base situation  $s_b$  that contains just a man it is possible to find (at least) one extended situation  $s_e, s_b \leq s_e$  containing that man and a goddess he worships. Since that goddess is unique *in that extended situation*, the truth conditions for the sentence are fulfilled. The sentence is thus predicted to mean more or less the same as *every man in Athens worships some goddess*.

This result of course clashes with our intuitions, according to which (38) can only be interpreted to mean that every man worships one and the same goddess, who is unique relative to some situation that doesn’t co-vary with men (say the goddess of beauty). This intuitively available reading can (more or less, ignoring issues of absolute uniqueness and persistence discussed

above) be derived assuming (34) by scoping *the goddess* above *every man in Athens*, but it would remain rather mysterious why this scoping is obligatory in a case like (38), while it is not in true donkey sentences like (37b).

On the present proposal, the intuitively available reading is readily represented by the LF in (40a) below. Alongside it, there a bound representation (40b), which we can safely ignore however, since it is inevitably false because the base-situation introduced by *every man in Athens* doesn't contain any goddesses whatsoever:

- (40) a. every man in Athens [ $\leq$  [ worships [ the $_{\sigma_{0/2}}$  goddess ]]]  
 b. #every man in Athens [ $\Sigma_2$ [ $\leq$  [ worships [ the $_{\sigma_2}$  goddess ]]]]

Still, the incriminated reading on which (38) essentially means 'every man in Athens worships some goddess' can be represented in our system, too, namely by LF (41):

- (41) every man in Athens [ $\leq$  [ $\Sigma_2$  [ worships [ the $_{\sigma_2}$  goddess ]]]]

Here the definite is s-bound to the extended situation, rather than the base situation, yielding the same truth conditions as (38b) above. But we can block this reading syntactically without much ado, by requiring that the  $\Sigma$ -prefix must be next to a DP, not something else. This is a stipulation, but a very local one, which is easy to formulate. We will return to the question whether it follows from a more general syntactic condition on  $\Sigma$ -placement below. For the moment we just stipulate that nothing must intervene between  $\Sigma$  and the binder DP.<sup>16</sup> Note that this is possible because we opted above to have only one of the two situations, the base-situation, introduced by the quantificational DP, while the other one is introduced by  $\leq$ . S-Binding a DP to the extended situation would have been much harder to rule out had we adopted the alternative to have both situations introduced by the DP; in this sense, the fact that representations like (41) should and can be ruled out in this fashion provides a further argument in favor of assigning the meanings we did above.

It should be noted that the unwanted reading of (38) can also be derived in Heim (1990)'s framework (or Elbourne (2001a)'s, which is identical in this respect). To block it, a stipulation that prohibits DPs from being indexed to

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<sup>16</sup>A more general version of this constraint will have to address cases in which DPs are bound by non-nominal elements such as conditional clauses, adverbials, tenses etc. I have to leave this issue for future research (cf. also Percus (2000)).

the extended situation (in our terms) would be needed. Since Heim discusses neither the details of the indexing procedure, nor the interpretation of DPs that are not s-bound, it is moot to speculate about the detail of such a convention. Suffice it to say that the present account, even with the stipulated restriction on  $\Sigma$ -placement is local in precisely the same way that our account of cross-over in section 2 is: It doesn't regard the coindexing of two elements in a phrase marker, but simply the possibility of locally inserting a binder.

Before closing this section, we need to add one more complication. In our meaning for the definite determiner in (32), repeated here, we simply interpreted the restriction relative to the situation  $g(\sigma_n)$ :

$$(42) \quad \llbracket \text{the}_{\sigma_n} \rrbracket^g = \lambda P' \lambda P_2 \lambda s. P_2(\text{the unique } x \text{ such that } P'(x)(g(\sigma_n))(s))$$

Note, however, that  $g(\sigma_n)$  is a particular situation, which is part of one particular world. Accordingly, *the <sub>$\sigma_1$</sub>  man sings* will denote the set of situations  $s$  in which the unique man in  $g(\sigma_1)$  sings, which means that for most such  $s$ ,  $g(\sigma_1)$  isn't even a part of  $s$ . This raises various problems familiar in counter-part semantics which we need not go into here. Intuitively, what we want the sentence to denote is the set of all situations  $s$  such that the unique man in *that part of  $s$  which is a counter-part to  $g(\sigma_1)$*  sings in  $s$ . We will therefore have to replace  $g(\sigma_n)$  with the more cumbersome  $G_s^g(\sigma_n)$ , to be read as 'that situation in  $s$  which is a counter-part of  $g(\sigma_n)$ ':<sup>17</sup>

$$(43) \quad \llbracket \text{the}_{\sigma_n} \rrbracket^g = \lambda P' \lambda P_2 \lambda s. P_2(\text{the unique } x \text{ such that } P'(x)(G_s^g(\sigma_n))(s))$$

Technically crucial though it is, the reader can ignore this complication for the remainder of this paper and simply think of  $G_s^g(\sigma_n)$  as 'the situation  $\sigma_n$ '.

