

Focus Binding: The interpretation of GIVEN pronouns

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Consider the two classic focus environments in (1) and (2), and notice that the pronouns *he* and *his* are generally constrained to refer to Sherlock. In (1), *he* must refer to Sherlock in order for the response to properly answer the question; and in (2), *his* refers to Sherlock in order to maintain the contrast between the phrase *Sherlock's intellect* and the phrase *his patience*. For the rest of this paper, I will describe such pronouns as **focus-bound** and call the process of constraining their interpretation **focus binding**.

- (1) Q: What instrument does Sherlock play? A: He plays the violin.
- (2) Sherlock's intellect exceeds his patience.

Entirely independent from the interpretation of pronouns, focus structure imposes constraints on discourse. For instance, consider the two versions of (2) below, this time with names in place of the pronoun and accented words marked with SMALL CAPS. In this context, the second occurrence of the name *Sherlock* sounds quite odd when it is accented but fine when it is unaccented. For the name *Watson*, though, the pattern is reversed. I propose that these two observations are linked: the pronoun *his* in (2) – especially when unaccented – simply denotes whatever non-pronominal material would be unaccented in the same position. Furthermore, I will argue that pronouns interpreted in this manner are closer to bound pronouns than free ones, in that their meaning is determined locally. Evidence for this view comes from sloppy identity readings; for instance, (4) has a reading claiming that Watson's intellect does not exceed Watson's patience. Despite the fact that most theories of ellipsis take the elided pronoun in (4) to be essentially a carbon copy of the spoken one, this second pronoun may be interpreted in a strictly local context, deriving the two different denotations required for the sloppy reading.

- (3) SHERlock's INTellect exceeds . . .
 - a. . . . Sherlock's / #SHERlock's PATience.
 - b. . . . #Watson's / WATson's PATience.
- (4) Sherlock's intellect exceeds his patience. Watson's intellect does not ~~exceed his patience~~.

Let us call this proposal the Focus Binding Hypothesis, formulated at a high level in (5). This basic idea, I argue, suffices to explain phenomena ranging from those just discussed to more exotic cases like paycheck pronouns and donkey anaphora. The resulting theoretical system is surprisingly close to the E-type theories of Evans (1977, 1980), Heim (1990), *inter alia*. The focus binding account has the conceptual advantage, though, of being derived from independently motivated focus constraints, as well as several empirical advantages to be discussed below.

- (5) Focus Binding Hypothesis
Pronoun interpretation may be set locally to satisfy rules of focus structure.

The theory developed here requires only a basic discourse structure – one that keeps track of utterances spoken and allows searching for salient antecedents. To the extent that this simpler proposal explains the data which motivated more complex theories of discourse, such as Discourse Representation Theory (Kamp 1981, Kamp and Reyle 1993) or Dynamic Semantics (Heim 1982, 1983, Groenendijk and Stokhof 1991, Dekker 1993), this paper will constitute an argument against such theories. However, I will not directly compare my system to these approaches.

The paper is organized as follows. In Section 1, I introduce the phenomenon of focus binding and argue that focus-bound pronouns derive their interpretations from local, derived assignment functions rather than global, contextually provided assignments. Section 2 presents the first formal analysis of focus binding for pronouns with type- $\langle e \rangle$ antecedents, and Section 3 uses this formalism to capture the phenomenon of paycheck pronouns. In Section 4, I turn to more complex cases, involving pronouns whose antecedents are indefinites and other higher-type items. This provides the basis for the analysis, in Section 5, of Donkey Anaphora. Last, Section 6 suggests potential extensions and concludes the paper.

1 Focus binding

A major concern in focus theory is the effect on the phonology, syntax, and semantics of the word or phrase when it has been recently uttered before. For the purposes of this section, the following two conditions will suffice to illuminate this phenomenon:¹

