Origins of weak crossover:
When dynamic semantics meets event semantics

Abstract. Approaches to anaphora generally seek to explain the potential for a DP to covary with a pronoun in terms of a combination of factors, such as (i) the inherent semantics of the antecedent DP (i.e., whether it is indefinite, quantificational, referential), (ii) its scope properties, and (iii) its structural position. A case in point is Reinhart's classic condition on bound anaphora, paraphrasable as *A DP can antecede a pronoun pro only if the DP C-commands pro at S-structure*, supplemented with some extra machinery to allow indefinites to covary with pronouns beyond their C-command domains. In the present paper, I explore a different take. I propose that anaphora is governed not by DPs and their properties; it is governed by predicates (i.e., in the unary case, objects of type <e, t>) and their properties. To use a metaphor from dynamic semantics: discourse referents can only be 'activated' by predicates, never by DPs (*dynamic predication principle* -- DPP). This conceptually simple assumption is shown to have far-reaching consequences. For one, it yields a new take on weak crossover, arguably worthy of consideration. Moreover, it leads to a further general "restatement of the anaphora question" in Reinhart's (1983) words.

1. Introduction: What is at stake?

> "WCO may be described as a syntactic configuration in which pronouns cannot be interpreted as co-construed with certain kinds of displaced or quantified antecedents. If it is correct to say that (a) the blocking of this co-construal does not seem logically required, (b) the effect is syntactically conditioned, (c) the effect is widespread in the world's languages, and (d) it does not appear to arise from instruction, then it is reasonable to assume that the WCO effect is a peculiar consequence of the human language capacity and a clue to the structure of that capacity." (Safir 2017)[1]

Weak crossover (WCO) has been at the center of intense research for some 50 years (since at least Postal 1971).[2] The persisting recurrence of research aimed at providing accounts for WCO,[3] including the present attempt, is a symptom of the fact that we all still look at it with a sense of awe and mystery—a mystery that, if pried open, might reveal important properties of the syntax/semantics interface. The present paper explores a novel explanation for WCO in terms of the dynamics of discourse. Textbook-style cases of WCO typically have the following form:

(1) Canonical crossover cases:

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[1] https://doi.org/10.1002/9781118358733.wbsyncom090
[2] Another important early reference among many is Jacobson (1977).
[3] Cf., e.g., Jacobson (1999), Ruys (2000), Shan and Barker (2006), Safir (2018), among many others. For an overview, see Safir (2017).

a. * Who_1 did [his_1 book make t_1 rich]
b. [$whose_1$ book]$_2$ [t_2 made him_1 rich]
c. * No author who_1 [his_1 book made t_1 rich] showed up.
d. No author [$whose_1$ book]$_2$ [t_2 made him_1 rich]] showed up.
e. i. Some manager interviewed every analyst.
ii. Every $analyst_i$ [some manager interviewed t_i]
iii. His manager interviewed every analyst.
iv. * Every $analyst_i$ [his_i manager interviewed t_i]

In (1a) and (1c) a wh-item is dislocated to the left periphery of a clause and in so doing 'crosses over' a constituent that contains a pronoun. Such a pronoun cannot be interpreted as covarying with (or being bound by) the dislocated constituent. This contrasts with what happens in, e.g., (1b) and (1d), where no crossing over occurs. WCO effects extend to non-wh-dependencies (in particular, scope assignment for quantifiers), as illustrated in (1e). It is easy to get an inverse scope reading for sentences like (1e.i,ii). But in the very same configuration it is hard or impossible to get pronoun binding, as seen in (1.e.iii,iv).[4]

Beyond the canonical cases, WCO has huge ramifications for many aspects of grammar. Consider for example the case of functional readings of wh-words, as in (2a,b), or the distribution of list readings in questions with quantifiers, as in (2c,d):

(2) a. Q: Which person does no one ever have dinner with?
A: His undertaker.
b. Q: Which person has dinner with no one?
A: * His undertaker.
c. Q: Which extra guest did everyone bring along?
A: John brought Sue, Mary brought Bill, …
d. Q: Which person brought every guest?
A: * John brought Sue, Mary brought Bill,…

The impossibility of getting a functional answer in (2b) and a list reading in (2d) have been analyzed as cases of WCO.[5] For example, the trace in (2a,b) can be argued to be a functional one, with the argument of the function understood as a null pronoun that must be bound by a suitable antecedent. The binding of this covert pronoun turns out to be WCO-compliant in (2a) but not in (2b), whence the impossibility of a functional reading in the latter case. Our proposal will have consequences for many ramifications of WCO effects, but we won't be able to pursue them all within a single paper, given how widespread they are.

[4] I do not believe that this is an artifact of the view that scope is movement. Any way of getting inverse scope for quantifiers is bound to give the option of binding pronouns, as in (2e).
[5] Cf., e.g., Chierchia (1993), Dayal (2016, ch. 4).

While we won't be able to reason through all the consequences of our proposal, there is one class of WCO extensions that will play an important role in our argumentation, namely, extensions to donkey anaphora. The following illustrates the relevant paradigm:[6]

(3) a. Every farmer who bought a donkey was impressed by its strength.
b. * Its_j strength impressed every farmer who bought a $donkey_j$.
c. * [every farmer who bought a $donkey_j]_i$ [its_j strength impressed t_i]
d. Which farmer that bought a $donkey_i$ was impressed by its_i strength?
e. * Which farmer that bought a $donkey_i$ did its_i strength impress t?

The reason why this paradigm constitutes a challenge above and beyond the paradigm in (1) is that accounts of the contrast in (1) in general do not automatically extend to (3). In particular, none of the 'classical' approaches—cf. (4) below—do. It is not so obvious how whatever mechanism gets unleashed for non-C-command anaphora can be prevented from applying in the cases in (3).

To further put the problem in perspective, let us briefly review the main 1980s-style approaches that have set the stage for much work on WCO in the years since. They are sketched in (4):

(4) Classical approaches to WCO
a. Reinhart (1983): A pronoun *pro* can be bound by (covary with) an antecedent XP iff that XP (or its trace, if the XP is quantificational) is in an A position that C-commands pro. (= XP must C-command pro before A'- movement, if any)
b. Koopman and Sportiche (1983): An XP in an A' position can bind one and only one element. (Bijectivity)
c. Safir (1984):
If a single quantifier binds more than one syntactic variable, then either (i) or (ii) must hold:
i. Both syntactic variables are pronouns.
ii. Both syntactic variables are traces.
(Parallelism on Operator-Binding)

What is striking about all of these proposals is that they appear to be more complex than other constraints on binding like, say, the Binding Theory (along the classical lines of Chomsky 1981). Moreover, they have no obvious 'functional grounding'. Principles A and B of the Binding Theory do: reflexive morphology on a pronoun encodes the need for a local antecedent. It is natural, then, to try to relate to this the fact that non-reflexive pronouns *cannot* be locally bound, as a kind of 'elsewhere' effect.[7] Nothing of the sort can be said about constraints like those in (4).

[6] This data, from Chierchia (1995a), goes as far back as Higginbotham (1980, 1985). Since then it has been addressed in some important subsequent work; see especially Büring (2004) and references therein.
[7] See, e.g., Schlenker (2005), Marty (2017) for takes on the Binding Theory directly relevant to the present approach.

Beyond these general qualms, all of the approaches in (4) face certain well-known and quite formidable empirical challenges. In particular, the following phenomena have been repeatedly pointed out in the literature as problematic for all of them:

(5) Empirical issues with canonical WCO constraints:

a. Donkey anaphora

i. If a $farmer_1$ buys a $donkey_2$, he_1 trains it_2.

ii. Every farmer that buys a $donkey_1$ trains it_1.

b. Inverse linking

The mayor of no $city_1$ despises it_1/its_1 population.

c. Possessor binding

Every first-year $student_1$'s advisor tries to help him_1 or her_1 through the initial rough phase.

d. Binding into adjuncts

I spend an inordinate amount of time with every first-year $student_1$ in order to afford him_1 or her_1 a smooth entrance into our program.

All of these familiar phenomena are prima facie incompatible with the C-command condition on pronoun binding, or with bijectivity, or with parallelism. It is worth underscoring, in particular, the case of binding from the object position into adjuncts, i.e. (5d). Its problematic nature can be best appreciated by considering the paradigm in (6):

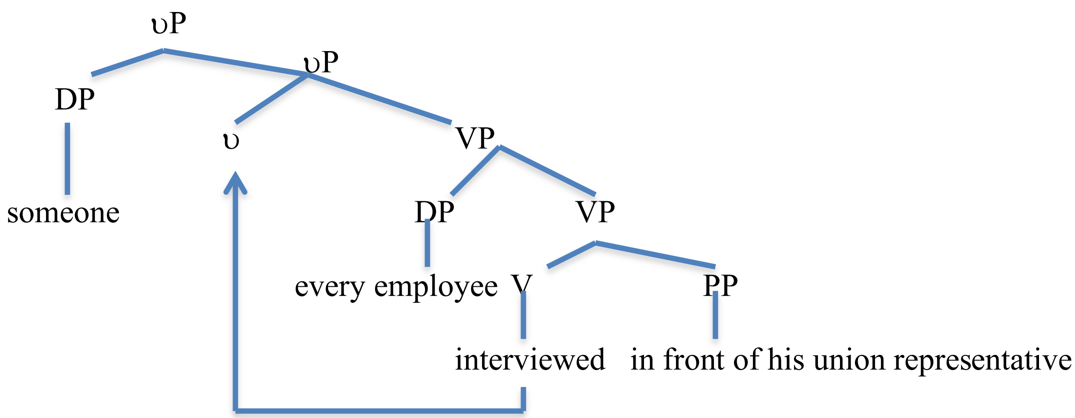
(6) a. Someone interviewed every new employee.

b. His manager interviewed every new employee.

c. Someone interviewed every new employee in the presence of his union representative.

We already pointed out that while it is easy to construe (6a) with the object having wide scope over the subject, it is hard or impossible to get the object to bind a pronoun embedded in the subject position, as in (6b). However, it is perfectly natural for a quantifier in object position to bind into a higher adjunct, as in (6c), regardless of whether the object is construed with wide or narrow scope with respect to the subject. The problem here is the asymmetry between the subject and the adjuncts: both are higher than the object, and yet the object can easily bind into adjuncts, but hardly so into the subject. This situation has led some researchers (e.g. Larson 1988, Pesetsky 2004) to invoke 'cascading' structures / VP-shells such as (7):

(7)



The idea here is that adjuncts, no matter how high they wind up at spell-out, are generated as sisters to the verb, which is subsequently head-raised leftwards, as indicated by the arrow in (7). In their base position, adjuncts are C-commanded by the object, which supposedly explains why binding by objects into adjuncts is possible. However, this generalization of the VP-shell approach faces many issues. For one thing, accounts based on bijectivity or parallelism still have a problem here, for structures like (7) wind up with an operator binding two (non-parallel) positions. Moreover, adjuncts pattern very differently from arguments when it comes to, e.g., extraction, and show no Principle C effect with respect to the object (cf. the grammaticality of, e.g., *They caught him before John could say 'beep'*).[8] All of this makes it desirable to try to understand binding into adjuncts in a way that retains a more surfacy constituency for adjunction.

If things were not sufficiently complex, one has to also keep in mind the existence of A'-like kinds of movement that appear to obviate WCO effects. Topicalization in English and clitic left dislocation in Italian are cases in point:

(8) a. This book$_i$ [I would expect its$_i$ author to disavow t$_i$] but that book$_j$ [I wouldn't __]
(Lasnik and Stowell 1991)
b. i. ?? Il suo dipartimento deve sostenere finanziariamente un bravo studente.
'His department must provide financial support for a good student.'
ii. Uno bravo studente, il suo dipartimento lo deve sostenere finanziariamente
'A good student, his department him must provide financial support for.'

Scrambling, which we won't be able to discuss within the limits of the present paper, presents similar characteristics as well. Some forms of (typically local) scrambling obviate WCO, while other don't; this has led to their being characterized as A- vs. A'-scrambling, respectively.[9]

So while scope assignment and wh-movement in English display very robust WCO effects, other kinds of displacements, like those in (8), appear to obviate them. This too is part of the picture we'd like to make some sense of. While we will not be able to fully illuminate all of these complexities here, we hope to offer a useful tool for exploring them further.

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[8] Example due to one of the referees.
[9] Cf., e.g., Mahajan (1990), Baylin (2001), Titov (2012), among many others.

1.1. The idea in a nutshell: Dynamic Predication.

Let me couch the main idea I would like to pursue in ‘dynamic talk’. Dynamic semantics (DS) involves three things: (i) an operation of discourse referent (DR) introduction/activation, (ii) a way of passing on activated DRs via context updates through ‘accessible’ domains, and (iii) an interpretation of pronouns according to which they covary with accessible DRs. The introduction of DRs in a dynamic setting is usually associated with an existential operator, which I’ll notate for now as ‘$\mathit{\exists}$’ to distinguish it from the ordinary, static existential quantifier ‘$\exists$’. Accessibility is determined by the lexical semantics of the basic Boolean operators. In all versions of DS I am familiar with, DR introduction is considered to be a property of DPs. For example, a sentence like (9a), on a typical DS, is compositionally broken down as in (9b).

(9) Introduction of DRs via DPs/arguments:
   a. A man walked in.
   b. i. a man $\Rightarrow \lambda P \mathit{\exists} x\, [\text{man}(x) \wedge P(x)]$
      ii. walked in $\Rightarrow \lambda y.\ \text{walked-in}(y)$
   c. $\lambda P \mathit{\exists} x\, [\text{man}(x) \wedge P(x)](\ \lambda y.\ \text{walked-in}(y)) = \mathit{\exists} x\, [\text{man}(x) \wedge \text{walked in}\ (x)]$

The result of composing the parts in (9b) is (9c), in which a DR has been properly declared and is ready to be picked up by a pronoun, modulo accessibility. I propose to consider instead the compositional breakdown in (10a):

(10) Dynamic Predication: Introduction of DRs through predicates.
   a. i. a man $\Rightarrow \lambda P \exists x\, [\text{man}(x) \wedge P(x)]$
      ii. walked in $\Rightarrow \lambda x \mathit{\exists} y.\ x = y \wedge \text{walked-in}(x)$
   b. $\exists x\, [\text{man}(x) \wedge \mathit{\exists} y.\ x = y \wedge \text{walked-in}(y)] \Leftrightarrow \mathit{\exists} x\, [\text{man}(x) \wedge \text{walked in}\ (x)]$

The existential quantifier associated with the subject in (10a.i) is an ordinary static one. It does not declare a DR whose value can be passed on. The existential quantifier in the predicate in (10a.ii) does activate a DR. The final outcome in (10b) is equivalent to the one in (9c), but the compositional path through which (10b) is derived differs from that in (9).

Why bother? What is the significance of switching from the traditional approach in (9) to the one in (10)? Consider a canonical WCO case like *His son saw a man*, with the quantified DP *a man* now in object position. Quantified DPs need to be assigned scope. But if DPs *never* introduce DRs, then the object DP *a man* won’t be able to, regardless of where it gets scoped at. The object argument slot of *see* will introduce a DR. But plausibly a DR introduced in the *object* position won’t be accessible to a pronoun embedded in the *subject* position. This, in fact, turns out to be a ‘theorem’, once we switch to event semantics and the clause gets broken down into a series of structurally determined conjuncts, as we will see below. And so the pronoun embedded in the subject position in *His son saw a man* turns out not to have a sentence-internal accessible antecedent.

This idea, which I am going to call the 'Dynamic Predication Principle' (DPP), needs to be fleshed out in many ways. But it is simple and clearly has non-trivial consequences. These consequences deserve to be played out, especially if the various pieces of the proposal (e.g., the assumed event semantics, or the idea that argument slots may introduce DRs) turn out to have some amount of independent motivation, as I believe they do.

One more thing. To say that DPs never introduce DRs entails that DR introduction doesn't take place at their scope sites either. Consider *His son saw a man* again:

(11) DPs never introduce DRs.
   a. His son saw a man.
   b. a man_i [his son saw t_i]
   c. $\lambda P \exists x\, [man(x) \wedge P(x)]\, (\lambda x_i.$ his father saw $x_i)$ Heim and Kratzer (1998)
   d. i. $DPi\ [\phi] \Rightarrow DP(\lambda x_i.\ \phi)$
      ii. NOT: $DPi\ [\phi] \Rightarrow DP(\lambda x_i.\ \exists y.\ x_i = y \wedge \phi)$

In a movement-based approach to scope, the object *a man* in (11a) undergoes covert movement, resulting in structures like (11b). These structures are generally interpreted as in (11c). According, e.g., to Heim and Kratzer (1998) the index on the DP acts an abstractor over the rest of the clause (i.e. the scope), thereby creating something of type <e,t> which then can properly combine with the DP meaning as in (11c). The interpretive rule that Heim and Kratzer give is as in (11d.i). We want to keep it that way. We definitely do not want it to be as in (11d.ii), where a DR is being introduced at the landing site of quantifier raising (QR). For otherwise the claim that DPs never introduce DRs would be vacuous. To put it differently, our claim is not that *all* predicates introduce DRs. The claim is that *only* predicates do. Which predicates? Well, all lexical predicates for starters—plus, probably, a few derived ones. But certainly not those that arise just to resolve a type mismatch and allow the discharging of scope, like those created by QR. These are the questions we want to explore: which predicates are dynamic and introduce DRs? What features do they share? Which predicates are static and do not introduce DRs?