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<sup>17</sup>We define:

- (i)
  - a. for all  $s_1$ ,  $cpc(s_1)$  = the set of all counterparts to  $s_1$
  - b. for all  $s_1, s_2$ ,  $cp(s_1)(s_2)$  = the  $s \in cpc(s_1)$  such that  $s \leq w_{s_2}$
  - c. for all assignment functions  $g$ , variables  $\sigma_n$ , and situations  $s_1, G_{s'}^g(\sigma_n) =$ 
    - 1)  $w_{s_1}$  if  $n = 0$
    - 2)  $cp(g(\sigma_n))(s_1)$  otherwise

Note that this also take formal care of our convention that  $\llbracket \text{Det}_{\sigma_0} \rrbracket^g \dots (s)$  is always relativized to  $w_s$ .

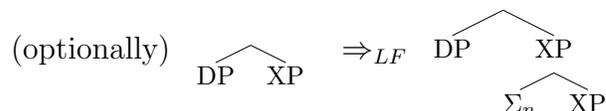


an i-variable. In that case, (45a) has a second LF that looks like (46):

(46) [ every knight who courted a lady ]  $\Sigma_8[\mu_4[\leq [ [\mathbf{the}_{\sigma_8} \mathbf{lady} ]\text{'s mother} ]$   
visited  $t_4$ ]]

Note that this LF doesn't involve a  $\beta$ , i.e. no i-binding, and is therefore not excluded by the A-binding requirement. Yet, it has the same interpretation as the LF in (45a), for the reasons pointed out in Elbourne (2001a), discussed in section 4 above. Thus, if Elbourne's analysis is correct, that is, if e-type pronouns without i-variables exists, then a constraint on  $\Sigma$ -adjunction, parallel to that on  $\beta$ -adjunction, is called for to rule out (46). Anticipating the discussion in the next section, I assume that this is indeed the case, and therefore formulate the rule for s-binding as in (47):

(47) a. situation binding (final):



where  $n$  is an index, and DP occupies an A-position

b.  $[\Sigma_n \text{ XP}]^g = \lambda x \lambda s. [\text{XP}]^{g[\sigma_n \rightarrow s]}(x)(s)$ <sup>18</sup>

Note that (47) also more or less naturally encompasses our earlier requirement that  $\Sigma$  cannot be adjoined underneath  $\leq$ , since this configuration doesn't match the structural description in (47a). Arguably, there is an intuition behind this, too: that  $\Sigma$  and  $\beta$  are DP-related elements, while  $\leq$  is not, though a formal exploration of this intuition is beyond the scope of this paper.

This concludes our account of cross-over. (47), together with (2) from section 2 excludes any dependence of an e-type pronoun on a DP in  $\bar{A}$ -position.

## 5.2 Dependent Definites

Our argument for restricting s-binding to A-positions rests on the premise, inherited from Elbourne (2001a), that e-type pronouns without i-variables

<sup>18</sup>A flexible types version of this rule is needed for some later examples. Its definition is as follows:  $[\Sigma_n \text{ XP}]^g = \lambda G. SB(\lambda s. [\text{XP}]^{g[\sigma_n \rightarrow s]})(G)$ , where  $SB(\psi)(G) = \text{i} G(\lambda x. \{s \mid s \in \psi(s)(x)\})$  if  $\psi \in D_{et}^S$ , otherwise ii)  $\lambda \phi. S(\lambda s \lambda x. \psi(s)(x)(\phi))(G)$  if  $\psi \in D_{T_1, T_2}$ , with  $\phi \in D_{T_1}$ .

exist. In the remainder of this section I will review and present evidence that this is correct. More in general, it will be shown that there are definite descriptions at LF which are co-variant with a DP antecedent, but don't contain i-variables.

A first example of this kind that might come to mind are dependent definites, i.e. sentences in which we have an overt plain definite description instead of an e-type pronoun:

- (48) a. Every farmer who owns a donkey beats the donkey.  
 b. \**The donkey's* attorney sued every farmer who beat *a donkey*.
- (49) a. *Every boy's* mother likes *the boy*.  
 b. \**The boy's* mother likes *every boy's* girlfriend.
- (50) a. Some person from *every city* likes *the city*.  
 b. \*Some person from *the city* likes *every city's* beaches.

As shown above, these definites show clear cross-over effects. While the subject-object examples might sound somewhat artificial and strained, the object-subject examples are certainly worse.

As we would expect, given the present analysis, dependent definites do not only occur with embedded quantifiers as antecedents, but can also be directly c-commanded by their antecedent, provided that they do not thereby violate Principle C of the binding theory:

- (51) a. *Most modern cars* let *the driver* adjust *the mirrors* from *the inside*.  
 b. *Some movies* are so long that you forgot *the title* by the time they end.

In these cases, too, a cross-over effect can be seen, as in the following examples from Chierchia (1995):226:

- (52) (Every young author will have a new book at the fair.)  
 a. *Every author* will personally present *the book* to the critics.  
 b. \**The book* will make *every author* rich.

While (52a) can be understood with the definite being s-bound by the subject DP (*the book* = 'his book'), no analogous reading is possible in (52b); it can only be understood to talk about one specific, contextually given book.