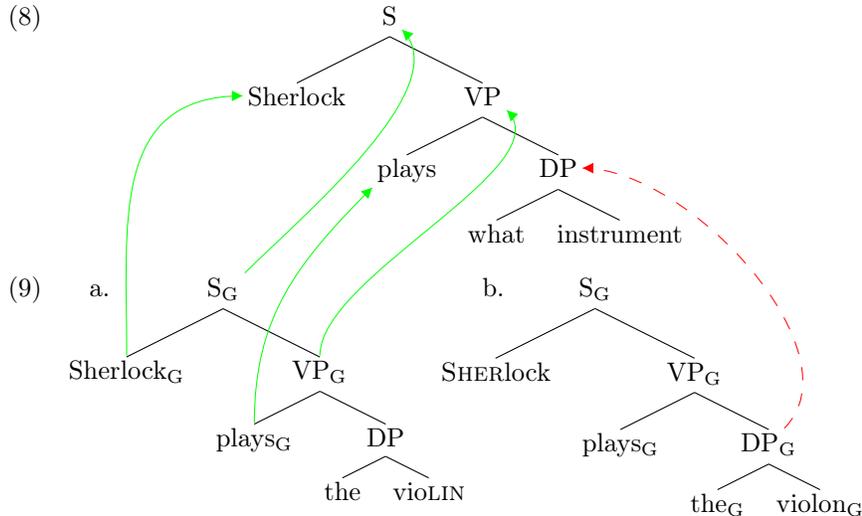
- (6) G-marking: An LF phrase may optionally bear a G feature. Such a phrase is typically pronounced less prominently in English.

¹These conditions are adapted from Schwarzschild (1999) and Féry and Samek-Lodovici (2006). Féry and Samek-Lodovici crucially assume a second syntactic feature, *f* for **focus-marking**, in their analysis of focus structure. Although this second feature is compatible with the proposal presented here, it is not necessary, and therefore I have omitted it from my discussion for expository purposes.

- (7) GIVENness (version 1 of 3): For every G-marked phrase α_G , there must be an antecedent phrase β such that $\llbracket \beta \rrbracket = \llbracket \alpha \rrbracket$ modulo any non-G-marked material within α .

The condition in (6) establishes the syntactic G feature, which marks old or **GIVEN** material. Material that is not **GIVEN** is often called **NEW**. The condition in (7) requires every **GIVEN** phrase to find a matching phrase (usually one spoken previously in the same discourse); I will call such a matching phrase a **focus antecedent**, to distinguish it from a pronominal antecedent.

This system explains the pattern of acceptable G-marking in answers to questions. For instance, consider the question raised in (1) above, repeated in (8). An answer to this question (without any pronouns) is shown in (9) with two different G-markings, only one of which is felicitous. I have again indicated pitch accents in using SMALL CAPS². Solid green lines connect **GIVEN** items in these answers to their focus antecedents in the question. A dotted red line shows a failed antecedence relationship in the version of the answer in (8b):



The G-marking in (9a) is licensed because the **GIVEN** nodes *Sherlock* and *plays* have exactly matching antecedents in the question; and the **GIVEN** VP and S nodes have matching antecedents modulo the **NEW** DP *the violin*. The G-marking in (9b), on the other hand, violates **GIVENness** since the **GIVEN** node DP (among many others) has no antecedent.

But what about an answer to (8) that uses a pronoun in place of the full name *Sherlock*? A close reading of existing proposals of focus theory yields the following more precise version of **GIVENness**:³

²See Selkirk (1995), Schwarzschild (1999), and Féry and Samek-Lodovici (2006) for more details on how focus marking corresponds to pronunciation.

³See Rooth (1985, p. 59) and Schwarzschild (1999, p. 154).

- (10) GIVENNESS (version 2 of 3): For every G-marked phrase α interpreted using an assignment g , there must be an antecedent phrase β such that $\llbracket \beta \rrbracket^g = \llbracket \alpha \rrbracket^g$ modulo any non-G-marked material within α .

This new version of GIVENNESS makes clear how the system treats a GIVEN pronoun $pron_i$ under an assignment g : for each such pronoun, there must be an antecedent β such that $\llbracket \beta \rrbracket^g = \llbracket pron_i \rrbracket^g = g(i)$. This suggests that GIVEN pronouns are interpreted via whatever assignment is currently in effect when they are evaluated.

In this section, I will argue that this view of GIVENNESS must be updated to account correctly for local meanings of GIVEN pronouns. To this end, Section 1.1 introduces the notion of sloppy identity, a phenomenon that has proven to be an important empirical tool for distinguishing nuanced meanings of pronouns. Section 1.2 applies this tool to pronouns whose meanings seem to be constrained by focus structure, suggesting a slightly updated version of GIVENNESS, which allows for the assignment to be altered solely in order to satisfy focus constraints.

1.1 Sloppy identity

Since at least Reinhart (1983), differing readings under VP ellipsis have been used as a diagnosis for bound pronouns. For instance, consider (11a), which has the two readings shown in (12):

- (11) Sherlock saw his hat. Watson did, too.
- (12) a. ... Watson saw Sherlock's hat. [strict identity]
 b. ... Watson saw his own hat. [sloppy identity]

In the reading illustrated in (12a), the owner of the hat is maintained as Sherlock in the second clause; this is called the **strict identity** reading. In the reading illustrated in (12b), however, the hat's owner shifts to Watson instead of Sherlock; this is called the **sloppy identity** reading (Ross 1967).