1.2. The plan

Above I have couched my main claim in 'dynamic talk'. The kind of DS I will end up using is very basic. In fact, it will be simpler than most dynamic approaches, in that we will not want to invoke dynamic generalized quantifiers (a move which represent a corollary of the view that DPs do not introduce DRs).[10] While this opens up the

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[10] Dynamic generalized quantifiers not only introduce DRs; they also allow dynamic transfers of DRs introduced in their restrictions to their scope. For example, in *Every man that has a donkey beats it* the subject DP *every man that has a donkey* activates a DR for the head noun *man* and enables transfer of the DR associated with *a donkey* to the scope of the subject. See, e.g., Groenendijk and Stokhof (1990), Kanazawa (1994), Chierchia (1995a), and references therein. Cf. also Barker and Shan (2008) for a mechanism analogous to dynamic generalized quantifiers in a continuation framework.

possibilitly of simplifying DS, the way I am putting dynamics to use is very different from the way it is done elsewhere.

The central idea in this project has important points of contact with and precedents in approaches that employ background frameworks different from DS. In particular, it has points of contact with the approach developed by Büring (2004), who builds on Jacobson (1999) among others, and endorses a situation-theoretic framework. It is also well known that DS has both formal and conceptual overlaps with 'continuation'-based approaches (e.g. Barker 2002 and related work), and I have no doubt that the idea sketched above could also be developed with continuations. However, in so far as I can see, the approach developed here differs non-trivially, both conceptually and empirically, from the approaches to anaphora just mentioned, whether situation or continuation based, and I will try to indicate some ways in which this is so (especially in Section 5).

The plan is as follows. In Section 2 we will work out the Dynamic Predication Principle and its main consequences. This will be done by presenting the version of DS that is to act as our background framework and by marrying it with an independently motivated event-based semantics. In Section 3, we will more broadly explore the consequences of DPP, as spelled out in Section 2, against the traditional data set for which DS was articulated in the first place, namely donkey sentences. In Section 4, we will look at cases of A- and A'-movement that bleed WCO, and formulate a concrete hypothesis as to how and why they do so. In Section 5 we will draw some comparisons with situation-/continuation-based approaches to crossover phenomena and conclude. In the Appendix, readers will find a few worked out examples and derivations.

2. Dynamic semantics *plus* event semantics

As mentioned in the Introduction, the view that typically it is predicates which introduce DRs resonates deeply with (and, in fact, was directly suggested to me by) an idea put forth in Büring (2004).[11] He argues that there are *two* systems of indices in syntax: one for A'-binding, and one for A-binding. Büring adopts the standard view of scoping as movement, but with a twist: the binder associated with QR binds only its own trace. Pronoun binding is dealt with in terms of a separate binder to be (optionally) inserted at A-positions, as illustrated below:

(12) a. Every cat licks its whiskers.
b. Every cat_i [t_i β_3 licks its_3 whiskers]
c. Every cat λ_i [t_i λ_3 [t_3 licks t_3's whiskers]]

According to Büring, a sentence like (12a) requires two steps to yield a bound pronoun interpretation. The first is the insertion of a pronoun binder β, which can be inserted at any A-position. The second is QR, which assign scope to the subject DP by adjoining it to its scope site (string vacuously, in the case at hand). These two operations yield the structure in (12b), which is interpreted as in (12c). The operator β in (12b) links the A-

[11] Büring's approach in turn has several sources, including, in particular, Jacobson (1999).

position to the embedded pronoun.[12] This is clearly very close to our claim that predicates (i.e., things that determine A-positions) are what creates antecedents for anaphora. Büring argues that his approach provides us with a way of deriving some of the basic WCO effects:

(13) a. Its whiskers bother every cat.
b. Every cat_i [its_3 whiskers bother t_i]
c. * Every cat_i [its_3 whiskers β_3 bother t_i]
d. * Every cat_i β_3 [its_3 whiskers bother t_3]

The canonical A'-binder in (13b) can never 'see' pronouns—this is a way of (re)stating the view that pronouns cannot, in general, be A'-bound.[13] The β-operator in (13c) is correctly inserted in an A-position, but it is too low to bind the pronoun embedded within the subject. In (13d), on the other hand, the β-operator is high enough to link the pronoun within the subject to the object position, but it is not in an A-position. In sum, there is no way of getting the undesired binding.

While this approach provides us with a potentially interesting take on WCO, it remains unclear where the required two systems of indices come from. Here is what Büring himself says:

> "To put the gist of this treatment as a slogan: A'-dependencies and pronoun binding dependencies are strictly distinct.[3]"
> Fn. 3: "Maybe there is a more principled reason why binding from an A'-position cannot bind pronouns, namely that the traces of 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 A'-trace binding (as has been suggested recently in Ruys (2000)). This would avoid the stipulated restriction on β-adjunction to A-positions."
> (Büring 2004, 28)

DS provides us with a way of pursuing Büring's main suggestion while at the same time grounding his double-indexing idea in an independently needed semantic difference between traces and pronouns (though ultimately it is not traces but pronouns that wind up having a type different than e). Here is how two critics of DS put it:[14]

> "[Dynamic Montague Grammar] thus supports *two* binding strategies [my

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[12] This is similar to how the Geach rule works; cf. Geach (1970).
[13] A highly important class of cases where this generalization does not hold concerns resumptive pronouns (cf. e.g. McCloskey 2002, 2006, among many others). Resumption is a huge topic in its own right, and we certainly won't be able to address it within the limits of this paper. However, clitic left dislocation in Italian does make use of resumption, and we will show how at least that case can be handled in a reasonably principled manner within the present framework.
[14] The target of Barker and Shan's observation is Groenendijk and Stokhof (1990); B&S make this point because the notation used by Groenendijk and Stokhof obfuscates this important distinction.

> emphasis, *GC*]. On the one hand it provides a stock of variables that are evaluated with respect to an assignment function in the usual way. On the other, it provides a separate system in which the role of variables is played by discourse markers, which are evaluated with respect to a state."
> (Shan and Barker 2008: 37)

As Shan and Barker point out, DS *needs* two semantically different mechanisms, which line up perfectly with Büring's double indexing system; this provides us with preliminary motivation to replace the situation-based framework Büring adopts with DS and to translate Büring's slogan into the one put forth in Section 1.1. and repeated here:

(14) Dynamic Predication Principle.
DRs can only be introduced by predicates

2.1. Which dynamic system?

In the present subsection, I am going to introduce the version of DS that I will use to explore the idea that anaphora is regulated by predicates. The bite of the dynamics comes from the operation that activates discourse referents and passes them along to accessible domains, employing the notion of accessibility common to all approaches that have developed out of Kamp (1981) and Heim (1982). Of course, the precise characterization of accessibility is open to many questions. For example, Schlenker (2007) alleges that accessibility for the purposes of presupposition projection retains certain stipulative features. I'll say something about this in Section 2.1.2. below, after having introduced certain basics in 2.1.1. For these basics, I will follow Heim in assuming that DR-introduction is subject to a novelty condition (i.e., a 'fresh' DR, not present in previous discourse, must be used) and that the interpretation of definites, including pronouns, is subject to a familiarity condition requiring that at the moment of evaluation of the definite, its antecedent must be available/active.[15] The system has two sets of devices for 'binding', variables and pronouns, of different semantic type, where the latter can only get their antecedents from active DRs; this embodies the following informal view of pronouns:

> "Pronouns are essentially indexical. … Pronouns are a device to refer to contextually given entities. … And when I say that a pronoun refers to a contextually given entity, I mean it relates to something that is 'given' at its point of occurrence … by an expression that literally occurs to the left of the pronoun's occurrence in a formula." (Dekker 2012: 17)

As we will see (cf. especially Section 2.1.2), Dekker's emphasis on 'leftness' is somewhat misplaced: binding of pronouns is ultimately a structural matter. But his point about the quasi-indexical character of pronouns is right on target, I think.

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[15] The system I propose is closely based on Heim (1982) and Dekker (1996, 2012). But it adopts a notation more similar to Muyskens (1996) and Champollion et al. (2018).

2.1.1. *Basics of dynamics*. In DS the meaning of a sentence is viewed as a way of updating an input context or information state. Since we are not dealing with intensional phenomena, the semantic value of sentences can be represented as a relation between assignments, generally of the form $\lambda\omega\lambda\omega'.\ \phi$ (cf. Groenendijk and Stokhof 1991), where $\omega, \omega', \ldots$ are variables over assignments and ϕ is some expression of type t (i.e., truth value denoting). Assignments are *partial* functions from numbers n into individuals (of type e). For example, a sentence like (15a) will be represented as (15b), ignoring for the time being the event argument.

(15) a. he_3 runs $\Rightarrow$ [run](he_3)
b. $\lambda\omega\lambda\omega'.\ \omega = \omega' \wedge run_{<e,t>}(\omega_3)$
where ω_n is an abbreviation for $\omega(n)$ and the formula to the right of the double arrow in (a) is to be understood as an abbreviation for the formula in (b).

The formula in (15b) takes as input some assignment ω and returns the same, if ω_3 is defined and the individual in the third coordinate runs. Our basic types are e, t, and n (where n is the type of numbers). The type of assignments is $<n,e> = \boldsymbol{\omega}$ (boldface $\boldsymbol{\omega}$); the type of sentence values is $T = <\boldsymbol{\omega},<\boldsymbol{\omega},t>>$, which we will call 'context change potentials' (CCPs), following Heim (1982). CCPs can be 'evaluated' relative to an assignment as follows:

(16) a. $\downarrow_\nu \phi = \exists\omega[\phi(\nu)(\omega)]$ (ϕ is true relative to ν)
b. Example: $\downarrow_\nu$ he_3 runs $= \exists\omega[\ \nu = \omega \wedge run_{<e,t>}(\nu_3)]$ (ν satisfies $run_{<e,t>}(\nu_3)$)

The formula in (16b) is defined iff ν has a value in its third slot; if defined, it is true if the individual ν_3 runs and false otherwise. The '$\downarrow$' operator extracts from CCPs their corresponding (traditional) truth conditions, relative to an assignment.

In this setting, basic logical functors operate over CCPs. The following is a standard way of defining them, based on Groenendijk and Stokhof (1991):

(17) Basic logical operators
a. $\neg\phi = \lambda\omega\lambda\omega'.\ \omega = \omega' \wedge \neg\downarrow_\omega \phi$
b. $(\phi \wedge \psi) = \lambda\omega\lambda\omega'.\ \exists\omega''\ [\phi(\omega)(\omega'') \wedge \psi(\omega'')(\ \omega')]$
c. $\phi \rightarrow \psi = \neg\ (\phi \wedge\neg\ \psi)$
d. $\phi \vee \psi = \neg\ (\neg\ \phi \wedge\neg\ \psi)$
e. $\exists\alpha_a\ \phi = \lambda\omega\ \lambda\omega'.\ \exists\alpha_a\ [\phi(\omega)(\omega')]$
f. $\forall\alpha_a\ \phi = \neg\exists\alpha_a \neg\ \phi$

The above logic does not yet countenance DR introduction ($\exists$, as defined in (17e), is static). DR introduction is an operation that takes as input an assignment undefined over some coordinate n and returns as output an assignment where that coordinate is now anchored to some specific individual u. Given that we want to pursue the idea that only predicates introduce DRs, we might as well couch DR introduction as an operation on predicates:

(18) For any $P_{<e,t>}$, and any n, [...] is that function such that:
i. $[P_{<e,t>}] = \lambda u[\ \lambda\omega\lambda\omega'.\ \omega = \omega' \wedge P(u)]$ Dynamic lift
ii. $[P_{<e,t>}]^n = \lambda u[\ \lambda\omega\lambda\omega'.\ \omega =^{n/u} \omega' \wedge P(u)]$ DR introduction
where $\omega =^{n/u} \omega'$ is an abbreviation of $\omega' = \omega \cup <n,u>$, defined only if the the input assignment is *un*defined for the n-th coordinate.

[P] without superscript simply lifts the type of $P_{<e,t>}$ to <e,T>, by tacking onto it a trivial input/output assignment pair; $[P]^n$ does the same but also activates a novel DR n linked to whatever P will take as argument.[16] Recall that assignments, being *partial* functions from numbers into individuals, are generally of the form {<1,u>, … , <n,u'>, …}. For example, {<1, John>, <3, Mary>} is a partial assignment that maps the first slot into John and the third slot into Mary. DR introduction adds a new pair to partial assignments of this sort (as long as the result of this addition is still a function).

Finally, pronouns denote functions from assignments into the individual hosted at a specific 'address' or coordinate (see 19a).[17] They combine with dynamic predicates (of type <e,T>) via a rule that uses function composition, specified in (19b) and illustrated in (19c).

(19) a. $he_n \Rightarrow \lambda\omega.\ \omega_n$ Type: <**ω**,e>
b. If P is of type <e,T>, then: $P_{<e,T>}(\lambda\omega.\ \omega_n) =_{df} \lambda\nu\ \lambda\nu'.\ P(\lambda\omega.\ \omega_2(\nu))(\nu)(\nu')$
c. Example:
i. $[run]^3(\lambda\omega.\ \omega_2) = \lambda\omega.\lambda\omega'.\ [\omega =^{3/\ \omega_2} \omega' \wedge run(\omega_2)]$
ii. $[run](\ he_2)$

The predicate *run* in (19c) is taken to introduce a DR (in the third coordinate), on the assumption that dynamic predicates generally do, and applies to ω_2, using the operation in (19b). Thus the input to (19c) must be defined on its second coordinate. The introduction of a new DR by $[run]^3$ is in this case without effect, since such DR is equated, via predication, to ω_2, which must be known at the point of evaluation. This justifies abbreviating (19c.i) as (19c.ii).

This system delivers, basically, the approach to indefinites that is the thread common to all versions of DS. A sequence of sentences like (20a) gets the interpretation in (20b) in a completely standard way. The magic of the dynamics makes (20b) have the same truth conditions as (20c). The only difference in the compositional mapping is that DR introduction is built into the main predicate of the clause along the lines sketched in Section 1.1, rather than into the subject *someone* (cf. the Appendix for a complete derivation).

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[16] Alternatively, DR introduction can be broken down into two steps as follows:
(i) $D^n(u) = \lambda\omega\lambda\omega'.\ \omega =^{n/u} \omega'$ Type of D^n : <e,T>
(ii) $[P]^n = \lambda u.\ D^n(u) \wedge [P](u)$

[17] Definites in general are of the same type as pronouns and combine in the same way. For example:
(i) His_3 father $\Rightarrow \lambda\omega.\iota x[\text{father of}(\omega_3)(x)]$

(20) a. Someone [walked in]^4. He_4 was [tall]^3
b. $\exists x$ [walked in]^4 (x) $\wedge$ [tall] (he_4)
c. $\exists x$ [walked in(x) $\wedge$ tall(x)]

Superscripts indicate DR introduction. The first conjunct in (20a) introduces a new discourse referent in the fourth coordinate of the input assignment and passes it along to the second conjunct. The second conjunct contains the pronoun he_4, which requires that at its point of evaluation, the fourth coordinate of the input assignment have a value. In this case the familiarity presupposition triggered by he_4 is satisfied. So the second sentence checks whether ω_4 is tall, and if so, the output is passed further along.

2.1.2. *How 'stipulative' is DS?* The semantics for the propositional connectives in (17) encodes the (standard) accessibility relation informally characterized in (21):

(21) *Accessibility*
A is *accessible* to B if a DR active in A can covary with a pronoun in B.

a. [A and B]	i. A is accessible to B (but not vice versa).
	ii. B is accessible to whatever is conjoined with [A and B].
b. [If A, B]	i. A is accessible to B (but not vice versa).
	ii. A, B are *not* accessible to what is conjoined with [if A, B].
c. [not A]	Nothing in A is accessible to what is conjoined with [not A].
d. [A or B]	i. A is not accessible to B, nor is B to A.
	ii. Neither A nor B is accessible to what is conjoined with [A or B].

Examples of how accessibility affects anaphora are provided in (22); each example is accompanied by a rough breakdown of the sentence into macro-constituents, plus the aspect of accessibility responsible for the (im)possibility of anaphoric binding:

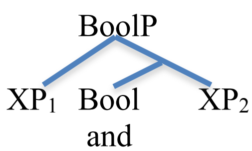
(22) a.i. John saw a cat_i and fed it. Mary fed it_i some more.
ii. [[A and B] and C]; A is ACCESSIBLE TO C (from (21a))
iii. * I saw it_i and fed a cat_i.
[A and B]; B is not ACCESSIBLE TO A
b. i. * If there was someone in the house, I'll be scared. My dog attacked him.[18]
ii. [[if A then B] and C]; A is not ACCESSIBLE TO C (from (21b))
c. i. John didn't buy a new car_i. ?? He borrowed it_i from me.
ii. [[Not A] and B]; A is not ACCESSIBLE TO B (from (21c))
d. i. ?? Either John has a new car for us to borrow, or it_i is parked in that garage.
ii. [A or B]; A is not ACCESSIBLE TO B (from (21d)

The infelicitous cases in (22) all involve unresolved anaphora, i.e. occurrences of it_i with no accessible antecedents.