It should be clear that all these judgements are correctly predicted if we

assume (47): that binding the definite involves s-binding, and that s-binding can only take place from an A-position. However, they could alternatively be predicted by assuming that all these dependent definites include a covert individual variable, which is responsible for the co-variation. That is, *the book* is *his book* at LF, *the donkey* is really *the donkey he owns*, and *the city* has an afterlife as *the city they are from* (cf. the proposal in Chierchia (1995):225ff).

In order to conclude from these examples that it is a restriction on s-binding (rather than i-binding) that incurs the cross-over effect, then, we have to find a way of showing that these examples do *not* involve hidden individual variables, but just the elements we see at the surface.

### 5.3 Plain Definites and Skolem Definites

To rephrase the issue, we need to find a way to determine what the correct LF-representation for the three DP types in (53) is:

- (53) a. it  
       b. the donkey  
       c. the donkey he owns

In the context of our discussion, there are two options for the LF-representation, and correspondingly, the interpretation, of the first two DP types: They could be represented as definite DPs containing a pronoun, essentially as (53c), and be interpreted, effectively, as skolem functions (since they'd map an individual, or a value assignment to the pronoun, and a situation to an individual, say, people to the donkeys they own), or they could be represented as definites without a pronoun, essentially as (53b), and be interpreted as individual concepts, i.e. functions from situations to individuals. Let us call these options *skolem descriptions* and *pure descriptions*, respectively.

A view under which all the cross-over effects with donkey pronouns and definite descriptions are ultimately traced to hidden individual variables within these, then, is committed to the view that (53a) through (53c) alike are skolem descriptions at LF. We will show that this is incorrect; rather, plain definites as in (53b) are pure descriptions at LF, definites with pronouns in them are skolem descriptions, and donkey pronouns are plain definites if their antecedent NP is a plain NP like *(a) donkey*, and are skolem definites only if their antecedent NP contains a pronoun, as in the case of *the donkey he*

*owns* or *his donkey*. Or, put snazzily, everything is what it is at the surface, except a donkey pronoun, which is what its antecedent is at the surface.

If this is correct, then since donkey pronouns, plain dependent definites, and definites with a pronoun in them show cross-over effects alike, cross-over must pertain to situation binding and individual binding the same.

To preview the argument in a nutshell, pure descriptions (*the donkey*) have more stringent requirements on their binders than skolem descriptions (*the donkey he owns*): A binder for the former must introduce a base-situation that contains a donkey, while a binder for the latter need not. Put differently, whenever a DP does not yield a co-varying reading, we can *ceteris paribus* conclude that it must be a pure description at LF. (The following examples directly build on Elbourne (2001a)’s arguments for his proposal to represent donkey pronouns as pure descriptions, rather than skolem descriptions; his examples and judgements are indicated by ‘E’.)

As a first step, observe that plain definites and definites containing a pronoun behave markedly different from one another if they serve as the antecedents in VP ellipsis; while definites containing pronouns allow sloppy identity readings, plain definites don’t.<sup>19</sup>

- (54) a. In this town, every farmer who owns a donkey beats the donkey he owns, and the priest does, too. (strict/sloppy; E:44a/b)  
 b. In this town, every farmer who owns a donkey beats the donkey, and the priest does, too (strict/?\*sloppy)

The priest in (54b) doesn’t beat his own donkey, but either the same one poor donkey every donkey owning farmer beats (strict identity, with *the donkey* being scopally independent), or the donkey of every farmer (a sort of across-the-board reading, the derivation of which need not concern us here). This is different in (54a), which allows for the priest beating his very own donkey — a run-of-the-mill case of sloppy identity.

The contrast in (54) alone suggests that plain definites and definites containing pronouns should not be the same beasts at LF. Moreover, situation theory accounts for their different behavior, assuming that plain definites are plain descriptions at LF, while definites containing pronouns are skolem descriptions. The former need to be s-bound to co-vary, which is possible

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<sup>19</sup>As Elbourne (2001a) shows, all these data can be replicated with down-stressing instead of ellipsis; I leave the down-stressing examples out in the interest of space.

only if the s-binder introduces a base-situation big enough to contain a donkey. Since *the priest* does not introduce such a situation, the unavailability of a co-varying (=sloppy) interpretation in the second conjunct of (54b) is explained:

- (55) the priest
- a.  $*\Sigma' [\leq [\text{beats the}_{\sigma_1} \text{ donkey} ]]$  ( $g(\sigma_1)$  doesn't contain a donkey)
  - b.  $\leq [\text{beats the}_{\sigma_{0/2}} \text{ donkey} ]$  (*the donkey* anaphoric/absolute)
  - c.  $\beta' [\leq [\text{beats the}_{\sigma_{0/2}} \text{ donkey he}_1 \text{ owns}]]$  (DP i-bound)

Skolem descriptions like (55c), on the other hand, can co-vary by virtue of i-binding. They will then denote, for every assignment  $x$  to the pronoun *he* the unique donkey  $x$  owns in either a contextually given situation, or the world. Hence, co-variation with the priest is possible in (54a).