One way to analyze these two readings is to posit that there are actually two different structures in the first clause of (11), and whichever of two appears is copied into the ellipsis site (Keenan 1971, Sag 1976):⁴

- (13) a. Sherlock $[_{VP} \text{ saw his}_i \text{ hat}]$. Watson did $[_{VP} \text{ saw his}_i \text{ hat}]$, too.
 b. Sherlock $\lambda_i [_{VP} \text{ saw his}_i \text{ hat}]$. Watson did $\lambda_i [_{VP} \text{ saw his}_i \text{ hat}]$, too.

The structure in (13a) shows a **free** occurrence of the pronoun *his*, which is interpreted via the contextually-derived, **global** assignment function used to interpret the entire sentence. If this global assignment returns Sherlock for index i , then *his* will denote Sherlock both in the pronounced version and inside the ellipsis. The structure in (13b), on the other hand, shows an occurrence of *his* that is **bound** by a c-commanding λ operator. The λ operator combines with the VP to denote a λ function. This operator also creates a **local** assignment

⁴For high-level summaries of such theories of ellipsis, see Heim and Kratzer (1998), Section 9.3, p. 248, Büring (2005), Section 5.5, p. 114, and Merchant (to appear).

function (used only to evaluate the VP) wherein the relevant index (i in this case) returns a variable whose value corresponds to the argument passed to the λ function. In (13b), therefore, no matter what the global assignment function returns for index i , the pronounced pronoun his_i will always denote Sherlock, the argument passed to the λ function. However, since the argument to the λ function in the ellipsis site is now Watson instead of Sherlock, the local assignment function used to evaluate the elided VP will return Watson for index i ; and therefore the second clause of (13b) will denote the proposition that Watson saw his own hat.

Under this view, then, sloppy identity readings can be thought of as tools to diagnose which pronouns can receive their meanings via a local assignment. Such an assignment is possible in the first clause of (11), and therefore a sloppy identity reading is available in the second clause. This diagnostic tool will be used in Section 1.2 below to argue that focus-bound pronouns derive their meanings via a local assignment as well. First, though, I should mention that VP Ellipsis is not the only construction where sloppy identity readings arise. Consider the two following additional cases (where items written in a smaller font are pronounced far less prominently than surrounding material):

(14) Sherlock saw his hat, and Watson saw his hat, too.

(15) Only Sherlock saw his hat.

The only differences between (14) and (11) is that in uttering (14) you actually pronounce the repeated VP *saw his hat* – but you pronounce it quickly, with lowered pitch, in a manner referred to as **deaccenting** (Tancredi 1992). Notice that the same two readings arise in (14) as were found in (11). Next, (15) shows a single-clause example where a sloppy-identity reading occurs. There are two parts to the meaning of a sentence of the form “only ϕ ”: (a) ϕ is true, and (b) alternatives to ϕ are false.⁵ It is part (b) of this meaning where a sloppy identity reading may arise. For instance, consider the two readings for (15) that arise even when *his* is fixed to mean Sherlock:

- (16) (a) Sherlock saw his hat, and . . .
 (b) . . . no one else saw Sherlock’s hat.
 (b’) . . . no one else saw their own hat.

The reading marked (b’) is the one that is akin to sloppy identity: the pronoun *his* in this reading may refer to people other than Sherlock.

1.2 Sloppy identity unbound

An interesting question about focus-bound pronouns, now, is whether or not they license sloppy identity readings. Take (2), for instance, reproduced in (17)

⁵These alternatives are generated by replacing the NEW material in ϕ . See Rooth (1985), von Stechow (1997, 1999).

with appropriate G-marking⁶:

- (17) Sherlock_G's INTellect exceeds [his_i]_G PATience.

The GIVENness constraint as spelled out in (10) above applies to pronouns after they are interpreted via the contextually-derived, global assignment function. Because the pronoun is not syntactically bound in (17)⁷, there is no local assignment function involving the index i . Remember, though, that it was the local assignment function in (13b) that allowed for a sloppy identity reading. Here, without a local assignment, the only possible way to interpret the pronoun *his* is via the global assignment. Indeed, authors since Reinhart (1983) have claimed that sloppy identity requires a pronoun with a c-commanding antecedent.