[18] This holds modulo 'modal subordination' phenomena. See Roberts (1987).

In DS the type of Boolean operators is systematically lifted from the type t of truth values to the type T of CCPs. The formal simplicity of the lifting in (17) speaks to its naturalness, I think. I will comment just on one point here. Traditional Boolean ‘$\wedge$’ is replaced in DS by function composition, i.e. a *symmetric/commutative* truth function is replaced with an *asymmetric/non-commutative* operation, namely: $f \mathbf{o}\, g = \lambda u.f(g(u))$. This is a fairly local and yet fundamental shift of perspective that DS brings about, which raises the question of how to map the *componens f* and the *componendum g* onto syntactic constituents. The syntax of simple coordination is uncontroversial:

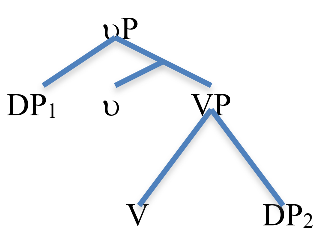
(23) a.



b. i. John met a linguist$_i$ and talked to her$_i$.
ii. *John met her$_i$ and talked to a linguist$_i$.

Basic evidence from anaphora (23b) clearly shows that the higher XP$_1$ must be the *componens f* and the lower XP$_2$ the *componendum g*. The reasoning behind this is fully parallel to the analysis of, e.g., reflexives vis-à-vis basic clause structure. The reflexivization operation is asymmetric: one argument slot in the clause hosts the reflexive pronoun and is linked to another that hosts the antecedent. There is plenty of evidence that the V forms a constituent with the object as in (24a). [19]

(24) a.



b. i. John likes himself.
ii. * Himself likes John.

Given (24a), basic evidence about anaphora, viz. (24b), tells us that reflexivization, however implemented, must make the lower argument dependent on the higher one, rather than the other way around. Note that it is easy in principle to get the opposite result by either modifying the semantics of reflexivization or the basic constituency of the clause. It seems to follow from this that the DS of coordination is as much or as little stipulative as the standard semantics of reflexivization. From the point of view of anaphora, the dynamics of coordination is not about parsing, or processing, or incrementality any more than the semantics of reflexives is. It seems plainly unwarranted to set different standards for the present analysis of conjunction vs. any run-of-the-mill

[19] The functional head ‘υ’ (*little v* or *voice* – cf., e.g., Kratzer 2003) introduces the basic subject position. Nothing hinges on this particular choice.

analysis of reflexivization and deem one of them ‘stipulative’ while unquestioningly accepting the other.[20]

2.2. Events in a dynamic setting

Event semantics has proven useful in a variety of domains.[21] Applied to a sentence like *John loves his cat*, it yields an analysis as in (25a), whose informal paraphrasis is as in (25b):

(25) a. John loves his cat $\Rightarrow \exists e$ [EX(e)(j) $\wedge$ TH(e)(j’s cat) $\wedge$ love(e)]
b. There is an eventuality e (a state, in the case at hand) such that John is the EX(periencer) of e and John’s cat is the TH(eme) of e and e is a state of loving.
c. $love_{<ev, <e, et>>} \Rightarrow \lambda e \lambda x \lambda y[EX(e)(y) \wedge TH(e)(x) \wedge love(e)]$ *Polyadic approach*
d. $love_{<ev,t>} \Rightarrow \lambda e.love(e)$ [22] *Monadic approach*
where *ev* is the type of eventualities

There are two main strategies to arrive at the analysis in (25a). One is to lexically decompose the verb as shown in (25c) (e.g., Parsons 1990); the other is to assume that verbs are monadic predicates of events as in (25d) (e.g., Borer 2005, Champollion 2015). I will now discuss what happens when event semantics is combined with dynamic conjunction and the view that ‘lexical’ (underived) predicates (i.e., *love*, *TH,* and *EX* in (25a)) introduce DRs (i.e. DPP). I will first take the ‘monadic’ approach (Section 2.2.1); this will lead us to a straightforward explanation of how binding into adjuncts is to be derived (Section 2.2.2). I will then indicate how this same framework accommodates the polyadic approach, if so desired (Section 2.2.3).

2.2.1. *Verbs as monadic predicates*. Thematic roles are ultimately relations between eventualities and individuals, as illustrated in (25a). If verbs are monadic predicates of events, thematic roles *must* be introduced in the semantic composition via some system of applicative heads. The latter can be analyzed either as functions that apply to individuals and enable them to combine with the verb (e.g. Champollion 2015) or, conversely, as functions that apply to the verb complex and make it combine with the relevant argument (cf., e.g., the discussion of *voice* in Kratzer 2003). Nothing hinges on this choice, insofar as we are concerned. For concreteness, let us choose the second option. Accordingly, a sentence like (25a), repeated as (26a) below, is going to have the structure in (26b),

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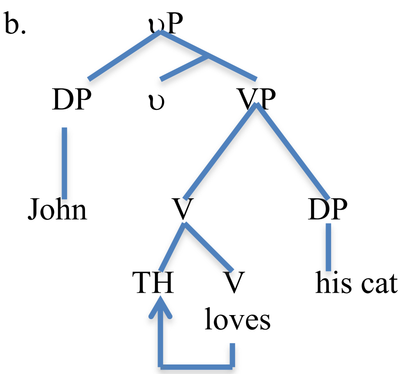
[20] I believe that these considerations extend to presuppositions, but it is impossible to pursue this here.
[21] A standard reference in this connection is Parsons (1990), who develops an original insight from Davidson (1967). For an important more recent contribution, see e.g. Kratzer (2003), a.o.
[22] I am ignoring here the world argument. The types in (25) should be intensionalized, e.g. as in (i) for the monadic case:
(i) $love_{<w,<ev,t>>} \Rightarrow \lambda w\ \lambda e.love(w)(e)$, where w is the type of worlds
It should furthermore be noted that Kratzer (2003) adopts an ‘intermediate’ position between those we are considering.

where *voice* (or 'little V') and TH are the applicative heads. In particular, TH is an 'object-creating' head into which V incorporates. TH is abstract in English but overtly realized in many other languages;[23] the main steps of the compositional interpretation of (26a) are schematically summarized in (26c):

(26) a. John loves his cat.

b.



c. i. $TH(love) = \lambda u \lambda e[TH(e)(u) \wedge love(e)]$

ii. $TH(love)(his\ cat) = \lambda e[TH(e)(j\text{'s}\ cat) \wedge love(e)]$

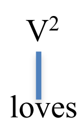
iii. $\upsilon\ (TH(love)(his\ cat)) = \lambda u \lambda e[EX(e)(u) \wedge TH(e)(j\text{'s}\ cat) \wedge love(e)]$

iv. $\upsilon\ (TH(love)(his\ cat))(j) = \lambda e[EX(e)(j) \wedge TH(e)(j\text{'s}\ cat) \wedge love(e)]$

Each applicative head applies to its sister (a predicate of events) and turns it into a function that looks for an individual. So, in particular, TH applies to V and adds an argument to it, as indicated in (26c.i). The result applies to the object *his cat*, yielding a new predicate of events, with the theme argument now 'discharged'. The interpretation then goes through a second cycle. Little υ applies to its sister, adding the EX-argument to it. The outcome is a new property of events, in (26c.iv), that eventually undergoes existential closure to deliver the meaning in (25a). These are simple compositional steps, and nothing hinges on the details; readers should feel free to replace them with their own preferred method of composition.

We are now ready to add a dynamic setting to this analysis and to implement the view that every basic/lexical predicate can introduce a DR. The relevant basic pieces here are *love*, TH, and EX. Predicates in a dynamic setting are of type <e,T>, i.e. functions from individuals into context change potentials, and *love*, TH, and EX need to be lifted accordingly. In the framework of Section 2.1, the lifting is going to be accomplished by the $[\ldots]^n$ operator, which also activates a discourse marker linked to its argument. Here is an example:

(27) a.



$\Rightarrow \lambda e.[love]^2(e)$ Type: <e,T>

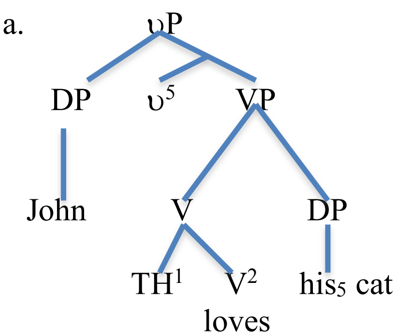
b. i. $\lambda e \exists x_2\ [e = x_2 \wedge love(e)]$

ii. $\lambda e\ [\lambda \omega \lambda \omega'.\ \omega =^{2/e} \omega' \wedge love(e)]$

[23] Cf., e.g., Alsina and Mchombo (1990), a.o.

As already mentioned, I am going to use numerical superscripts to mark the site at which the introduction of the corresponding DR is realized. In (27a), we see the interpretation of the V node. The formula to the right of the double arrow signifies that the event variable *e* is linked to the now active DR in the second slot of the output assignment. This corresponds to what in the informal notation of Section 1 was represented as in (27b.i)—notation to be abandoned now in favor of the formally explicit (27b.ii). The event argument declared in (27) is ready for a pronominal pick in subsequent discourse (e.g.: *John loves Mary. It is a great love*). Next, *TH(e)* and *EX(e)* (both of type <e,t>) will be lifted in a similar manner to $[TH(e)]^1$ and $[EX(e)]^5$ respectively (with indices picked at random, but subject to 'Novelty'). Consequently, the whole of the structure in (26), reproduced in (28), will yield the interpretation in (28b), using the very same modes of composition used in (26c), adjusted for type:

(28) a.



b. $\lambda e\ [\ [EX(e)]^5(j) \wedge [TH(e)]^1(his_5\ cat) \wedge [love]^2(e)\ ]$

Everything here is as in (26c) but for the fact that formulae are now of the type T of context change potentials, rather that the type t of truth values. The formula in (28b) contains three active DRs (<5, 1, 2>), with accessibility arising deterministically. In this instance, the pronoun *his* contained in the second term of formula (28b) has only DR 5 accessible to it, and picks it up in the way in which pronouns do in a dynamic setting. In interpreting a structure like (28) we are implicitly assuming that conjunctions are interpreted according to their hierarchical arrangement, which in English (almost) coincides with their surface S V O order. But this is an area where languages do vary. Consider for example a hypothetical structure like (29):

(29) $\lambda e\ .\ \underset{O}{[TH(e)]^1(his_5\ cat)} \wedge \underset{V}{[love]^2(e)} \wedge \underset{S}{[EX(e)]^5(j)}$

In DS, conjunction is *not* commutative and (29) is not equivalent to (28b). The mode of interpretation in (29) might well be relevant in analyzing, e.g., OVS (or VOS) languages. Whether (29) is the right analysis for such languages is going to depend on a variety of factors, including, e.g., what the anaphora facts turn out to be (and in particular, whether an anaphora embedded within the subject may or may not have the object as antecedent). It is also possible, however, that the surface order in these languages is derived via V / VP fronting (or S extraposition) out of a basic [S [V O]] structure, in which case a more

English-like behavior is to be expected.[24] While settling these matters won't be easy, the hope is that the present perspective on clause structure might grow into an interesting tool for cross-linguistic semantic investigations of word order variation.

Be that as it may, we do not have such complications in English, where basic constituency is relatively clear and tells us unequivocally that (28b) is the right interpretation. This observation immediately gets us the basic WCO facts in a Büring-style way:

(30) a. i. Everyone loves his cat.
ii. [every one_i [t_i υ^5 TH^1 loves his_5 cat]]
iii. every one (λx_i . $\exists e$ [$[EX(e)]^5(x_i) \wedge [TH(e)]^1(his_5\ cat) \wedge [love]^2(e)$])
b. i. His cat loves everyone.
ii. [every one_i [his cat υ^5 TH^1 loves t_i]]
iii. every one (λx_i $\exists e$ [$\mathbf{[EX(e)]^5(his\ cat)} \wedge [TH(e)]^1(x_i) \wedge [love]^2(e)$])[25]

Sentence (30a.i), after scope assignment, has the (linearized) syntactic structure in (30a.ii) annotated with a grammatically well-formed set of indices. Its interpretation is as in (30a.iii). The quantifier in subject position binds its trace, which is linked to the DR 5 introduced by little υ. This happens in a position accessible to the pronoun contained within the object. Per contrast, with sentence (30b.i), the syntactic structure we get after scoping is as in (30b.ii). The raised quantifier cannot directly bind the pronoun, because, as on Büring's approach, the indices associated with QR and those associated with pronouns belong to different 'circuits'. The pronoun in subject position doesn't have *any* accessible antecedent (see the Appendix for an explicit derivation). While on Büring's approach the double indexing is not rooted in a different semantics of pronouns vs., say, traces, in our approach it is: traces are of type e, while pronouns are of type $\langle \boldsymbol{\omega}, e \rangle$, and hence quantifiers cannot bind the latter directly.

2.2.2. *'Binding' into adjuncts*. Büring (2004) remains silent on the issue of binding from the object position into an adjunct, and for good reasons. Clearly, binding into adjuncts is beyond the reach of the β-operator, and it is far from obvious how his or any approach that adopts a similar perspective can address this question. The present proposal, unmodified, actually predicts binding into adjuncts, at least for all adverbial phrases that act as event modifiers. The reason is simple: adverbs that modify the main event argument of the verb (as per Parson's (1990) proposal) are composed with the rest of the sentence intersectively, via conjunction, and they are base generated to the right of the main predicate in English; hence objects will be accessible to adverbial modifiers.[26] As

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[24] See e.g. Chung (1990), Massam (2010) for relevant discussion.

[25] Strictly speaking, the formula in (29b.iii) should be:

(i) every one ($\lambda x_i \downarrow_\omega \exists e$ [$\mathbf{[EX(e)]^5(his\ cat)} \wedge [TH(e)]^1(x_i) \wedge [love]^2(e)$])

where $\downarrow$ maps CCPs into expressions of type t, as per Section 2.1.1.

[26] Right-adjoined adjuncts can of course be fronted, as in (i):

(i) Next to him everyone saw a snake [next to him]

In this case, the semantics will presumably work off the trace, i.e. in terms of the reconstructed structure. Cf. e.g. Fox (1999), a.o. See also Section 3.3.

usual, to see what is involved, let us consider first how things work from a static perspective, by looking at an example like (31a), which, following Parsons, will get the interpretation in (31b).

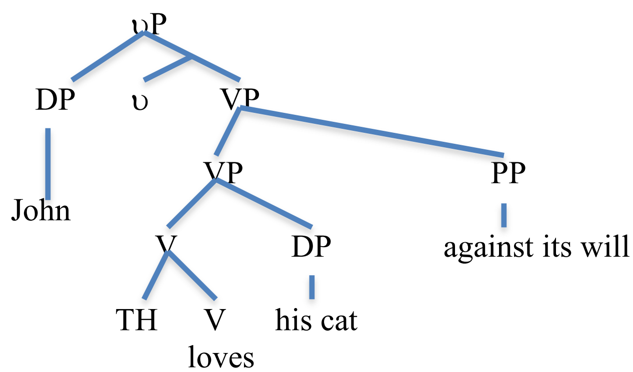
(31) a. John loves his cat against its will.

b. $\exists e\,[\,EX(e)(j) \wedge TH(e)(j\text{'s cat}) \wedge love(e) \wedge against(e)(j\text{'s cat's will})]$

c. There is an eventuality e of which John is the Experiencer and John's cat is the Theme which is a state of love and this state holds against the will of John's cat.