It is worth emphasizing this latter point. While a skolem description contains two bindable variables, one a situation, the other an individual, it can co-vary on account of only the i-variable being bound, with the s-variable indexed to a bigger situation. That bigger situation, say in (54a), may contain any number of donkeys, as long as it contains a unique donkey owned by the farmer/priest. It is only pure descriptions that need to achieve co-variation and uniqueness by virtue of the s-variable alone, which explains their demand for a custom-tailored base-situation containing one and only one donkey.

This distinction can be used as a probe to the LF representation of donkey pronouns. As Elbourne (2001a) observes, donkey pronouns don't allow for sloppy identity either:

- (56) In this town, every farmer who owns a donkey beats it, and the priest does too. ( $?*sloppy/strict$ ; E:45/46b)

In other words, the donkey pronouns pattern with plain definites, rather than definites containing pronouns. Representing plain definites and donkey pronouns both as plain descriptions at LF accounts for this patterning, and its consequences for sloppy identity. The elided VP in (54b) and (56) is then represented as (57):

- (57)  $\Sigma_1[\leq [\text{beats the}_{\sigma_1} \text{ donkey} ]]$

For this to be interpretable, the subject to this VP must introduce a donkey-laden base-situation, which *the priest* patently doesn't.

Elbourne's particular theory also explains *why* the donkey pronoun in (56) exists at LF in the form of a plain description, rather than a skolem description: Its antecedent NP is itself of the form *donkey*; it doesn't contain a pronoun. Since, on Elbourne's story, donkey pronouns involve NP deletion under identity, this means that the donkey pronoun itself will have a pronoun-less NP as its descriptive core at LF.

This predicts, of course, that an antecedent NP containing a pronoun can itself license a donkey pronoun that expands to be a skolem description. This, come to think of it, is the case in classical paycheck-sentences such as (58):

- (58) Mary gave her paycheck to the bank, while the priest gave *it* to the Church.

We can interpret *it* to be the priest's paycheck, provided we are ready to accommodate that the latter has a unique paycheck. If *it* were represented as *the paycheck*, this reading couldn't obtain, given that the base-situation introduced by *the priest* contains no paycheck, just as little as it contains a donkey; in other words, an LF like (59a) wouldn't do the trick:

- (59) a. \*the priest  $\Sigma_8[\leq$  gave [**the $_{\sigma_8}$  paycheck**] to the bank ]  
 b. the priest  $\beta_8[\leq$  gave [**the $_{\sigma_0}$  paycheck of his $_8$** ] to the bank ]

However, since in (58) the antecedent to the pronoun is *his paycheck*, the pronoun itself can be interpreted as a skolem description, roughly 'his paycheck' or 'the paycheck of his'; (59b) correctly represents this reading.<sup>20</sup>

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<sup>20</sup>This line of reasoning carries over to donkey sentences: If a donkey-pronoun has a skolem antecedent, and can therefore be interpreted as a skolem description, it should in turn license sloppy identity in VP ellipsis/down-stressing. This prediction seem to be borne out:

- (i) Every farmer who beat the donkey he owns later apologized to it, and the priest did, too.

LF every farmer who beat the donkey he owns  $\beta'$   $\Sigma_2$  later apologized to **the $_{\sigma_2}$  donkey he' owns**, and the priest  $\beta'$   $\Sigma_2$  later apologized to **the $_{\sigma_0}$  donkey he' owns**, too



can be seen with EQB as well:

- (62) Every boy's cat scratched him, only Bosco didn't (sloppy ok: 'didn't scratch the boy who owns him')

Once again, cat Bosco, being the exception to the rule, can be accommodated to be on of the 'every boy's cats', and therefore introduce a base-situation containing cat *and* caboodle.

As an aside, note that the fact that (62) allows for a sloppy construal (parallel to (61) above) shows the insufficient generality of analyses in which the binding in basic cases like *every boy's cat likes him* is accomplished by somehow i-binding *him* directly or through some kind of unselective binding, to *every boy* (a method championed by all analyses I am aware of, except Bach and Partee (1980, 1984), e.g. May (1977, 1985, 1988); Higginbotham (1980b, 1983, 1987); Larson (1987); Reinhart (1987); Barker (1995); Hornstein (1995); Heim and Kratzer (1998)). It is therefore worthwhile to emphasize that examples without a structural binder can be rather productively constructed, once we understand the recipe:

- (63) a. Every boy's parents are supposed to buy him a dictionary, but many of them simply can't afford to/none of them can afford to.  
b. Most people's publishers tell them when a book is going to appear, but Routledge doesn't.  
c. Every boy's mother said she liked him. I didn't expect them to.  
d. (child to father:) Everybody's dad supports them, but you don't!

End of aside.<sup>22</sup>

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These cases are less spectacular than those presented in the main text, though, because they are also analyzable via sloppy i-binding by *a donkey/every boy* under an unselective binding or binary binding approach.