And yet, consider the pair of sentences in (18), involving VP ellipsis. The current theories of focus predict the sloppy identity reading to be lacking here, because the only structure available to copy into an ellipsis site is the one where *his* refers globally to Sherlock, as shown in (18):

- (18) Sherlock's intellect exceeds his_i patience.
 Watson's intellect does not ~~exceed his_i patience~~.

Under this structure, the second, unspoken *his* is interpreted as the item indexed i in the global assignment – i.e., Sherlock. This is indeed a reading of the second sentence, but an equally salient (if not more salient) reading is the unpredicted sloppy one, where the second *his* refers to Watson. Similarly, (19) has a strict and sloppy reading, and again the sloppy reading is at least as salient:

- (19) Only SHERlock's intellect exceeds his patience. Therefore, ...
 a. ... Watson's intellect does not exceed Sherlock's patience. [strict]
 b. ... Watson's intellect does not exceed his own patience. [sloppy]

Additionally, quite natural sloppy identity cases exist where the antecedent is in a separate sentence from the pronoun – a configuration most theories claim to preclude syntactic binding.⁸ For instance, in reference to the famous televised debate of 1960, one could say the following:

- (20) Kennedy looked good. People voted for him.
 Nixon looked bad. People didn't.

The most salient reading for the last sentence in (20) is that people didn't vote for Nixon – a sloppy reading. Thus, it seems that sloppy readings are possible even in the absence of syntactic binding.

⁶The G-marking shown assumes that Sherlock has been mentioned previously in the discourse, but this is not crucial to the analysis

⁷Its only potential syntactic binder, *Sherlock*, does not c-command the pronoun. See Section 2.3.1 for more discussion of this point.

⁸See Kayne (2002) though for a proposal that such cases do involve binding across a suprasentential syntactic structure.

Based on cases like these, I propose that focus structure itself can create a local assignment able to license sloppy identity. The intuition behind this account is that a pronoun may take a new value locally in order to maintain focus constraints. I capture this intuition in my final informal version of the GIVENNESS constraint:

- (21) GIVENNESS (version 3 of 3): For every G-marked phrase α interpreted using an assignment g , there must be an antecedent phrase β and a variant g' of g such that $\llbracket \beta \rrbracket^{g'} = \llbracket \alpha \rrbracket^{g'}$ modulo any non-G-marked material within α . If so, $\llbracket \alpha \rrbracket^g = \llbracket \alpha \rrbracket^{g'}$.

I will formalize and implement this proposal in Section 2 below.

2 Analysis

This section will present a proposal to explain the interpretation of GIVEN pronouns with singular, type- $\langle e \rangle$ antecedents. I base my analysis of focus binding on proposals in Rooth (1992) and Schwarzschild (1999).⁹ Section 2.1 introduces the notion of focus alternatives, and Section 2.2 uses this notion to define a GIVEN node's focus antecedent. Section 2.3 compares this system to previous analyses of similar phenomena.

2.1 Focus alternatives

Following Rooth (1985, 1992), I will assume that each LF node α has two semantic values. Its **ordinary semantic value**, written $\llbracket \alpha \rrbracket^o$ or simply $\llbracket \alpha \rrbracket$, is calculated normally (e.g., as described in Heim and Kratzer 1998). Its **focus semantic value**, written $\llbracket \alpha \rrbracket^f$, is a set containing alternatives identical to α modulo any NEW items. I will refer to the members of this set as α 's **focus alternatives**; these alternatives effectively list α 's potential focus antecedents.

The focus semantic value of a node α under an assignment g can be defined using a recursive procedure like (22) (cf. Hamblin 1973, von Stechow 1974, Keenan and Faltz 1978, Gazdar 1980, Keenan and Faltz 1985, Rooth 1985):

- (22) a. NEW nodes:
If α is not G-marked, $\llbracket \alpha \rrbracket^{f,g} = \{\phi \mid \phi \text{ is a contextually salient denotation of the same type as } \llbracket \alpha \rrbracket^g\}$.
- b. Simplex GIVEN nodes:
If α is G-marked and has no children, $\llbracket \alpha \rrbracket^{f,g} = \{\llbracket \alpha \rrbracket^g\}$.