The syntactic structure of (31a) is roughly as in (32a), while (32b) illustrates the main interpretive steps for the sentence:

(32) a.



b. i. Lower VP: $\lambda e[TH(e)(j\text{'s cat}) \wedge love(e)]$ (from 26)

ii. Upper VP: $\lambda e[TH(e)(j\text{'s cat}) \wedge love(e) \wedge against(e)(\text{its will})]$

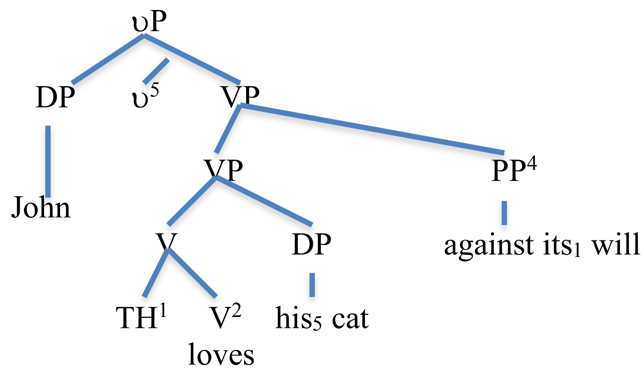
iii. $\upsilon P = \lambda e[EX(e)(j) \wedge TH(e)(j\text{'s cat}) \wedge love(e) \wedge against(e)(\text{its will})]$

c. If α and β are both of type <e,t> (or <ev,t>), then the interpretation of $[_{XP}\ \alpha\ \beta]$ is: $\lambda x[\alpha(x) \wedge \beta(x)]$

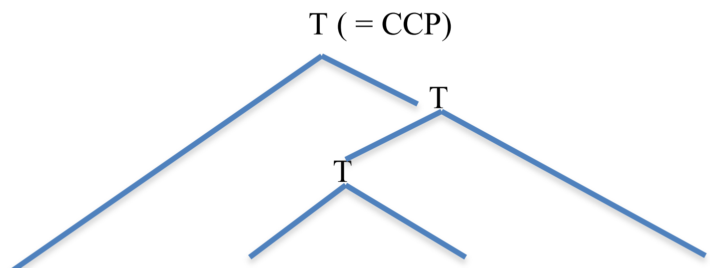
I am assuming that the modifier *against its will* is adjoined to VP, but absolutely nothing changes if, instead, it is adjoined higher up. The interpretation of the lower VP *loves his cat*, on the basis of the procedure outlined in (26), is (32b.i). The interpretation of the PP *against his will* is that of a predicate of events, namely $\lambda e.against(e)(x)$, where $against(e)$ is true of an individual x iff e happens or holds against x. Adjunction involving *two* properties of events (as in the upper VP) is interpreted following an intersective schema like the one in (32.c). This gives rise to a new property of events, namely (32b.ii), which then is operated on by the applicative head associated with the subject in the usual way and results in (32b.iii). I've tried to stick as closely as possible to textbook ways of interpreting structures of this sorts.

It should be clear that by suitably lifting all the predicates from <e,t> to <e,T> via the operator that introduces DRs, and using modes of combinations parallel to those in (32) adjusted for type, we get the interpretation we want, namely (33b):

(33) a.



b.



i. $\exists e[[[EX(e)]^5(j) \wedge [[TH(e)]^1(his_5\ cat)(e) \wedge love(e)\ ] \wedge [against(e)]^4(its^1 will)]]]$

ii. $\exists e\ [\ [EX(e)]^5(j) \wedge [TH(e)]^1(his_5\ cat) \wedge love(e)\ \wedge [against(e)]^4(its_1 will)\ ]$

iii. Accessibility hierarchy: <5,1,2,4>

The tree in (33b.i) reflects how the various conjuncts (of type T) are put together (and is, thus, in its relevant features isomorphic to the syntactic tree in (33a)). While in DS coordination is not commutative, it *is*, however, associative. Hence the complicated internal bracketing can be ignored, and (33b.i) can be equivalently expressed as (33b.ii). The set of DRs introduced and their accessibility hierarchy are represented in (33b.iii). The pronoun *its* in the adjunct is in a position where the DR associated with the object of the main clause *is* accessible to it. Nothing changes if we switch to a quantified object as in (34a,b):

(34) a. John loves every cat against its will.

b. i. every cat_i[John υ^5 TH^1 loves t_i [against his_1 will]

ii. $\forall x_i[cat(x_i) \rightarrow \exists e[\ [EX(e)]^5(j) \wedge [TH(e)]^1(x_i) \wedge love(e)\ \wedge [against(e)]^4(its_1 will)]]$

iii. $\forall x_i[cat(x_i) \rightarrow \exists e[\ EX(e)(j) \wedge \exists x_1\ [x_i = x_1 \wedge TH(e)(x_i) \wedge love(e)\ \wedge$ $against(e)(x_1\text{'s will})]]]$

Here, the raised quantifier binds the only thing it can bind, namely its own trace. Such trace is equated in the formula $[TH(e)]^1(x_i)$ to the DR 1, introduced by TH. This DR is passed on and gets picked up by the pronoun embedded in the adjunct. Formula (34b.ii) is truth-conditionally equivalent to (34b.iii), which yields the right interpretation for (34a).

It is evident at this point that switching from Büring's β-operator to the thesis that lexical predicates introduce DRs (i.e., DPP) is not just a different way of putting his same idea. It brings along at least one conceptual difference and one empirical one. The conceptual difference is that my proposal derives the necessity of a dual system of indices from a dual semantics for dependencies at a distance (variable binding vs. DR activation). The empirical difference, which is a consequence of the conceptual one, is that we predict that an internal argument (i.e., a direct or indirect object) can antecede a pronoun in an adjunct, as a consequence of how accessibility plays out.

2.2.3. *Verbs as n-place relations*. The approach sketched above carries over to the polyadic view of verbs once we extend DR introduction to relations, as in (35):

(35) If R is of type $\langle e_1, \langle \ldots, e_n, t\rangle \ldots\rangle$, then:
$[R]^j = \lambda x_1, \ldots, \lambda x_n\ \lambda\omega\ \lambda\omega'[\ \omega =^{j/x1} \omega' \wedge R(x_1)\ldots(x_n)]$

Through successive uses of the generalized operator in (35),[27] DRs will be introduced in the order in which the arguments are fed into the predicate, with DRs introduced 'higher up' accessible to (anaphors contained in) the 'lower' ones. In a way, this mechanism captures directly Büring's (and, e.g., Jacobson's) insight that anaphora is governed by argument structure. There is one important caveat, however. We still crucially need the event argument, for that is what explains the phenomenon of binding into adjuncts, given Parsons'approach to event modification. The question arises, then, of where this event argument should be introduced. Is it the first argument of the verb, as in (36a), or is it the last, as in (36b)?

(36) a. $\text{love}_{\langle ev, \langle e, et\rangle\rangle} \Rightarrow \lambda e\ \lambda x \lambda y\ [EX(e)(y) \wedge TH(e)(x) \wedge \text{love}(e)]$ = (25c)
b. $\text{love}_{\langle e, \langle e, \langle ev,t\rangle\rangle\rangle} \Rightarrow \lambda x \lambda y \lambda e\ [EX(e)(y) \wedge TH(e)(x) \wedge \text{love}(e)]$

Parson's approach to event modification works equally well if we assume that the event argument is introduced *last,* as in (36b). But then the event argument ends up introducing a referent accessible to the other arguments. This may let in crossover violations through the back door, by way of the e-type approach to pronouns, as informally indicated in (37):

(37) a. His father loves a boy.
b. There is an eventuality e and a boy u such that e is is a love-eventuality and **the father of the experiencer of e** loves u.

The argument associated with the object, namely u, does not directly bind the pronoun in subject position. The binding is achieved indirectly, however, via the description in (37b). It is worth noticing that a similar problem arises on any situation-based approach: if propositions are sets of situations, what is to prevent us from accessing arguments of the verbs, for purposes of anaphora, via the situations themselves, given that that is how indirect anaphora works anyways in situation-based theories? On the monadic, non-

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[27] Strictly speaking, the DR-introducing operator ought to be generalized also to types that end in T of the form $\langle e_1, \langle \ldots, e_n, T\rangle \ldots\rangle$, for after the first application of $[\ldots]^n$, that is the type we get. I leave that as an exercise for the reader.

situation-based approach to the semantics of verbs, this issue does not arise. DRs are introduced at the predicate level, so the DR for the event argument must be introduced at the innermost clause nucleus, before any other argument. In a sense, it seems to me that the present discussion provides a (further) argument that the monadic predicate approach is the right basis for event semantics.[28]

In conclusion, switching DR introduction from arguments (i.e. individuals and generalized quantifiers) to lexical (for the time being) predicates does lead to a non-trivial restatement of the anaphora question. Now it is time to point out why this change of perspective is independently necessary. There are cases entirely unrelated to WCO where it can be shown that DR introduction *has* to take place in the predicate. They have to do with phenomena associated with what in Chierchia (1998) I called 'Derived Kind Predication' (DKP).

2.3. Further evidence for predicate-level DR introduction: From DKP to DPP.

Bare Plurals (BPs) are known to show noun-like behavior: [29]

(38) a. i. Dinosaurs are extinct.
ii. * A dinosaur is extinct.
b. ii. Anteaters are so called because they eat ants.
iii. ??An anteater is so called because it eats ants.

The paradigm in (38) follows if we assume that BPs are just names of kinds (to be regarded as things of type e) and that the *so-called* construction only works with noun-like (referential) constituents. However, BPs also display quantificational force in ways that broadly speaking vary with the aspect (generic vs. episodic) of their environment:

(39) a. i. Raccoons are systematically chased away. $\forall$
ii. Raccoons were chased away yesterday. $\exists$

Let us focus in what follows on episodic contexts, so as to avoid the complexities of generics. The sentences in (40a) systematically differ in interpretation from those in (40b):

(40) a. i. A raccoon was not chased away yesterday. $\exists \neg$
ii. Some raccoons were not chased away yesterday. $\exists \neg$
iii. A raccoon was chased away repeatedly yesterday. $\exists$ ADV
b. i. Raccoons were not chased away yesterday. $\neg \exists$
ii. Raccoons were chased away repeatedly yesterday. ADV $\exists$

The sentences in (40a) all display a quantified subject and either negation or a Q(uantificational)-adverb; in (40a), the subject apparently *must* take wide scope with

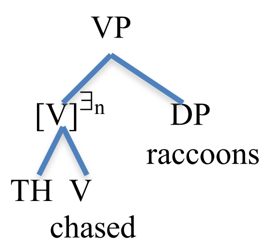
[28] This subsection was prompted by remarks due to Patrick Eliot. I am grateful to him for making me clarify these points.
[29] Cf. Carlson (1977), Chierchia (1998), Dayal (2004), Krifka et al. (1995), a.o.

respect to them, while in (40b), the existential force of the bare plurals has to be construed with narrow scope with respect to both negation and the Q-adverb. The very same paradigm holds with respects to objects:

(41) a. i. I didn't chase away a raccoon/some raccoon yesterday. $\exists \neg$
ii. I chased away a raccoon/some raccoons repeatedly yesterday. $\exists$ ADV
b. i. I didn't chase away raccoons yesterday. $\neg \exists$
ii. I chased away raccoons repeatedly yesterday. ADV $\exists$

In the sentences in (41a) both negation and the Q-adverb unambiguously have *narrow* scope with respect to the object. For the sentences in (41b) the opposite is the case. These systematic contrasts would make no sense if bare plurals had the option of being interpreted as ordinary quantified DPs. We would expect no contrast at all if that were the case. Notice how robust the facts are: there is simply no way of interpreting *a raccoon* in (41a.ii) under the scope of *repeatedly*, just as there is no way of interpreting *raccoons* in (41b.ii) as having wide scope relative to *repeatedly*. Thus the quantifier associated with *raccoons* in (41b.ii) seems to have an 'ultra-narrow' scope not shared by any overtly quantificational indefinites (including the weakest ones, like the determiner *a*). This phenomenon, known since Carlson (1977) as *differentiated scope*, has led to the conclusion that whatever quantificational force bare plurals may acquire *must* come from the predicate, at the point when it combines with its argument (let us call this point the 'first merge' site). Let me spell this out.

(42) a.



b. i. λe. **TH(e)(raccoons)** $\wedge$ chase(e)
ii. λe. **$\exists x_n$ [$x_n \leq$ raccoons $\wedge$ TH(e)(x_n)** $\wedge$ chase(e)]
iii. λe. [TH(e)]$^{\exists n}$(raccoons) $\wedge$ chase(e)]
iv. [TH(e)]$^{\exists n}$ = λy . $\exists x_n$ [$x_n \leq$ y $\wedge$ TH(e)(x_n)]

When we merge the V with the object, what the standard interpretation procedure affords us is (42b.i), where the whole raccoon-kind is the theme of a (particular) chasing event e. The way we actually interpret this, however, is as in (42b.ii), where the chasing event involves some instances of the raccoon-kind. Thus, there must be some operation on the predicate that introduces instances of the argument, as in (42b.iii-iv), for example. Whenever this operation is in place, Q-adverbs, negation, etc. will have to take scope over it. Moreover, quantified DPs have to undergo scope assignment to some higher site, yielding the observed wide scope construal. This reasoning readily explains the contrasts in (40)-(41) while retaining a uniform analysis of bare plurals as kind denoting.

It is important to note that the operation of 'introduction of instances' laid out in (42) must be prevented from applying at scope sites. To see this, consider (41b.ii) again, repeated below as (43a). Imagine assigning scope to the object as in (43b) and applying the instantiation operation as in (43c):

(43) a. I chased away raccoons repeatedly yesterday.
b. raccoons$_i$ [I chased away t$_i$ repeatedly yesterday]
c. raccoons$_i$ [I chased away t$_i$ repeatedly yesterday]$^{\exists n}$

The interpretation of (43c) would be 'There are raccoons x such that I chased away x repeatedly yesterday'—which is wrong. But if DPs *never* 'introduce instances', as we have claimed in Section 1.1, neither on their own nor when scoped out, then the construal in (43c) will not be available.

It should be clear at this point that the operation of 'instance introduction' necessary to make sense of the scope behavior of bare plurals is virtually identical to the DR-introduction rule discussed in Section 2.1, modulo the fact that we are dealing with kinds. In my discussion of kind reference in Chierchia (1998), I present the operation of 'kind-instantiation' as a local 'sort adjustment' operation, which becomes necessary when we want to say something about kinds ('Derived Kind Predication'; DKP). Obviously, it is preferable to maintain, as I do here, that there is a fully general mechanism of instance introduction freely available on predicates (but not at scope sites). If the argument of a predicate is a singular individual, then its instance can only be itself; if the argument is a kind, individual instances of it will be introduced.

The way in which 'instance introduction' works with bare plurals has been motivated so far purely on the basis of scope considerations. But it clearly has consequences for anaphora. The instances introduced at the predicate level (i.e. the activated DRs) should be able to provide antecedents to anaphors and pronouns occurring in accessible positions (both within and outside of the C-command domain of the predicate, modulo accessibility). This is indeed so.

(44) a. I walked out and saw raccoons that were chasing their own tails.
b. I walked out and saw raccoons in my garden. I got a gun and shot them all.

Notice that, e.g., (44a) does not mean 'Raccoons were chasing raccoons' tails'. It means that each raccoon was after its very tail. Similarly, (44b) says that I shot the instances of the raccoon-kind I saw pillaging my garden. This signifies that we cannot get by just with reference to kinds (i.e. with something like (42b.i)), without instance introduction at the appropriate level.

The behavior of bare plurals, while having nothing to do *per se* with WCO, introduces evidence of the strongest kind in favor of, essentially, the very same idea we have proposed in connection with WCO and anaphora in general: DRs are introduced at the predicate level, not at scope sites, i.e. the effects of DKP are subsumed by DPP.[30]

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[30] The subsumption of DKP by DPP can be formalized by modifying DR introduction (cf. (18) above) as follows:

(a) $[P_{<e,t>}]^n = \lambda u[\ \lambda\omega\lambda\omega'.\ \exists u'[u' \leq u \wedge \omega =^{n/u'} \omega' \wedge P(u')]$

Where if u and u' range over ordinary individuals then $u' \leq u$ holds iff u' = u; if u' is an ordinary individual and u a kind, then $u' \leq u$ hold iff u' is an instance of the kind u.

2.4. Interim summary and the road ahead

We have adopted a standard DS and twisted it according to the following mapping hypothesis:

(45) DPP.
  a. DPs never introduce DRs, neither inherently nor at their scope sites.
  b. DRs are introduced as an operation on predicates.

This seems to afford a variant of Büring's situation-based approach in which his 'double indexing' is derived from a semantic distinction between simple variable binding and DR introduction/transmission. The approach we have outlined provides essentially the same treatment as Büring's for basic WCO facts, but goes beyond it in that it extends to binding into adjuncts. So far, we have dealt with DR introduction at the level of basic predicates (basic verbs and their theta roles). But this is not going to be enough. DRs also have to be introduced at the level of some derived predicates, and we will want to see how and when that happens. We also need to probe further how DS is affected by DPP. For example, we haven't yet discussed the staples of donkey anaphora, namely conditionals and relative clauses. To these issues we now turn.

3. Broader issues in DS

In this section we will explore how DPP plays out in the broader scheme of things dynamic. We will start out with generalized quantifiers (GQs), then move on to relative clauses and E-type pronouns, and conclude with a glance at conditionals and generics. Readers who are already inclined to believe that some version of DS tailored to these traditional topics can be made to work compatibly with the perspective we are adopting should feel free to skip this section and move on to the newer linguistic consequences of DPP in Section 4.

3.1. The non-dynamic character of quantificational DPs

The claim that quantificational DPs do not introduce/transmit DRs means essentially that they should be interpreted in the traditional way as relations between sets. Predicates in a dynamic setting are in general interpreted as functions from individuals into CCPs; so some type adjustment, be it of the simplest kind, will be called for in analyzing determiners. We will first deal with GQs in general; then we will discuss indefinite DPs (*a man*, *two horses*, etc.) more in particular, as they have a broader range of options than non-indefinite, quantificational DPs (*every man*, *no horse*, etc.).

The standard move in a dynamic setting is to treat GQs as 'tests', i.e. a way of probing the input for certain properties which, if matched, allow for the input to be passed along unchanged. This is illustrated in (46) for a basic quantificational sentence.