<sup>22</sup>The (im)possibility of sloppy identity should also be useful to shed light on the internal make-up of directly dependent definites of the kind in (51) and (52). Polly Jacobson (p.c.) offers the sentences in (i), based on Jacobson (1999), in which sloppy identity seems fine:

- (i) a. Every young author will have a book at the fair. Every ambitious author will present the book to the critics, but lazy Bill won't.  
b. Everyone in Berkeley in the sixties put eucalyptus on the mantle. Bill still does.

Similar remarks apply to *local*-type expressions (P. Jacobson p.c., Mitchell (1986); Partee (1989)):

In this subsection, we have seen ample evidence that there are pure descriptions at LF, both as the spell-out of donkey pronouns, and as the representation of simple definites. Therefore, we have to conclude that the cross-over facts with simple definites and donkey pronouns in the standard cases must be accounted for by situation cross-over. That is, the correct representations for the minimal pairs in (64)/(65) are as given underneath:

- (64) a. Every farmer who owns *a donkey* beats *it/the donkey*.  
 LF: every farmer who owns a donkey  $\Sigma_7[\leq$  beats the $_{\sigma_7}$  donkey]
- b. \**Its/The donkey's* lawyer sued every farmer who beat *a donkey*.  
 LF: every farmer who beat a donkey  $\mu'$  ( $*\Sigma_2$ ) [ the $_{\sigma_2}$  donkey's lawyer sued  $t_1$ ]
- (65) a. *Every author* will present *the book*.  
 LF: every author  $\Sigma_4$  [ will present the $_{\sigma_4}$  book]
- b. \**The book* will make *every author* rich.  
 LF: every author  $\mu_8$  ( $*\Sigma_6$ ) [ the $_{\sigma_{0/6}}$  book will make  $t_8$  rich ]

This concludes our argument for imposing a cross-over condition on s-binding.

## 6 Embedded Quantifier Binding

In the previous section we have developed a compositional situation semantics for BOOD that accounts for cross-over effects. In section 3 we have argued that BOOD encompasses more cases than just donkey sentences, in particular genitive binding and inverse linking, which are jointly referred to as E(mbedded) Q(uantifier) B(inding). In this last section we will give the details of the e-type analysis of EQB including situations, which is a straightforward extension of the techniques used in the previous section.

Our assumption in section 3 has been that a sentence like (10), repeated here, has the essential semantics in (66b):

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- (ii) Every Red Sox fan watches the worls series in a local bar. John does too.

It doesn't seem implausible to me to analyze these particular examples as cases of s-binding, parallel to (62) and (63); if cases like these in general don't show any pragmatic restrictions at all, however, this would suggest that *some* apparently plain DPs do contain i-variables after all, and that our snazzy slogan that 'everything is what it is at the surface' is too simple-minded (as Jacobson, p.c., suspects). I leave this issue for further research.

- (66) a. *Every boy's mother likes him.*  
 b. for every boy  $x$ , the mother of  $x$  has the following property:  $\lambda y.y$  likes **the R/son-of**  $y$

Subject DP and VP under this analysis had the denotations  $\lambda P.for\ every\ boy\ x,\ there\ is\ a\ y,\ y\ is\ x's\ unique\ mother,\ and\ P(y)$  and  $\lambda z.z\ likes\ the\ son\ of\ z$ , respectively.

We now need to add situations to that analysis. Under the situation analysis, the e-type pronoun is spelled out simply as **the boy**, with *the* s-bound by the subject DP. The interpretation for the predicate is straightforwardly derived from the following representation:

- (67) a.  $\Sigma'[\leq [\text{likes} [\mathbf{the}_{\sigma_1} \mathbf{boy}]]]$   
 b.  $\lambda x \lambda s_b.$  there is a situation  $s_e, s_b \leq s_e$  such that  $x$  likes in  $s_e$  the unique boy in  $s_b$

The following would be a good denotation for the subject DP:

- (68)  $\lambda P \lambda s.$  for every boy  $x$  in  $w_s$ , there are  $y, s_b$  such that  $y$  is  $x$ 's unique mother,  $s_b$  is a minimal situation of  $y$  being  $x$ 's mother, and  $P(y)(s_b)$

Together, the meanings in (68) and (67b) will derive the correct truth conditions. Note in particular that (68) introduces a minimal mother+son situation for each boy, which functions as the base-situation for s-binding *the boy* in the predicate. To get this compositionally, we need to revise the denotation for the genitive 's and the definite article once more, so that they introduce their own quantification over situations:<sup>23</sup>

- (69) a.  $[[\text{the}]^g = \lambda P_1 \lambda P_2 \lambda s.$  there are  $x, s'$  such that  $\{x\} = \{x \mid P_1(x)(s)\},$   
 $\min(P_1(x))(s')$  and  $P_2(x)(s')$  = THE  
 b.  $[[\text{'s}]^g = \lambda R \lambda x. THE(R(x))$

According to (69),  $t_1$ 's mother VP, or *the mother of  $t'$  VP*, denotes the set of situations  $s$  such that there is an  $x$  which is the unique mother of  $g(t_1)$  and

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<sup>23</sup>*min* is a function that maps any set of situations onto the minimal ones among them, i.e. for any  $P \in \{0, 1\}^S$ ,  $\min(S) = \{s' \in S \mid P(s')$  and for all  $s''$  if  $P(s'')$  and  $s'' \leq s'$ , then  $s'' = s'\}$ .

We don't explicitly require in (69a) that  $s' \leq s$ , given that  $x$  by definition must be part of  $s$  and  $s'$ , which can only be the case if  $w_s = w_{s'}$ .

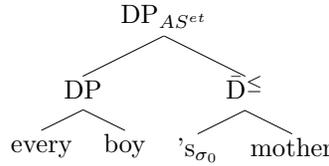
at least one minimal situation of  $x$  being  $g(t')$ 's mother is in  $\llbracket \text{VP} \rrbracket^g(x)$ . If  $t'$  is the trace of *every boy*, i.e. if  $g(t')$  ranges over boys, there will be a minimal mother+boy situation for each boy  $x$ , such that the mother loves the unique boy in that situation. This is precisely what we want.

Alas, there is one last complication: If *the* as part of an e-type pronoun bears a situation index, so should *'s/the* as part of a possessive DP, and any other determiner, for that matter:

- (70) a.  $\llbracket \text{the}_{\sigma_n} \rrbracket^g = \lambda P_1 \lambda P_2 \lambda s. \text{there are } x, s' \text{ such that } \{x\} = \{x \mid P_1(x)(G_s^g(\sigma_n))\},$   
 $\min(P_1(x))(s') \text{ and } P_2(x)(s') \quad \boxed{= \text{THE}^{g, \sigma_n}}$   
 b.  $\llbracket 's_{\sigma_n} \rrbracket^g = \lambda R \lambda x. \text{THE}^{g, \sigma_n}(R(x))$   
 c.  $\llbracket \text{every}_{\sigma_n} \rrbracket^g = \lambda P_1 \lambda P_2 \lambda s. \text{for all } x, s' \text{ such that } P_1(x)(G_s^g(\sigma_n)), \text{ if}$   
 $\min(P_1(x))(s'), \text{ then } P_2(x)(s')$   
 d.  $\llbracket \text{some}_{\sigma_n} \rrbracket^g = \lambda P_1 \lambda P_2 \lambda s. \text{there are } x, s' \text{ such that } P_1(x)(G_s^g(\sigma_n)),$   
 $\min(P_1(x))(s') \text{ and } P_2(x)(s')$

We are now in a position to derive the DP meaning every step of the way, starting with the LF in (71):<sup>24</sup>

(71)



- a.  $\llbracket \text{mother} \rrbracket^g = \lambda x_1 \lambda x_2 \lambda s. x_2 \text{ is } x_1 \text{'s mother in } s \quad \boxed{= \text{MOM}}$   
 b.  $\llbracket ['s_{\sigma_0} \text{ mother}]_{\bar{D}} \rrbracket^g = \lambda x_1 \lambda P_2 \lambda s_1. \text{there are } x_2, s_2 \text{ such that } \{x_2\} =$   
 $\{x_3 \mid \text{MOM}(x_1)(x_3)(G_{s_1}^g(\sigma_0))\}, \min(\text{MOM}(x_1)(x_2))(s_2) \text{ and } P_2(x_2)(s_2)$   
 $= \lambda x_1 \lambda P_2 \lambda s_1. \text{there are } x_2, s_2 \text{ such that } \{x_2\} = \{x_3 \mid \text{MOM}(x_1)(x_3)(w_{s_1})\},$   
 $\min(\text{MOM}(x_1)(x_2))(s_2) \text{ and } P_2(x_2)(s_2)$   
 c.  $\llbracket ['s_{\sigma_0} \text{ mother}]_{\bar{D}^{\leq}} \rrbracket^g = \lambda x_1 \lambda P_2 \lambda s_1. \text{there are } s_2, s_3, x_2 \text{ s.t. } s_1 \leq$

<sup>24</sup>I henceforth abbreviate  $\llbracket \leq Z \rrbracket$  as  $Z^{\leq}$ , parallel to the notation for argument saturation above, for the sake of brevity. (71b) still gives the semantics of the intermediary step.

The following definition, to replace (26b), allows situation extension to apply to categories of any type that ends in  $t$ :

- (i) situation extension, flexible types version:  $\llbracket Z^{\leq} \rrbracket^g = \text{XT}(\llbracket Z \rrbracket^g)$ , where  
 a.  $\text{XT}(p) = \{s_1 \mid \text{there is a situation } s_2 \text{ such that } s_1 \leq s_2 \text{ and } s_2 \in p\}$  if  $p$  is in  $D_t$ , else  
 b.  $\text{XT}(p) = \lambda \phi. \text{XT}(p(\phi))$  if  $p \in D_{\langle T_1, T_2 \rangle}$  (with  $\phi$  a variable of type  $\langle T_1 \rangle$ )