(46) a. No donkey smokes.
  b. i. $[\text{donkey}]^2 = \lambda u\ \lambda\omega\lambda\omega'.\ \omega =^{2/u} \omega' \wedge \text{donkey}(u)$

ii. $[\text{smokes}]^5 = \lambda u \lambda \omega \lambda \omega'.\ \omega =^{5/u} \omega' \wedge \text{donkey}_{<e,t>}(u)$

c. no $([\text{donkey}]^2)([\text{smokes}]^5) =_{df}$

$\lambda \omega\ \lambda \omega'.\ \omega = \omega' \wedge \{u: \downarrow_\omega \text{donkey}_{<e,T>}(u)\} \cap \{u: \downarrow_\omega \text{smoke}_{<e,T>}(u)\} = \varnothing$

The DRs in the restriction and scope of *no* in (46b) are chosen randomly. Also, I am ignoring the event argument, to simplify the exposition. Basically, what goes on in (46c) is that we look at the extension of restriction and scope using the ↓-operator, check whether the current state of the world verifies the relevant relation among them, and if so proceed on to the next state. This approach generalizes to all determiner meanings. For any determiner meaning D of type <<e,t><<e,t>,t>>, we can define the corresponding test D' in a general way:

(47) $D'(P_{<e,T>})(Q_{<e,T>}) = \lambda \omega\ \lambda \omega'.\ \omega = \omega' \wedge D\ (\lambda u.\ \downarrow_\omega P(u))(\lambda u. \downarrow_\omega Q(u))$

Note that use of the ↓ operator effectively wipes out access to all DRs that may be active in the restriction or in the scope of D. It also prevents dynamic transfer of antecedents from the restriction to the scope. In other words, quantificational determiners are taken to be both externally and internally static.

Indefinite determiners have a broader range of options. They can take scope non-locally and are externally dynamic (i.e., accessible to subsequent discourse). For the non-local character of their scope, I favor the approach in Reinhart (1996) and Winter (1997), according to which indefinites are associated with choice functions, subject to (possibly non-local) ∃-closure. One question that comes up in this connection is whether the operation of existential closure of a choice function activates a DR or not.[31] The answer is unclear to me. Saying that it does implies that long-distance indefinites may obviate crossover, for the DR introduced at the site of the closure will be able to act as antecedent to pronouns in domains accessible to it. Now, indefinites generally display crossover phenomena. But so-called specific ones show a significant improvement:

(48) a. * His_i father hates a boy_i.
b. His_i father hates $[\text{a boy I know}]_i$ /$[\text{a friend of mine}]_i$ /$[\text{a certain boy}]_i$.
c. His_i father hates John_i.

Sentences like (48b) are significantly better than sentences like (48a); they pattern with sentences containing definites, like (48c). So perhaps the deviance of (48a) is due to the fact that *a boy* is treated like a regular quantifier; and the improved character of (48b) is due to the fact that the indefinites in it are construed as existentially closed choice functions, where a DR is introduced at the site of the closure. While this looks like a good angle, it also leads to a series of questions which, though frequently discussed, are still poorly understood. The choice function reading is clearly not readily available in (48a) (for otherwise that DR would be able to provide an antecedent to the subject). Thus, the

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[31] Notice that a yes-answer is perfectly compatible with the motto that DPs as such never introduce a DR: existential closure is designed to take place at a distance from where the DP meaning is interpreted.

choice function reading (or at least the DR introduction associated with it) must be somehow triggered or motivated by appropriate discourse conditions, having to do with making the indefinite more prominent and hence more specific, and/or linking it to something the speaker has in mind (as *a certain* seems to suggest). Clearly, more research is needed in this connection. For the time being, I will assume that the existential closure of choice functions may lead to the introduction of DRs, if the relevant discourse conditions are met.

Introducing DRs for long-distance indefinites is one way of making them accessible to subsequent discourse. A complementary way to go is generalizing to (non-long-distance) indefinites the approach developed in connection with bare plurals. We have assumed than when a kind-denoting term combines with a predicate, the operation of DR introduction is allowed to look at instances of the kind, so that *Dogs are barking* winds up meaning something like 'Instances of the dog-kind are barking'. Now, indefinites are known to have predicative uses, in which they must be property denoting::

(49) a. John is a $[\text{linguist}]^2$.
b. Those are two $[\text{friends of mine}]^3$.
c. I consider him a $[\text{good colleague}]^1$.

It is easy to extend to properties our treatment of kind predication. For any theta role θ and event e, we know what $[\theta(e)]^n(u)$ means, when u is of type e (cf. (18) in Section 2). We can generalize $[\theta(e)]^n$ to the case of predicative DPs occurring in argument positions as follows:

(50) For any thematic role θ, any eventuality e, and any (dynamic) property α,
a. $[\theta(e)]^n (\alpha) = \exists u\, [\alpha(u) \wedge [\theta(e)]^n(u)]$
Example:
b. A dog walked in $\Rightarrow \exists e\, [\ [TH(e)]^2([dog]^3) \wedge [walk\ in]^1(e)\ ]$
c. $\exists e\, \exists u[\ [dog]^3(u) \wedge [TH(e)]^2(u)]\ \wedge [walk\ in]^1(e)\ ]$ by (50a)

In a way, an approach that relies solely on choice functions is more appealing, as it falls back on an independently needed device. However, given the not well understood character of the discourse conditioning on choice function indefinites, we may want to keep other options open.

The bottom-line is that non-indefinite quantificational DPs work just as on the classic theory of GQs. And in a way, the treatment of indefinites is also fairly traditional; they are composed into their argument positions in a way that keeps their DRs accessible. Choice-functional construals of indefinites are subject to discourse conditionings that are yet to be fully understood and may obviate crossover.

3.2. Relative clauses and E-type pronouns

A consequence of the view that DPs never introduce DRs is that relative clause anaphora must be indirect (exactly as in Büring 2004). We should check two issues in this connection. The first is whether there is an empirically adequate and principled, situation-free approach to indirect, E-type pronouns. The second issue is whether such an approach avoids the issues of over-generation that threaten situation-based approaches. I will show that an adequate approach to indirect anaphora is within reach by modifying a proposal by Champollion et al. (2018).

As is well known, donkey pronouns display a range of readings (from ∀ to ∃) with a systematic pattern of preference, which in the small sample of familiar quantifiers in (51) can be roughly summarized as follows:[32]

(51) a. *Every*: ∀ > ∃
- i. Every man that has a donkey beats it. ∀
  = Every man that has a donkey beats all the donkeys he owns.
- ii. Every man who had a dime put it in the meter. ∃
  = Every man who has a dime puts one dime he owns in the meter.

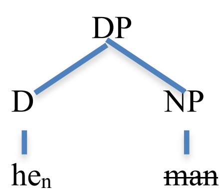
b. *No*: ∃ > ∀
- i. No one with a teenage son lends him the car on weekdays. ∃
- ii. No one who has an umbrella leaves it home on a rainy day. ∀

c. Some/a: ∃ > ∀
- i. A friend who had a car lent it to me. ∃
- ii. A friend who had a car refused to lend it to me. ∀

We won't be able to get to the bottom of this pattern within the limits of this paper. All I want to do is give a plausibility argument: Drawing only on well-supported proposals from the existing literature, we can assemble a principled, situation-free theory of indirect pronominal dependencies for the paradigm in (51).

For the syntax of pronouns, we are going to adopt an ellipsis-based analysis along the lines of Elbourne (1995), a.o.

(52) a.



b. A man [walked in]^3. He$_3$ ~~man~~ was tall.

Pronouns are viewed as determiners with an anaphoric index (*n* in (52a)). Their sister node is elided under identity with some NP present in the structure. A structure like (52a) is going to be interpreted as a function from a DR with index n, ω_n, into a member of the set of men, which I am going to denote as $f_{man}(\omega_n)$.[33] But which function? That depends.

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[32] Cf. Kanazawa (1994), Chierchia (1995a), Geurts (2002), Champollion et al. (2018), among many others.

[33] Technically, these are 'Skolemized' choice functions. Recall, moreover, that in the 'official' framework of Section 2.2, pronouns are of type <ω,e>. That is to say, the denotation of the pronoun in (45) actually is:

(i) he$_n$ ~~man~~ $\Rightarrow \lambda\omega.\ f_{man}(\omega_n)$

There are two main cases. The first is when the NP that triggers the elision is linked to a DR accessible to the pronoun, as in (52b) or in (53a) below:

(53) a. i. Everyone fed his cat.
ii. everyone$_i$ [t_i υ^3 fed [he$_3$ ~~one~~ 's cat]]   Rough LF
b. i. $f_{one}(\omega_n) = \omega_n$, if $\omega_n \in$ person   Abbreviated as ID_{one}
ii. $\forall x\ [person(x) \rightarrow \exists e[\ [AG(e)]^3(x) \wedge [TH(e)](ID_{one}(\omega_3)\text{'s cat}) \wedge fed(e)]$
$= \quad \forall x\ [person(x) \rightarrow fed\ (x\text{'s cat})(x)$

In such a case, the function f_{one} is just interpreted as a restricted identity map, following Elbourne. Where I depart from him is in the second case, i.e. when the NP that triggers the ellipsis is *not* accessible to the pronoun, as in (47a):

(54) a. [Everyone$_i$ who has a cat]$_i$ t_i υ^3 fed it$_3$ ~~cat~~
b. i. $\forall x\ [person\text{-}etc.(x) \rightarrow \exists e[\ [AG(e)]^3(x) \wedge [TH(e)](\ f_{cat}(\omega_3)\text{'s cat}) \wedge fed(e)]$
ii. $f_{cat}(x) = a$, where a is the/one of the cats x owns

In such a case, f_{cat} is construed as a variable ranging over some/any contextually salient function from individuals into the appropriate range (namely, cats), along the lines indicated in (54b).[34]

What does this leave us with regarding uniqueness presuppositions? Suppose that everyone has just one cat; then there is just one function f_{cat} around that fits the bill, and the interpretation of sentences like (47a) is straightforward. This may be the reason why speakers seem to have their strongest intuitions about donkey sentences in the presence of uniqueness presuppositions. If, on the other hand, we are in a context where the possibility of owning more than a cat is countenanced, then there will be more than one function, namely f_{cat}, f'_{cat}, … , that have to be considered. The natural move in this connection is to regard (53a) as true if the sentence can be satisfied by any way of selecting functions of the relevant type (in the spirit of supervaluation theory). This is tantamount to the following interpretations:

(55) a. $(\forall f_{cat})\ \forall x\ [person(x) \rightarrow fed\ (\ f_{cat}(x))(x)$
b. $(\forall f_{son})$ [No one with a teenage son]$_i$ [t_i υ^3 lends $f_{son}\ (\omega_3)$ the car on weekdays][35]

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[34] A common feature of ellipsis-based approaches like Elbourne's is that they are designed to rule out sentences like (i):
(i) * Every cat owner fed it.
(ii) [Every cat owner]$_i$ t_i fed [it$_i$ ~~NP~~]
While sentence (i) arguably brings to salience a function from people to cats, there is no NP around to trigger a proper ellipsis. Constituents of N-N compounds like [$_N$ cat$_N$ owner$_N$] cannot license NP elision. Only the whole compound *cat owner* projects as an NP. But then the entire complex would have to be interpreted as the identity function, Principle B of the Binding Theory would kick in, and the sentence would be ruled out.
[35] The parentheses in (55) are a reminder that the universal quantification over choice functions is not part of the actual logical form of the relevant sentence, but rather part of its evaluation (as on supervaluation theory), very roughly along the following lines:

So for quantificational determiners like *no* or *every* we are getting the preferred truth conditions. Secondary interpretations arise, presumably, via domain restriction. Rather than considering all possible choice functions, we limit ourselves to some subdomain—whatever suffices to address the 'Question under Discussion'. If the issue is avoiding tickets when parking, we will restrict the domain of dimes to those sufficient to feed the parking meter, etc. This is all rather sketchy, but not so different from what happens on any available alternatives.

For indefinites, we have more options. Since indefinites leave DRs in their restriction accessible, the donkey pronoun can be bound directly. So for a sentence like (56a), besides the indirect strategy, which yields a default ∀-reading as in (56b), we also get the interpretation (56c):

(56) a. A friend with a car lent it to me
b. $(\forall f_{car})$ [A friend with a car]$_i$ t_i υ^3 lent $f_{car}(\omega_3)$ to me]
c. $\exists u[\text{friend with [a car]}^3]^1(u) \wedge \text{lent}(\text{it}_3\ \text{~~car~~})(\text{me})(u)]$

The subject in (56a) contains two active DRs, one associated with *a friend*, the other with *a car*, and both are accessible to the pronoun *it*. The result is an ∃-reading. The reason why this reading turns out to be the preferred one for indefinites is likely to be the fact that direct binding is simpler than indirect binding (it requires no appeal to the context, to supervaluations, etc.).

The present proposal extends to the other cases of non-C-command binding mentioned in Section 1, like inverse linking and possessor binding. We illustrate this for inverse linking, referring to Büring's work for further details:

(57) a. The mayor of no city despises it/its population.
b. no city$_i$ [[the mayor of t_i] υ^3 despises $f_{city}(\omega_3)$]
where, for any u, $f_{city}(u)$ = the city of which u is mayor.
c. i. $\text{No}([\text{city}])\ (\lambda u_i \exists e[\text{AG}(e)]^3((u_i\text{'s mayor}) \wedge [\text{TH}(e)]^1(f_{city}(\omega_3)) \wedge \text{despise}(e)]$
ii. $\neg\exists u_i \exists e[\text{city}(u_i) \wedge \text{AG}(e)(u_i\text{'mayor}) \wedge \text{TH}(e)(f_{city}(u_i\text{'s mayor}) \wedge \text{despise}(e)]$
$= \neg\exists y \exists e \exists x\ [\text{city}(y) \wedge \text{mayor}(y)(x) \wedge \text{AG}(e)(x) \wedge \text{TH}(e)(y) \wedge \text{despise}(e)]$

For the sake of simplicity, I am assuming here that the quantifier *no city* can be scoped out of the DP that hosts it (alternative assumptions would not affect pronoun binding).[36] The schematic logical form of (57a) is given in (57b), where the subject *the mayor of t_i* is linked to the third DR, activated by υ; this DR is accessible to the (indirect) pronoun in object position, which results in the interpretation given in (57c.i.), with the truth conditions in (57c.ii).

(i) A formula ψ(f), where f occurs free in ψ, is true in a world w iff for any appropriate, salient assignment function g, such that g(f) is defined, ψ(f) is true in w relative to g.

[36] For a more adequate treatment of these cases in terms of DP adjunction, cf. Rooth (1985: 112ff) or Heim and Kratzer 1998: 230ff).

The present approach to indirect, E-type pronouns does what it is supposed to do. It constitutes an existence proof for a situation-free take that predicts the distribution of preferred readings of donkey pronouns in relative clauses. Note here that it is not immediately obvious how the distribution of preferences in (51) can be derived from a situation-theoretic account. The latter could certainly accommodate the readings with determiners like *no* or *every*, by appealing to something like the 'strongest meaning hypothesis'. But the strongest meaning hypothesis would predict preference for the ∀-reading with indefinites as well, which is clearly wrong. By contrast, the present account relies crucially on DR introduction and accessibility to account for indefinites; these are notions that have no status in a situation-based approach.

It is also important to underscore that when crossover phenomena come into consideration, the present approach stands at no risk of over-generation, unlike a situation-based one. Compare standard WCO cases with donkey crossover ones.

(58) a. His cat loves everybody.
b. everybody_i [his cat loves t_i]
c. Every minimal situation s with someone in it is part of a situation s' in which *the cat of the person in s* loves s.
d. everybody_i [his cat υ^3 TH^1 loves^2 t_i]
e. i. everybody_i [$f(\omega_4)$'s cat υ^3 TH^1 loves^2 t_i] no antecedent for ω_4
ii. everybody_i [$f(\omega_2)$'s cat υ^3 TH^1 loves^2 t_i] presupposition clash
f. i. * Its_j strength impresses every farmer who owns a donkey_j.
ii. [every farmer who owns a $\text{donkey}]_j$ [$f(\omega_2)$'s strength υ^3 TH^1 impresses^2 t_i]

When quantificational objects are raised, as in (58a,b), a situation-based approach potentially leads to the (undesired) reading in (58c). The present approach relies in these cases on structures like (58d), where the E-type pronoun needs an antecedent but finds no active DR accessible to it. And if we pick any DR activated below the subject, as in (58e.ii), we get a presupposition clash.[37] Obviously, this line of explanation extends to donkey crossover cases, for the object DP in (58f.i), scoped out in (58f.ii), doesn't activate or transmit an active DR to its scope any more than the one in (58a) does.

In conclusion: our hypothesis for DR introduction not only is compatible with, but in fact *requires* a theory of indirect pronouns for DPs with relative clauses. We have sketched one above; readers should feel free to replace it with any other of their liking, provided that their version accomplishes the two key things that the present one accomplishes, namely (i) to account for the distribution of ∀/∃-preferences for donkey pronouns within DPs and (ii) to prevent crossover from resurfacing through the back door of indirect pronominal dependencies.