and  $P_3(x_2)(s_2)](\lambda x_6 \lambda s_1$ . there are  $x_4, s_5$  such that  $\{x_4\} = \{x_5 \mid \text{BOY}(x_5)(s_1)\}$ ,  $\min(\text{BOY}(x_4))(s_5)$  and there is an  $s_4, s_5 \leq s_4$  and  $x_6$  likes  $x_4$  in  $s_4$   
 $= \lambda s_6$ .for all  $x_1, s_3$  such that  $\text{BOY}(x_1)(w_{s_6})$ , if  $\min(\text{BOY}(x_1))(s_3)$  then  
there are  $s_2, x_2$  s.t.  $\{x_2\} = \{x_3 \mid \text{MOM}(x_1)(x_3)(w_{s_3})\}$ ,  $\min(\text{MOM}(x_1)(x_2))(s_2)$   
and there are  $x_4, s_5$  such that  $\{x_4\} = \{x_5 \mid \text{BOY}(x_5)(s_2)\}$ ,  $\min(\text{BOY}(x_4))(s_5)$   
and there is an  $s_4, s_5 \leq s_4$  and  $x_2$  likes  $x_4$  in  $s_4$

$\approx$   $\{s_6 \mid$  for all  $x_1$ , if  $x_1$  is a boy in  $w_{s_6}$  then for every minimal situation  $s_3$  of  $x_1$  being a boy there are  $x_2, s_2$ , such that  $x_2$  is  $x_1$ 's (unique) mother in  $w_{s_3}$ ,  $s_2$  is a minimal situation of  $x_2$  being  $x_1$ 's mother, and can be extended to a situation  $s_5$  such that there is an  $x_4$  which is the unique boy in  $s_2$ ,  $s_5$  is a minimal situation of  $x_4$  being a boy and can be extended to a situation  $s_4$  in which  $x_2$  likes  $x_4\}$  <sup>26</sup>

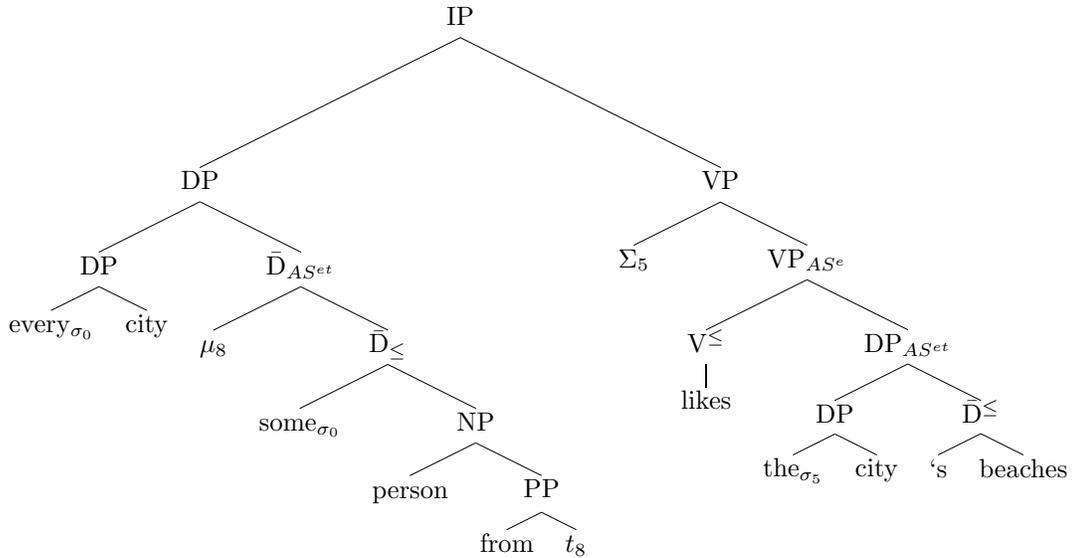
The analysis of the inverse linking cases doesn't bring anything new, except that the embedded QDP undergoes QR to get to its scope position:<sup>27</sup>

(74) Some person from every city likes its beaches.

<sup>26</sup>This implementation of the analysis hinges on the assumption that if  $x_1$  is a boy, and  $s_2$  is a minimal situation of  $x_2$  being  $x_1$ 's mother, then  $s_2$  is a situation that contains a boy. Sure enough  $s_2$  contains  $x_1$ , but does it 'contain'  $x_1$ 's boyhood? If the answer to this question negative, the analysis presented in the main text cannot be maintained as is. One amendment I can think of is appeal to accommodation. Another one is to leave the restrictor of the wide-scope DP within the narrow scope DP (i.e. by copying). I leave these issues for further research.

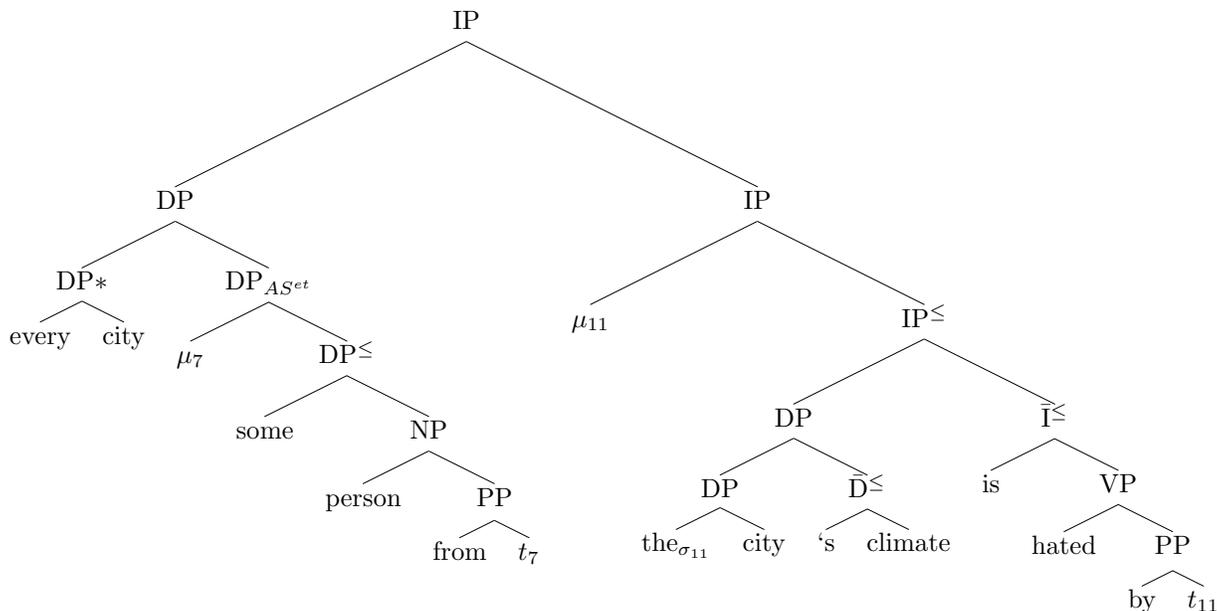
<sup>27</sup>Here, *every city* binds its trace through  $\mu_8$ . It couldn't s-bind or i-bind anything, given that it is in an  $\bar{A}$ -position. Thus bindings like the following are correctly ruled out:

- (i) a. \**its* mayor's brother from *every city* (trying to mean *every city's mayor's brother from that city*)
- b. \**its* enemies' destruction of *every city* (trying to mean *every city's destruction by/through its enemies*)



As for (Secondary) Weak Cross-Over, as shown above, s-binding is possible only under a-command, which lead us to stipulate that  $\Sigma$  can be adjoined next to an A-position only. The secondary weak cross-over effects follow from this, given that the apparent embedded quantifier binding is reanalyzed as s-binding by the subject DP. For example, the dependent reading indicated in (75) is ruled out because *some person from every city* lacks a position that a-commands *its climate*, making s-binding impossible. The closest we can get to binding *it* by *some person from every city* is the LF in (75) below, which fails to encode the intended reading: *the <sub>$\sigma_{11}$</sub>  city* refers to the unique city in  $g(\sigma_{11})$ , i.e. it is not s-dependent on *some person from every city*, nor could it be, given that the latter occupies an  $\bar{A}$ -position; the coindexing is thus semantically vacuous:

(75) \**Its climate is hated by some person in every city.*



## 7 Conclusion

The first part of this paper developed an account standard cross-over cases along the lines of Reinhart (1983), building on the idea that (non-resumptive) pronoun binding and trace binding are entirely separate phenomena of grammar. It was shown how this approach can extend to apparently problematic cases such as donkey cross-over and secondary cross-over, once an e-type approach to these phenomena is adopted. The result was a treatment which is significantly simpler and more local than any existing account, based on indexing or linking, of simple cross-over (Chomsky, 1976; Koopman and Sportiche, 1983, a.o.) or secondary cross-over (Higginbotham, 1983; Reinhart, 1987; Safir, 1984, a.o.). This, I submit, not only argues in favor of this particular treatment of cross-over, but also lends credibility to the uniform analysis of all BOOD phenomena, crucially including genitive binding and inverse linking, in terms of e-type pronouns.

The second part then went on to argue that the cross-over phenomenon is not restricted to the binding of individual variables, but should extend to the binding of situation variables, as seen in the case of dependent definites and, indeed, most e-type pronouns in BOOD. A fully compositional semantics of these cases was provided, including a mechanism for situation binding

which entirely parallels that proposed for individual binding, encompassing the parallel cross-over behavior.

Certainly, the semantics provided are nerve-wreckingly complex. They owe their complexity, however, to entirely independent considerations: The proper treatment of situations across worlds, the compositional semantics of inverse scope, the proper treatment of e-type pronouns in general etc. etc. The part concerning the very binding of situations is in fact rather simple. The complications arise with the proper and sufficiently detailed analysis of the various constructions we apply it to.

I thus submit that, given that we independently need analyses of all these things, it is actually a small step towards the unified situation semantic e-type analysis of BOOD, including, for the first time, embedded quantifier binding. The present paper showed what a compositional treatment of these case looks like, and demonstrated a fully local version of cross-over, donkey cross-over and secondary cross-over, i.e. one that doesn't involve any constraints on coindexing.

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