3.3. A glimpse into conditionals and generics

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[37] The pronoun requires that the input assignment to the whole clause be defined on its second coordinate; but the operation of DR introduction associated with the V head requires that the input assignment be *not* defined over that coordinate, because of 'novelty'.

Once again, the goal of this section is not to give a full-blown account of these much debated topics, but more modestly to orient the reader towards strategies in handling them which are compatible with the proposed, non-standard mapping from DS into syntax. In the area of conditionals there are fewer surprises than in the treatment of relative clauses (where we abandoned the predominant idea that there is dynamic transfer of DRs in generalized quantifiers). When it comes to conditionals, pretty much any of the standard DS approaches will do, for all that matters here. I will illustrate this claim by sketching—and updating bit—the (controversial) line of inquiry developed in Chierchia (1995a,b), in the spirit of the motto "If you are going to follow someone's prejudices, you might as well follow your own." But that is by no means the only way to go.

A conditional sentence like, say, (59a) will generally have a semantic structure of the form in (59b), where the possibly null Q-adverb is a binary operator on the *if*-clause, which forms its restriction, and on the main clause, which constitutes its scope:

(59) a. If a bishop meets a bishop, he always/often/never blesses him.
b. Q-ADV (a bishop meets a bishop)(he blesses him)

In any version of DS, the antecedent of a conditional like (59a) is going to contain two active DRs, corresponding to the subject and the object DPs. In traditional DS, this activation is done by the indefinites themselves; in the present incarnation of DS, it is done by the predicate instead. But let us put that difference aside for the time being, and let us represent the two active DRs as numerical superscripts on the whole sentence, as in (60a). Now, the quantificational force of indefinite DPs associated with active DRs can be, as it were, 'renegotiated'. That is to say, such DPs can effectively be turned into variables and get bound over again. Dekker (1993) dubbed this operation 'Existential Disclosure' (ED). ED is informally sketched in (60b). Its formal definition in the framework of Section 2 (for the unary case) is given in (60c); a worked-out example can be found in the Appendix.

(60) a. [a bishop meets a bishop] $^{<2,1>}$
b. $D_{2,1}$ ([a bishop meets a bishop] $^{<2,1>}$ =
= $\lambda u \lambda u'$ [[a bishop meets a bishop] $^{<2,1>} \wedge \omega_2 = u \wedge \omega_1 = u'$]
= $\lambda u \lambda u'$ [bishop(u) $\wedge$ bishop(u') $\wedge$ u meets u'] $^{<2/u,1/u'>}$
c. For any $[\phi]^n$ of type T, with active DR n: $D_n([\phi]^n) = \lambda u. [[\phi]^n \wedge \lambda\omega\lambda\omega'. \omega_n = u]$

Since active DRs reach into continuations, we can dynamically conjoin to (60a) an equation $\omega_n = u$, where u is an ordinary variable, and then abstract over u so as to 're-open' the sentence, as in (60b). Then we can use the Q-adverbs to quantify over the result in any way we want, as per the general schema in (61a), where ϕ is the *if*-clause (restriction) and ψ the main clause (scope):

(61) a. $Q(D_{n,m}(\phi))(D_{n,m}(\phi \wedge \psi))$
b. $\forall$ ($\lambda u \lambda u'$ [[bishop]^2(u) $\wedge$ [bishop]^1(u') $\wedge$ u meets u'] $^{<2/u,1/u'>}$) *1st arg*
($\lambda u \lambda u'$. [bishop(u) $\wedge$ bishop(u') $\wedge$ u meets u'] $^{<2/u,1/u'>} \wedge \omega_2$ blesses ω_1) *2nd arg*
c. Every pair <u,u'> such that both u and u' are bishops and u meets u' are also pairs such that both u and u' are bishops, u meets u', and u blesses u'.

Notice that the pronouns in the main clause (i.e. the scope) are *directly* dynamically bound (because of the use of conjunction in the second argument of Q in (61a)); no E-type/indirect binding is involved here. So, unlike D-quantifiers, ADV-quantifiers allow dynamic transfers from the restriction into the scope. We are ignoring modalization/quantification over worlds, but bringing it into the picture would be no more complex here than in any other framework. Ultimately, then, the idea is that Q-adverbs are *n*-ary quantifiers that can "disclose" active DRs in their restriction.

This illustrates how conditional donkey dependencies can be treated. The main alternative to approaches of this sort are situation-based ones. In particular, Elbourne (2010) develops an ingenious way of making situations fine grained enough so as to derive the same truth conditions as given in (61c), by resorting to a metaphysics of 'thin particulars'. A DS approach allows doing away with thin particulars, if one so wishes.

The disclosure-based approach just sketched gets indefinites to act as variables under Q-adverbs, and justifies talking of indefinites as being variable-like (Kamp 1981, Heim 1982)—a metaphor that carried a lot of weight in the 1980s, when the term 'unselective binding' was coined. However, it was soon discovered that while Q-adverbs can in fact prompt indefinites to act as variables, they do not necessarily act unselectively on all the indefinites in their restriction. For example, a sentence like (62a) can have either of the truth-conditionally distinct readings in (62b,c), depending on the context, on focus, etc.:

(62) a. If a painter lives in a village, it is usually pretty.
b. Most painters live in pretty villages.
c. Most villages in which painters live are pretty.

This entails that the Q-adverb is free to target ('disclose') any or all or just several of the DRs active in its restriction. The present account applied to conditionals and Q-adverbs makes this a free option for any Q-adverb. But there are alternative ways to achieve similar effects (see, e.g., Diesing 1992).

The main point of all this is that when it comes to conditionals, our approach, in spite of its non-standard stance on DR activation, is dynamic in a completely mainstream fashion, and it sides decidedly with DS on the treatment of bishop sentences, asymmetric readings, and the like.

Generics add further interesting facets to this general picture.[38] The GEN-operator is flexible (an *if/when*-clause may or may not be present) and polyadic (it allows material from the main clause to be incorporated into the restriction; see (63a)). Moreover, it allows (re-)introduction of DRs. Below is a brief and necessarily incomplete discussion of how GEN works.

As is well known, in the presence of a GEN-operator indefinites acquire a quasi-universal (highly modalized) force, depending on the context, the lexical meaning of the items involved, their presuppositional structure, etc. The following paradigm illustrates:[39]

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[38] In fact, the considerations that follow apply to all Q-adverbs. Cf. on this Chierchia (1995a,b).

[39] Interestingly, bare plurals in generic environments work in a wholly parallel way.

(63) a. A cowboy carries a gun (when he goes into a saloon). Subject: ∀; Object: ∃
'Every cowboy usually, typically, etc., carries a gun.'
b. A cat chases a mouse. Subject: ∀; Object: ∀
'For every cat and every mouse (the cat sees), the cat chases the mouse.'
c. A computer routes a modern plane.
'For every modern plane, a computer routes it.' Subject: ∃; Object: ∀

The basic line on this, developed in Krifka et al. (1995), a.o., is that the GEN operator, hosted in some Aspect projection, induces a splitting of the clause into a restriction and a scope, roughly along the following lines, for the sentences in (63):

(64) a. [a $cowboy_i$ GEN [$_{\upsilon P}$ t_i carries a gun]]
b. [a cat_i a $mouse_j$ GEN [$_{\upsilon P}$ t_i chases t_j]]
c. [a modern $plane_j$ GEN [$_{\upsilon P}$ a computer routes t_j]]

In the logical forms in (64), the restriction and the scope of GEN are identified structurally: GEN assigns universal force to the indefinites in its restriction (the Spec region of AspP, on the implementation in (64)), while indefinites in the scope (i.e. within the υP) retain their default existential force. DPs can enter into the restriction via standard syntactic operations, i.e. covert movement (or, in languages like German, overt movement, if Diesing 1992 is right), while subjects may be reconstructed back into their 'first merge' site. This structuring is basically free, modulo compatibility with presuppositions, the context, etc.

Interestingly, the restriction of GEN can be further modified by an *if*-clause, which can occur to the left or to the right of the main clause:

(65) a. If it is really hungry, a cat eats lizards.
b. A cat eats lizards, if it is really hungry.

This is a complex and interesting paradigm. Notice that (65a) looks, prima facie, like a case of WCO obviation. To see how the semantics associated with these logical forms can be cashed in, consider, for starters, an object generic like (66a):

(66) a. I love a good cup of coffee.
b. a good cup of $coffee_j$ $GEN^{3/j}$ [$_{\upsilon P}$ I love t_j]
c. i. Restriction: λx. good cup of coffee(x)
ii. Scope: λx. I love x
iii. (Rough) truth conditions:
GEN^j([$_{\upsilon P}$ I love t_j])(a good cup of coffee) =
$\forall_{GN}$(λx. good cup of coffee(x), λx. I love x])
where $\forall_{GN}$ is a modalized universal quantifier

The splitting algorithm outlined in (64) tells us that the logical form associated with (66a) must be something like (66b). In this situation, Gn takes two arguments: the υP (as scope) which contains the subject, and the dislocated object (as restriction). The standard Heim/Kratzer rule for interpreting dislocated DPs would not get us the intended meaning here, viz. (66c.iii). To get the reading we want, we need to abstract over the trace embedded in the scope and to (re-)introduce a DR associated with the object. I do that here by first copying the index of the raised object onto GEN (as a case of Spec-Head agreement, say). Then the index on GEN abstracts over the scope (i.e. the υP), creating the meaning in (66c.ii), while at the same time the indefinite is incorporated into the restriction with an associated DR (66a.iii). The reintroduction of a DR pays off when a right-adjoined *if*-clause is added:

(67) a. I like a good cup of coffee, if it is really hot.

b. a good cup of coffee$_j$ GEN$^{3/j}$ [$_{\upsilon P}$ I love t_j] [if it$_3$ is really hot]

c. GEN$^{3/j}$ ([$_{\upsilon P}$ I love t_j])([if it$_3$ is really hot])(a good cup of coffee)
$=_{df} \forall_{GN}[(\lambda x.[\text{good cup of coffee}]^3(x) \wedge \text{hot}(\text{it}_3), \lambda x_i \text{ I love } x_i)$

d. For any ϕ, ψ of type T, and any P of type<e,T>,
GEN$^{3/i}(\phi)(\psi)(P) =_{df} \forall_{GN}(\lambda x.[P]^3(x) \wedge \psi, \lambda i.\ \phi)$)

The right-adjoined *if*-clause must be incorporated into the restriction of GENin an LF of the form in (67b). In other words, GEN here takes three arguments, as indicated in (67c); and among other things, GEN introduces a new DR associated with *a cup of coffee* in a way that makes it accessible to the pronoun in the *if*-clause. This seems necessary because the DR introduced in the object position of *love* is not accessible to the *if*-clause, given that the latter is *not* an intersective modifier.

This line of analysis can be extended to preposed *if*-clauses with cataphoric pronouns, such as (68), by assuming they result from fronting, and by working out the semantics off the base position:

(68) If it is really hot, I love a good cup of coffee ~~[if it is really hot]~~

If this is correct, sentences like (68) are not real obviations of WCO, after all. The present approach also predicts, however, that sentences like (69a.i-ii) should be OK, while in fact they are degraded:

(69) a. i. ?? His department must support a good student.

ii. ? His department must support a good student when he is in trouble.

b. Un bravo studente, il suo dipartimento lo deve sostenere.
A good student, his department him must support

I don't know why (69a) is degraded. The addition of a right-adjoined *when*-clause improves things a bit. I also note that the Italian counterpart of (69a), namely (69b), which involves clitic left dislocation, is perfect, and this seems to constitute a genuine case of crossover obviation. We shall return to clitic left dislocation in Section 4.

The purpose of this quick excursion into the area of generics was to show further aspects of how the dynamics works, compatibly with our main thesis, particularly when material from the main clause gets to be integrated in the restriction of GEN or of a Q-adverb. The generic operator seems to drive the creation of complex derived predicates that lead to the activation of DRs.

3.4. Outcome

In conclusion, the panorama that emerges from this perusal of the landscape of classical dynamics should leave us optimistic. Basically, DPP ("Predicates introduce DR, DP-arguments don't") forces us to abandon the theory of dynamic generalized quantifiers. This entails that donkey dependencies involving relative clauses must be indirect (E-type); we have sketched a theory that enables us to get the various relevant readings, in a way that does not over-generate when it comes to WCO. For conditionals, generics, and like, on the other hand, one can plug in one's favorite theory. The architecture I've sketched for these constructions seems promising enough for us to pursue further our main thesis.

4. Further issues: when movement bleeds WCO

We have proposed that DR introduction is an optional, predicate-level operation. It links a predicate's argument to a newly activated DR. This operation enables anaphora by applying to lexical predicates, e.g. verbs and their thematic roles, given that DPs as such are anaphorically inert.

While this accounts for the basic cases of WCO, it does not entail by any means that DR introduction should be prevented from applying to derived predicates. So, given that movement creates derived predicates, one might well expect there to be cases of movement that bleed WCO. In Section 3.3, we have begun to explore this area in connection with the generic operator; in this section we explore two more such cases: A-movement (Section 4.1), and clitic left dislocation (CLLD) in Italian (Section 4.2), which constitutes a form of topicalization. This will give us a chance to also take a look at issues like 'weakest crossover' (Lasnik and Stowell 1991) and resumption, and at further interactions with the Binding Theory (BT). The general question in the background is whether there are certain common traits shared by all predicates that allow DR introduction.

4.1. The subject position

A-movement is known to bleed WCO.[40] To see what this entails from the present point of view we shall discuss the 'outermost' subject position, also known as the Extended Projection Principle (EPP) subject position. It is a familiar generalization that the EPP subject position is not necessarily thematic. The main evidence traditionally advanced for this view is the existence of expletives and raising verbs:

(70) a. It rains.
     b. It seems to John that every athlete is ready to compete.

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[40] The present section summarizes a line of argumentation developed more extensively in Chierchia (2017).

c. Every athlete$_i$ seems to his$_i$ coach [t_i to be ready to compete]

Verbs like *rain* or *seem* do not assign an 'external' theta role. *Rain* assigns perhaps no theta role at all, while *seem* assigns an 'experiencer' theta role (realized as an oblique argument marked by the preposition *to*) and a propositional one (realized in (70b) as a *that*-clause, and in (70c) as an infinitival clause). The absence of an external theta role for *seem* is confirmed by the possibility of raising the embedded subject, as in (70c). The subject *every athlete* in (70c) receives its theta role from the embedded predicate *ready to compete*, and it is then promoted to subject of the matrix clause, where it activates a DR. Thus, movement to the EPP subject position creates a (derived) predicate which allows DR activation. What this requires in the present framework is that the operation $[\ldots]^n$ of DR introduction be licensed at the level of the EPP head, say T(ense):

(71) a. every athlete$_i$ [$_{TP}$ t_i [T]^4 [seems to his$_4$ coach [t_i to be in good shape]]]
b. $= \lambda\phi\lambda u\ [\ \lambda\omega\lambda\omega'.\ \omega =^{4/u} \omega' \wedge \phi]$

T takes a propositional argument and returns something of type <e,T> that applies to the subject. It does whatever it is that T does to propositions, and adds a fresh DR linked to the subject (as per (71b)).

It is now time to take a step back and compare predicates that do and predicates that don't introduce DRs, to see what natural classes emerge. QR yields no semantic effects on the moved DP as such. Theta marking, by contrast, obviously does, i.e. it marks DPs as agents or themes in an event structure. What about EPP-movement ? Does it have semantic effects comparable to those of theta marking? Or is it more like QR? Rizzi (2005), Rizzi and Shlonsky (2007), a.o. argue that EPP movement does have semantic effects on the DP. They claim that the EPP position is associated with a semantic property they call 'aboutness'. Its empirical manifestation is illustrated by the following paradigm:

(72) a. Background question: What happened to John's truck?
b. John's truck hit a car.
c. i. ?? A car hit John's truck.
ii. A CAR hit John's truck.
d. i. * Una macchina ha urtato il camion di Gianni.
a car AUX hit the truck of Gianni
ii. * Una MACCHINA ha urtato il camion di Gianni.
a car AUX hit the truck of Gianni
iii. Una macchina lo ha urtato, (il camion di Gianni).
a car it AUX hit the truck of Gianni

Against a background like (72a), sentence (72b) is fine,[41] but (72c.i) is deviant, as is its Italian counterpart. In English, this deviance can be rescued by placing the nuclear stress on the subject. But in Italian, it cannot (cf. (72.d.ii)); cliticization of the object is

[41] This is expected on any theory of question/answer congruence, such as, e.g., Rooth (1992).

necessary, with optional right dislocation of the subject. This suggests, according to Rizzi, that the EPP position may come with a specific information structure requirement on the subject, having to do with the default presence of a background question like (72a). To spell this out remains difficult,[42] especially in view of cross-linguistic variation on this score, witnessed by the contrast between Italian and English. But the presence of specific conditions on information structure linked to the EPP position seems very real.

To sum up, the EPP position provides us with a clear instance of a derived predicate that introduces a DR, to be added to the case of Gn. In both instances, the heads that drive the movement impose specific requirements not only on their clausal sisters but also on the DPs they attract: an as of yet not fully understood information structure requirement for EPP subjects, and quantificational/modalization requirements in case of Gn. In this EPP movement differs clearly from QR. What emerges here is that the derived predicates that introduce DRs are those that share with the lexical ones the property of semantically 'affecting' their argument. Let us pursue this a bit further.

4.2. Topics

Lasnik and Stowell (1991) show that English Topicalization (ET) obviates WCO:

(73) This book$_i$ [I would expect its$_i$ author to disavow t$_i$]
but that book$_j$ [I wouldn't __]

ET is restricted to referential expressions, and therefore the dependency in (73) could in principle just be a case of coreference. However, Lasnik and Stowell observe that ET licenses sloppy readings in VP ellipsis, as (73) illustrates, which suggests that the pronoun-antecedent relation in (73) cannot be just a matter of coreference. The fact that ET may obviate WCO is not unexpected in light of the considerations presented in Section 4.1. Topic positions share features of information structure with prototypical (unfocused) subjects, to the extent that in some languages (like Mandarin and other so-called 'topic oriented' ones) it is hard to distinguish the two. It is therefore not surprising that a Top-head (null in English, but overt in many languages), as it attracts a DP to its Spec position, is endowed with a DR-introducing semantics, exactly like the EPP-subject head.[43]

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[42] As one of the referees points out, regardless of how we try to spell out Rizzi's 'aboutness' (cf. Chierchia 2017 for an attempt), it cannot entail that subjects cannot be focused, for they clearly can be.

[43] Lasnik and Stowell examine other cases of WCO obviation, involving 'tough'-movement and parasitic gaps, such as the following:

(i) Which employee did you talk to __ before his boss had a chance to brief __

A parasitic gap construction such as (i) is generally taken to involve an (abstraction) operator and a form of co-predication of the adjunct with the object of *talk to,* as schematically indicated in the following logical form:

(ii) Which employee$_i$ [did you talk to t$_i$ O^i [before his boss had a chance to brief t$_j$]]

While ET obviates WCO, Principle C effects are never obviated:

(74) * That man_i [TOP]^2 [he_2 would expect me to disavow t_i]
= 'That man is such that he would expect me to disavow him.'

In the present set-up, Principle C takes on the following form:

(75) (Modified) Principle C
a. A trace cannot be co-bound with a C-commanding pronoun.
b. A trace is co-bound with a pronoun in the following configuration:
[…DP_i $H^{n/i}$ …pro_n…t_i…] , where H^n C-commands pro_n and pro_n C-commands t_i

Like all BT-principles, Principle C is a syntactic constraint with semantic consequences; specifically, it blocks semantic co-variance of a trace with a C-commanding pronoun. In the formulation in (75), Principle C becomes a case of minimality or 'attract closest': H^n probes in its domain for its target (to be attracted to its Spec); pro_n is clearly a closer potential target than t_i, and hence the presence of pro_n blocks movement out of the t_i position.

This is perhaps the occasion to point out that on the present approach, 'canonical' Principle C violations, such as those in (76), are not actually ruled out by Principle C itself, but just pattern alongside other WCO violations:

(76) a. * He_i criticizes every new $author_i$'s book.
b. i. * [$Whose_i$ book]$_j$ does he_i criticize t_j?
ii. * Who_i does he_i believe that Mary will meet t_i?

What happens here is that the pronoun *he*$_i$ fails to have a clause-internal accessible antecedent. We'll try to make a case below that our re-formulation of Principle C has some advantages over the traditional versions.

The basic line on ET appears to be confirmed by clitic left dislocation (CLLD) in Italian,[44] a construction that shares key semantic properties with ET. Syntactically, CLLD involves dislocation of one or more constituents to the left periphery, with resumptive clitic pronouns (obligatory for arguments) in the base positions, subject to island effects:

(77) a. Francesco, io *(lo) amo __molto.
'Francesco, I him love a lot.'
b. * Francesco, Maria è uscita prima di incontrarlo.
'Francesco, Maria went out before meeting him.'

In our framework this obviation effect would follow simply from the fact that the object theta role of *talk to* introduces a DR accessible to the pronoun *his* embedded in the adjunct clause.

[44] See, e.g. Cinque (1977), Cecchetto and Chierchia (1999), Cecchetto (1999), and references therein.

Cecchetto (1999) and Cecchetto and Chierchia (1999), building on Torrego's (1994) approach to clitic doubling, argue that CLLD is the result of extracting a DP out of a 'Big DP' configuration, illustrated in (78a).

(78) a. [$_{DP}$ Francesco [$_{DP}$ lo]] 'Big DP'
b. Francesco$_i$ TOP^n [I [~~Francesco~~$_i$ him$_n$] love [~~Francesco him$_i$~~]]
c. [t$_i$ him$_n$] $\Rightarrow \lambda\omega: \omega_n = t_i \,.\, \omega_n$

(78b) shows how the syntactic derivation works. First the Big DP is moved preverbally to the canonical clitic position; then the DP is sub-extracted out it. The interpretation of the resumptive pronoun is given in (78c). Pronouns in a configuration like (78c) are interpreted as triggering a presupposition that their n-coordinate is linked to the value of their sister.[45] The TOP head will introduce a DR for n, in the same manner as its English counterpart and EPP-heads do. As expected on this analysis, CLLD obviates WCO but not Principle C:

(79) a. Uno studente così$_j$ TOP$_{3/j}$ [mi aspetterei che il suo$_j$ advisor lo$_3$ sosterrebbe __ ad oltranza]
'A student like that[I would expect that his advisor him would support__ strongly]'
b. * Un bravo studente$_j$ anche lui$_j$ crede che Gianni lo$_j$ aiuterebbe.
'A good student also he believes that Gianni him would help'
c. [A good student]$_j$ **TOP^3** also **he$_3$** believes that Gianni [t$_j$ **him$_3$**] would help

Sentence (79b) has a structure like (79c) on the analysis just sketched, and is ruled out by our version of Principle C, viz. (75).

So far, CLLD basically corroborates familiar generalizations about topics (and EPP subjects). An interesting additional twist comes from consideration of CLLD of oblique arguments (locative and dative PPs), which differs from CLLD of direct arguments in several ways. For example, the clitic double is optional with obliques (cf. (80a)), and scope reconstruction is only possible with direct arguments (cf. (80b)):

(80) a. In quel cassetto Leo (ci) mette ogni carta importante.
'In that drawer Leo (there) puts every important paper.'
b. i. Qualche compito di fonologia, Leo lo assegna ad ogni student. $\exists\forall$; $\forall\exists$
'Some phonology problem, Leo it assigns to every student.'
ii. In qualche cassetto, Leo ci tiene ogni carta importante. $\exists\forall$; $*\forall\exists$
'In some drawer, Leo there keeps every important paper.'
c. In palestra [ci+va T^n[Leo t $_{V+CL}$ [VP….]]

These and other related facts led Cecchetto (1999) to conclude that CLLD of PPs has a different syntax than CLLD of direct arguments, involving base generation of the PP in a TOP head in the left periphery; the TOP head, in this case, attracts the complex V+CL

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[45] For reasons of space I have to omit the semantic derivation, which is long but ultimately straightforward.

head, as shown in (80c). The details of the proposal do not matter here, but it is clear that a base generation hypothesis would immediately account for the absence of scope reconstruction (along with other differences, according to Cecchetto). What is interesting for us is that CLLDs of both DPs and of PPs display very strong ‘disjoint reference’ effects, typical of Principle C violations:

(81) a. * [Il padre di Gianni]$_i$ T^n [lui [t$_i$ lo$_n$] ama molto]
the father of Gianni he him loves much
b. * [A casa di Gianni]$_i$ T^k pro$_n$ ci$_k$ va volentieri.
to Gianni’s home he there goes willingly

In both (81a) and (81b) the pronouns in subject positions cannot corefer with the DP *Gianni* embedded within the DP or PP in Topic position.[46] When movement is involved, this is to be expected. But with base generation, it is not clear how the traditional Principle C would work.[47] On the present account, the only antecedent accessible to any pronoun in the main clauses in (81a,b) is the one linked to the whole DP or PP. The material embedded within the dislocated constituent (i.e. *Gianni*) is *not* accessible. Hence, in both cases the pronoun in subject position lacks an accessible antecedent.

In the present section we have explored a variety of predicates derived via movement that result in DR introduction: EPP movement, ET, and CLLD. The inventory is surely larger.[48] What do they have in common? Does our thesis that ‘affecting’ predicates (i.e., predicates that semantically affect their argument) introduce DRs hold up? A more detailed comparison between Topicalization-like movements, as just outlined, and wh-movement might help us address this question.

Like CLLD, wh-movement is driven (on a language-particular basis) by a designated head (the interrogative Comp). But the moved wh-item is not semantically affected otherwise. To clarify this contention, here is a sketch of the compositional steps in the interpretation of the question *who showed up?,* according to Karttunen’s (1977) classic approach.

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[46] The DP in Topic position in (74a) must associate with the object because the pronoun in subject position is not a clitic, and hence it cannot be used as a ‘double’.

[47] Cecchetto and Chierchia (1999) argue for CHAIN-binding, a technically complex solution that it would be nice to be able to avoid.

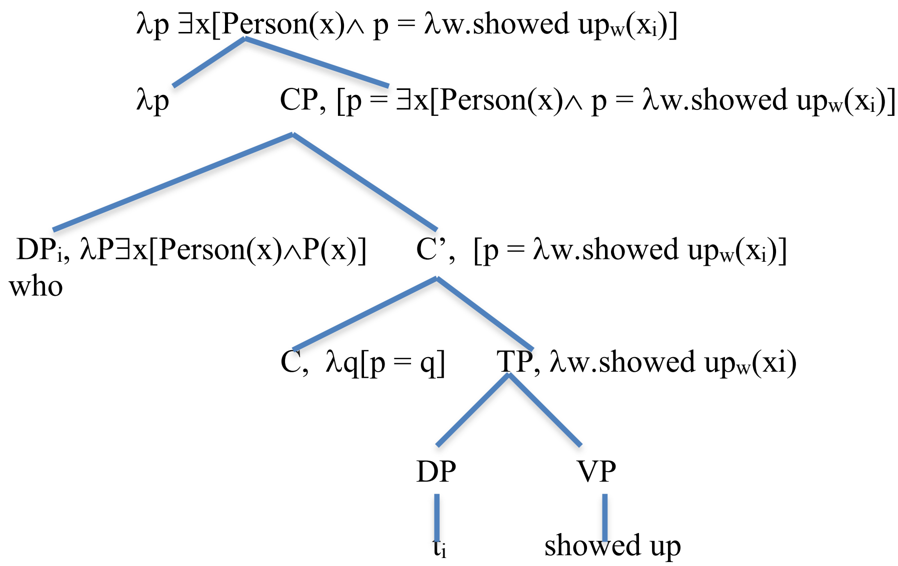
[48] I believe that the present line of analysis might also be useful in analyzing A- vs. A’-scrambling, much discussed in the literature. The following Russian example, from Baylin (2001), illustrates a case of A-scrambling which obviates WCO:

(i) ?? ee$_1$ sobaka nravitsja kazhdoj devochke$_1$
NOM-her dog appeals DAT-every girl
'Her dog appeals to every girl.'

(ii) kazhdoj devochke$_1$ nravitsja ee$_1$ sobaka
DAT-every girl appeals NOM-her dog

But it is impossible to pursue this within the limits of the present paper.

(82)



On this analysis, which of course exists in many variants,[49] the interrogative C transforms its TP sister by turning it into a question. The meaning of wh-words is that of ordinary quantificational indefinites. Wh-words are attracted to their scope site by C—overtly so in languages like English—and are simply quantified in. While the interrogative C affects the semantics of its clausal sister (by creating the core of the question meaning), the meaning of the wh-word as such is not affected by the movement.

So it seems that we can conclude that both QR and wh-movement share the property that the moved item is not affected in its meaning. Both kinds of movement are arguably ‘pure’ forms of scope assignment. This is not so for the kinds of movement that obviate WCO: they affect the moved DP. In generics, movement determines the quantificational force of indefinites and their modalization. Topics are only partially understood, but when a DP becomes a topic its meaning *is* affected: the topic must be selected from a set of familiar alternatives, a topicalized DP sets specific conditions on information structure that typically prevent quantificational DPs from being topicalized, etc. Something similar seems to be true even of the EPP position.

On this basis, we arrive at the following conjecture: Derived predicates that lead to the introduction of DRs share with lexical predicates a kind of ‘affecting/conditioning’ semantic quality. In both cases, the head with which a DP combines (directly via merge for theta-marking heads, indirectly via movement for non-theta-marking ones) affects or

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[49] Cf. Dayal (2016). The syntax-semantics mapping in (82) corresponds to what she calls the ‘baseline theory’ of questions.

conditions the meaning of the DP, and the introduction of DRs is part and parcel of that conditioning. Scope assigning movements do not share this property. In sum:

(83) *Affectedness as a condition on DR-introduction* (informal)
a. Derived predicates [DP_i ϕ] that do not semantically *affect* the dislocated DP do not introduce DR (i.e., are static).
b. Derived predicates that semantically condition the dislocated DP may introduce DRs (i.e., may be dynamic).

We have thus arrived at the formulation of a hypothesis, falsifiable in principle, on when derived predicates may introduce DRs: namely, when they share with lexical predicates a 'semantic affectedness' property. The challenge for future research will be to see whether semantic affectedness can be made formally explicit in useful ways. Along the way to the formulation of this hypothesis, we have discussed some consequences of the present approach for the Binding Theory and resumption.[50]

5. Comparisons and conclusions

It is time to take stock. We will do so by first briefly comparing the present approach with two other approaches that are as semantically explicit as the present attempt, namely, the situation-theoretic line explored by Büring (2004) and the continuation approach developed by Barker and Shan (2008). Then we will briefly summarize our results and point out a few future lines of inquiry that might build on them.

5.1. Situation-based approaches to anaphora

The comparison with Büring's (2004) proposal, a very lucid situation-based approach to WCO, has been implicit in much of our discussion above, since we have used his idea as inspiration. A brief review is in order, however, at this point. The basic architecture of Büring's proposal is simple. There are two systems of indices, one to deal with binding, the other to deal with scope. There is, however, no semantic difference between pronouns and traces which makes the whole approach rest, ultimately, on a puzzle. For non-C-command binding, Büring analyzes e.g. (84a) as (84b).

(84) a. i. Every man who has a donkey beats it.
ii. 'Every minimal situation s with a donkey-owning man is such that the man in s beats the donkey he owns in s.'

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[50] The main suggestion stemming from CLLD is that the resumptive clitics should be treated semantically as ordinary pronouns. But the phenomenology of resumption, like that of topic-hood, is very broad and diverse, and further work is needed to reach any conclusion. For example, Demirdache and Percus (2011) argue that resumption in Jordanian Arabic involves movement of the resumptive pronominal element; obviously this would require treating such resumptive elements differently from regular pronouns, regardless of whether the present take is on the right track or not.

b. Its mother kicks every man that beats a donkey.

The problem is how to prevent the mechanism unleashed in (84a) from applying to (84b), a case of donkey crossover. Büring does so by carefully developing a system where situation indices are overtly marked in the syntax and, when occurring within pronouns and definites, subjected to the same restriction as ordinary pronoun indices: they can be bound only from A-positions (via a suitable extension of how the β-operator works). While this is technically feasible, in a way it adds a further puzzle. We already have two indexing systems, one for pronouns one for traces; now we add situation indeces. While any DP activates activates situation indices, their use in definites must be rigidly regulated in the same manner as pronouns are: they can only be bound from A-positions. It is not obvious why this further restriction should obtain. In fact, it remains unclear how it can be maintained in the general case. Consider for example the object asymmetric reading of (85a), spelled out in (85b):

(85) a. If a painter lives in a village it is usually pretty.
b. Most villages inhabited by painters are pretty.
c. Most minimal situations s that contain a village inhabited by a painter are such that the village in s is pretty.

The semantics of (85a) seems to require carving out minimal village situations. This cannot be done, it would seem, without a scoping mechanism that pulls out the object of the *if*-clause in and allows situation binding from the landing site (clearly, not an A-position in the traditional sense). This is, in fact, exactly what Heim (1990) proposes for case like (85a). It goes without saying that the minute Büring allows binding of situation indices from A'- positions, he loses his account of donkey crossover.

Finally, as repeatedly noted, Büring does not address the issue of binding into adjuncts from internal arguments, nor is it obvious how to do so, from his perspective.

5.2. To continuize or not to continuize?

'Continuations' are a powerful computational device that can be put to many different uses. Barker (2002), Shan and Barker (2006), Barker and Shan (2008) put it to the service in providing a direct compositional, variable-free interpretation for language that bypasses as much as possible abstract syntax and, in particular, a level of logical form. We can't say much about meanings in continuation theory within the limits of the present work, except for noting that when it comes to sentences, continuations bear some similarity to the notion of CCPs. Here is how Barker puts it:

> "In fact, dynamic interpretation constitutes a partial continuization in which only the category S has been continuized (rather than continuizing uniformly throughout the grammar, as is done here)." (Barker 2002: 236)

The architecture of Shan and Barker's (2006) proposal on WCO (henceforth S&B) is based on leftness. The continuation approach affords a way for quantifiers embedded in object position to get scope over the whole sentence, including the subject. While scope is a prerequisite for pronoun binding, it doesn't automatically determine it. And so we can build into binding a constraint that prevents 'binding to the left' with respect to the base position of the binder. This is viewed as a processing constraint embodied in the motto "Evaluate expressions from left to right" (S&B, p. 94). This calls for an immediate *distinguo*. Crossover cannot be a matter of left-to-right processing following the temporal order of what we actually hear, for otherwise crossover cases with quantifiers (*his mother likes everyone*) vs. wh-movement (*who does his mother like*) should pattern differently. It must be left-to-right with respect to some structure where wh-movement is, as it were, reconstructed. Rather than 'linear order', what matters is 'evaluation order' (ibid. pp. 97 ff), which in case of wh-words must look at the phonologically empty base positions.

S&B's proposal is thus conceptually very different from ours, which makes no use of directional constraints. To highlight the stark conceptual difference, consider the following. Abstractly speaking one could build into S&B's system a mirror image 'rightness' constraint: "Do not bind to the right of the base position of the binder." One might ban 'rightness' as senseless from a processing point of view, but then we just saw that processing cannot be just left-to-right surface scanning, even in a language with rigid word order like English; moreover, VOS languages do exists. Be that as it may, the theory we are adopting envisions no directional constraint/parameter on anaphora.[51]

Despite these points, it remains quite hard to tease the two proposals apart empirically, at least on the basis of the familiar Anglo-centric data set we are considering here. The main reason for this is that conjunction figures prominently in determining accessibility. In DS, conjunction is function composition—an asymmetric, associative operation. However, surface order is obviously a key factor in determining how constituents are conjoined/composed with each other. This is not so with conditionals, however. The antecedent of a conditional is syntactically marked: *if*-clauses must be semantically construed as antecedents, wherever they occur in linear sequence. So here there is some potential for empirically distinguishing directional vs. non-directional approaches. On Barker and Shan's approach, a right-adjoined *if*-clause stands no chance of yielding antecedents for pronouns in the main clause. For us, on the other hand, right-adjoined *if*-clauses should remain accessible to the main clause, for accessibility is semantically, not linearly, determined. And thus cataphora into right-adjoined *if*-clauses should in principle be possible, despite the fact that cataphora is in general disfavored on processing grounds.

Barker and Shan (2008; B&S, henceforth) extend the continuation framework to donkey sentences and offer the following in favor of their directional view of *if*-clauses.

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[51] As is well known, there are pronouns that systematically 'look to their right' for their interpretation, originally studied in Jacobson's (1977) classic work:

(i) Every student that read it enjoyed the text assigned to him.
(ii) Every student that read it ~~text assigned to him~~ enjoyed the text assigned to him.

But, of course, an ellipsis analysis for these cases is available on any framework.

(86) * He beats it, if a farmer owns a donkey. (B&S 2008: 36)

They rule (86) out as a case of donkey crossover. However, there is a confound here. As is well known,[52] right-adjoined *if*-clauses occur in a position where they are C-commanded by the subject. There is much evidence in favor of this analysis, including, e.g., VP-anaphora and (traditional) Principle C effects:

(87) a. John sings in the shower, if he is happy, and Mary does ~~[$_{VP}$ sing in the shower if she is happy]~~ too.
b. * He$_i$ sings in the shower, if John$_i$ is happy.

If we eliminate the confound of strong crossover, things do change and cataphora into right-adjoined *if*-clauses suddenly becomes possible:

(88) a. I am sure that you'll like him$_i$, if you get to meet John$_i$.
b. * I am sure that you'll like him$_i$ and you'll get to meet John$_i$.

The contrast between (87b) and (88a) is stark, as is the contrast between (88a) and (88b), where we replace the conditional with conjunction. The latter strongly suggest that the semantics of these two connectives must be playing a role. Let us look next at indefinites in right-adjoined *if*-clauses. While indefinites may well be finicky, for all sorts of processing and pragmatic reasons, we would expect that cataphora to indefinites into right-adjoined *if*-clauses should be sometimes acceptable, for *if*-clauses are in principle accessible to the main clause they are adjoined to. The following data (adapted from Chierchia 1995a) suggests that this is indeed so:

(89) a. [Context: Teachers are very sensitive to the prices of textbooks.]
i. A teacher will never adopt it$_i$, if a textbook$_i$ is too expensive.
ii. * A teacher will never adopt it and a textbook is too expensive.
b. [Context: John is rich, and fanatic about cars]
i. He always buys it$_i$ on the spur of the moment, whenever he falls in love with a new car$_i$.
ii. * He always buys it$_i$ on the spur of the moment, and he does fall in love with a new car$_i$.
c. [Context: John was hit by something in the street.]
i. I hope he got its$_i$ plate, if it was a car$_i$.
ii. * I hope he got its plate, and probably it was a car.

The first two examples are generic 'multi-case' conditionals; the last is an epistemic 'one-case' conditional. They contrast systematically in acceptability with cataphora in conjunction (and with B&S's (86), which is however fraught with the confound mentioned above). These examples seem to be out of reach for an approach based on leftness. On a DS approach, on the other hand, once strong crossover and

[52] Cf. Chierchia (1995a) and references therein.

processing/pragmatic factors are controlled for, we expect cases like those in (89) to be possible (see Section 3.3, and Chierchia 1995a, for possible implementations).

Finally, the present approach gives us ways of addressing the very difficult problem of A'-dependencies that bleed WCO, if in a preliminary and tentative way. It remains to be seen what the analogue of affectedness modulated DR introduction by derived predicates would be in the continuation framework and how that could be made consistent with leftness.

Be that as it may, the continuation framework is an extremely powerful formalism, and does have points of contact with dynamics. Surely the idea developed in the present paper could be reconstructed within it, if one felt so inclined. For the time being, it seems fair to conclude that the DS approach developed in this paper differs conceptually and empirically from current continuation-theoretic approaches, and that the available evidence favors the former over the latter.

5.3. Final remarks and outlook

Any basic version of DS (not just the one adopted here) would enable one to explore our core idea, a somewhat unorthodox mapping of DR-introduction onto syntactic constituents (cf. (14) above):

(90) Dynamic Predication Principle
  a. DPs never activate DRs (either inherently or when scoped).
  b. Only predicates activate DRs.

We have tried to make (90) precise and worked out its consequences. Note that the second claim, (90b), in a way follows from the first, (90a): if anaphora works via DR activation, and DPs do not fit the role of activator, then what does? We *must* assume that lexical predicates (i.e., verbs and their theta roles) do. We have seen that there are independent empirical reasons for assuming this, unrelated to crossover phenomena, in the behavior of bare plurals. It clearly seems necessary to posit an operation of DR introduction at the first merge site for bare plurals, regardless of WCO. We have then shown in detail that the basic WCO facts flow from the assumptions in (90); this included an explanation of when and why binding from an internal argument into a higher adjunct is possible.

Nothing in (90) should lead one to expect that only *lexical* predicates can introduce DRs. And indeed, the fact that some derived predicates, i.e. predicates created by movement, do introduce DRs and therefore bleed WCO, has always been in plain sight. It has long been known that A-movement as well as some cases of A'-movement do not carry WCO effects along. In the present perspective, this question takes the form of which derived predicates introduce DRs and under what conditions. DR-introducing predicates should have some key property in common with lexical predicates, in a way that sets them both apart from QR/pure scope assignment. The (still informal) hypothesis we have arrived at is repeated here from (83):

(91) *Affectedness*
  a. Derived predicates [$DP_i\ \phi$] where $\lambda_i\ \phi$ does not semantically condition the

dislocated DP cannot introduce DRs.[53]
b. Derived predicates that semantically condition the dislocated DP may introduce DRs.

To 'semantically condition' a constituent means to impose on it tangible requirements that go beyond the lexical meaning of DP. This happens if, e.g., the predicate assigns to its DP argument a new theta role, or turns it into a topic, or assigns generic force to it, or the like (none of which are done by QR or wh-movement). For now, this list must be left open ended; but in time we may be able to arrive at interesting and constrained typologies. The case of wh-movement is very telling in this connection. Wh-movement is driven by a specific head, the interrogative Comp, which has an unmistakable semantic effect on its TP sister (namely, that of turning it into a question) but doesn't affect the semantics of the moved DPs: the latter are simply indefinites quantified into the question meaning.

The hypothesis we have arrived at does not entail that if a derived predicate semantically conditions its argument (the dislocated DP) it *must* introduce a new DR and bleed WCO. This is a point that only future research can clarify. Scrambling phenomena and resumption are prime domains to explore, in this new light. The hope is that the present perspective will provide a useful tool for cross-linguistic inquiries in those areas.

We have repeatedly remarked that while the version of DS used in the present paper is standard, the mapping hypothesis embodied in (90) is not. Some of the canonical hunting grounds for DS (e.g., conditionals and quantificational adverbs) are not significantly affected by the new mapping. Others (e.g., DPs with relative clauses) are: if the mapping in (90) is right, there are no dynamic generalized quantifiers. Be that as it may, we have provided evidence that the account of WCO explored here, while descending from a simple hypothesis that has many antecedents and parallels in the literature, is in no way equivalent, either conceptually or empirically, to any of the known treatments, and that its consequences go beyond the familiar.

Probing which 'natural logic' is enmeshed with the computational system of grammar is patently a long and trying process, where evidence comes from unexpected phenomena in unexpected ways. If the above picture is at least partly on the right track, a dynamic construal of basic logical functions may indeed be leading us towards a deeper understanding of crossover phenomena and clause structure.

Appendix

1. Summary of the formal theory

(1) Types.
a. Basic: e, t, **n**; where: D_e = U (domain of individuals, including events), $D_t = \{0,1\}$, $D_{\mathbf{n}}$ = N (the set of positive integers)

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[53] Here and throughout I am talking of the DP as 'the argument', even if the DP is quantificational and, therefore, technically a higher-order predicate. What matters is that ultimately a quantificational DP 'places an argument' within the predicate associated with the V-complex.

b. $D_{<a,b>} = [D_a \Rightarrow D_b]$ (the set of all total or partial functions from D_a into D_b)
c.i. $\boldsymbol{\omega} = <\mathbf{n}, e>$ Assignments
ii. $<\boldsymbol{\omega},e>$ Pronouns
iii. $T = <\boldsymbol{\omega}, <\boldsymbol{\omega},t>>$ Context change potentials

The sets of meaningful expressions, models, etc. for a formal language with these types are to be defined as for TY2 (Gallin 1975).

(2) Dynamic lifting and DR-introduction.
For any P, of type $<e,t>$:
a. $[P_{<e,t>}] = \lambda u\, [\, \lambda\omega\lambda\omega'.\ \omega = \omega' \wedge P(u)]$ Dynamic Lifting
b. $[P_{<e,t>}]^{n} = \lambda u\, [\, \lambda\omega\lambda\omega'.\ \omega =^{n/u} \omega' \wedge P(u)]$ DR Introduction
where $\omega =^{n/u} \omega'$ is an abbreviation of $\omega' = \omega \cup <n,u>$, defined only if the input assignment is *un*defined for the *n*th coordinate.

Pronouns, of type $<\boldsymbol{\omega},e>$, combine with predicates of type $<e,T>$ via function composition:

(3) Pronouns.
a. $he_n = \lambda\omega.\omega_n$
b. If β is of type $<e,T>$, and α is of type $<\boldsymbol{\omega},e>$, then
$\beta\,(\alpha_n) = \lambda\omega\,\lambda\omega'.\ \beta\,(\alpha(\omega)(n))(\omega)(\omega')$

(4) The logic.
For any ψ, ϕ of T, any variable ω, ω' of type $\boldsymbol{\omega}$, and any variable α_a of type a:
a. $\downarrow_\omega \phi = \exists\omega'\, [\phi(\omega)(\omega')]$ 'ϕ is true relative to ω;' $\downarrow$ is of type $<\boldsymbol{\omega},<T,t>>$
b. $\neg\phi = \lambda\omega\lambda\omega'.\ \neg\!\downarrow_\omega \phi \wedge \omega = \omega'$
c. $(\phi \wedge \psi) = \lambda\omega\lambda\omega'.\ \exists\omega''\, [\phi(\omega)(\omega'') \wedge \psi(\omega'')(\omega')]$
d. $\phi \rightarrow_\forall \psi = \neg\,(\phi \wedge \neg\, \psi)$
e. $\phi \vee \psi = \neg\,(\neg\, \phi \wedge \neg\, \psi)$
f. $\exists\alpha_a\, \phi = \lambda\omega\,\lambda\omega'.\ \exists\alpha_a\, [\phi(\omega)(\omega')]$
g. $\forall\alpha_a\, \phi = \neg\exists\alpha_a\, \neg\, \phi$

2. Examples

(5) a. Someone $[\text{walked in}]^2$. He_2 was $[\text{tall}]^3$
b. Interpretation of (a): $\exists x\, [\text{walked in}]^2 (x)] \wedge [\text{tall}]^3(he_2)$
Abbreviations: walked in = WI; tall = TA
Reduction steps.
Reduction of the first conjunct of (5b):
c. $\exists x[\, \lambda u.\lambda\omega\lambda\omega'.\ \omega =^{2/u} \omega' \wedge WI(u)]\, (x)]$ Def. of $[\ldots]^n$
d. $\exists x[\lambda\omega\lambda\omega'.\ \omega =^{3/x} \omega' \wedge WI(x)]$ λ-conv.
e. $\lambda\omega\lambda\omega'.\exists\, x[\, \omega =^{2/x} \omega' \wedge WI(x)]$ Def of $\exists$
Reduction of the second conjunct of (b):

f. $[TA]^3(he_2) = \lambda\omega\lambda\omega'.\ \omega = \omega' \wedge TA(\omega_2)$
(5b) in primitive notation:
g. $\exists\ x[\lambda\omega\lambda\omega'.\ \omega =^{2/x} \omega' \wedge WI(x)] \wedge \lambda\omega\lambda\omega'.\ \omega = \omega' \wedge TA(\omega_2)$
h. $\lambda\omega\lambda\omega'\ \exists\nu\ [\exists x[\ \omega =^{3/x} \nu \wedge WI(x)] \wedge\ \ \nu = \omega' \wedge TA(\nu_2)]]$ Def. $\wedge$
i. $\lambda\omega\lambda\omega'\ \exists x[\ \omega =^{3/x} \omega' \wedge WI(x) \wedge TA(x)]$ Elementary logic
j. $\downarrow_\nu \lambda\omega\lambda\omega'\ \exists x[\ \omega =^{3/x} \omega' \wedge WI(x) \wedge TA(x)]$
$= \exists\omega'\ \exists x[\ \nu =^{3/x} \omega' \wedge WI(x) \wedge TA(x)]]$ Def. $\downarrow$
(5j) is true in a world w iff:
k. $\exists x$ [walked in(x) $\wedge$ tall(x)]

(6) A crossover case.
a. i. His cat loves everyone.
ii. Logical form: [every one$_i$ [his cat υ^5 TH_1 t_i]]
iii. Interpretation: every one(λx_i $\exists e$ [**$[EX(e)]^5$(his cat)** $\wedge$ $[TH(e)]^1(x_i) \wedge [love]^2(e)$])
We focus on the subformula in boldface and show how if we resolve *his* to the index 5, we get a presupposition violation. Given the definition of conjunction, the same happens if we resolve *his* to any of the indices declared to the right of the subformula in bold.
b. **$[EX(e)]^5$(his$_5$ cat**) $= \lambda u\ .\ \lambda\omega\ \lambda\omega'.\ [\omega =^{1/u} \omega' \wedge EX(e)(u)]\ (f_{cat}(\omega_1))$
By λ-convention and definition of ' =n/u' we get:
c. $\lambda\omega\ \lambda\omega'.\ [\omega' = \omega \cup <1/\ f_{cat}(\omega_1)> \wedge EX(e)(\ \omega_1)]$
For $\omega \cup <1/\ f_{cat}(\omega_1)>$ to be defined, *1* must not be in the domain of the input assignment ω; but then $f_{cat}(\omega_1)$ cannot be determined and (c) is undefined.

(7) A case of 'Disclosure'
In what follows we apply the disclosure operator to *someone walked in*:
a. D_5 (someone [walked in]^5)
b. D_5 $(\lambda\omega\lambda\omega'\ \exists x[\ \omega =^{5/x} \omega' \wedge WI(x)])$ Cf. (5.i)
c. $\lambda u\ [(\lambda\omega\lambda\omega'\ \exists x[\ \omega =^{5/x} \omega' \wedge WI(x)] \wedge \lambda\omega\lambda\omega'\ \omega_5 = u]$ Def of D_n
d. $\lambda u\ .\ \lambda\omega\lambda\omega'\ \exists x[\ \omega =^{5/x} \omega' \wedge WI(x) \wedge \omega_5 = u]$ Def. $\wedge$

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