⁹Schwarzschild formulates his GIVENNESS condition as an optimality-theoretic constraint. For purposes of perspicuity, I will instead build focus constraints into the interpretation function $\llbracket \cdot \rrbracket$. This should not drastically alter Schwarzschild's system, though, since he actually does not rank GIVENNESS with respect to his other proposed optimality-theoretic constraints. Instead he proposes that GIVENNESS is a pragmatic constraint, taking precedence over his other focus constraints, which are phonological.

c. Complex GIVEN nodes:

If α is a G-marked node with children β and γ , $\llbracket \alpha \rrbracket^{f,g}$ is the **pointwise** combination of $\llbracket \beta \rrbracket^{f,g}$ and $\llbracket \gamma \rrbracket^{f,g}$ – i.e., the set containing, for each $b \in \llbracket \beta \rrbracket^{f,g}$, $g \in \llbracket \gamma \rrbracket^{f,g}$, the result of applying the standard Heim and Kratzer rule for combining b and g .

To illustrate how this procedure works, consider the following small structure:

$$(23) \quad [{}_{\text{VP}_G} [{}_{\text{V}_G} \text{plays}] [{}_{\text{DP}} \text{the violin}]]$$

The verb *plays* in (23) is G-marked and simplex, and therefore its focus semantic value is the singleton set containing its ordinary semantic value: $\{\llbracket \text{plays} \rrbracket\}$. The DP *the violin*, on the other hand, is not G-marked, and therefore it represents the set of salient similar denotations of the same type (type $\langle e \rangle$), e.g. (24):

$$(24) \quad \left\{ \llbracket \text{the violin} \rrbracket, \llbracket \text{the cello} \rrbracket, \llbracket \text{the sackbut} \rrbracket, \llbracket \text{the sousaphone} \rrbracket, \dots \right\}.$$

The VP in (24) is G-marked but not simplex, and therefore its focus semantic value is the pointwise combination of its children’s focus semantic values. Since the verb *play* is a function over individuals and $\llbracket \text{the violin} \rrbracket^f$ is a set of individuals, this pointwise combination is the result of applying the verb to each individual in $\llbracket \text{the violin} \rrbracket^f$:

$$(25) \quad \left\{ \llbracket \text{plays the violin} \rrbracket, \llbracket \text{plays the cello} \rrbracket, \llbracket \text{plays the sackbut} \rrbracket, \llbracket \text{plays the sousaphone} \rrbracket, \dots \right\}.$$

2.2 Focus antecedents

This view of focus alternatives allows us to give a more formal definition of GIVENNESS. First, though, let me introduce the concept of an assignment modification (Heim and Kratzer 1998, p. 112):

(26) Assignment Modification

Let a, m be assignment functions. Then, the modified assignment a^m is the smallest function such that

- a. for every $i \in \text{domain}(m)$, $a^m(i) = m(i)$, and
- b. for every $j \in \text{domain}(a)$ such that $j \notin \text{domain}(m)$, $a^m(j) = a(j)$.

Basically, when m modifies a , any index i in the domain of m returns the value that m assigns to i . Any remaining indices j in the domain of a that are not in the domain of m return whatever value a originally assigned to j . I will follow Heim and Kratzer in writing modifications using terms of the form x/i , where $x \in D_e$ and $i \in \mathbb{N}$.

Next, I propose the following meta-interpretation principle, which can be construed as an alteration or extension to the rules in Heim and Kratzer (1998) (cf. Schwarzschild 1999, pp. 152-3):

- (27) Interpretation of GIVEN Nodes (to be revised)
 For any GIVEN node α_G and assignment g , $\llbracket \alpha \rrbracket^g$ returns a value iff there is a salient node β and an assignment modification m such that $\llbracket \beta \rrbracket^{g^m} \in \llbracket \alpha \rrbracket^{f, g^m}$. If so, $\llbracket \alpha \rrbracket^g = \llbracket \alpha \rrbracket^{g^m}$.

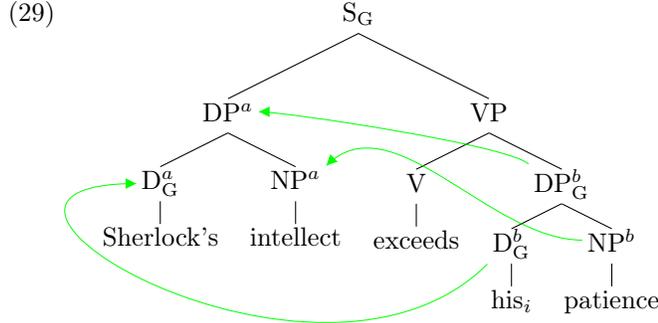
As mentioned before, a GIVEN node α is only interpretable if it has a matching focus antecedent. The principle in (27) defines such an antecedent as a salient node β which matches one of α 's focus alternatives. This is encapsulated in the term $\llbracket \beta \rrbracket^{g^m} \in \llbracket \alpha \rrbracket^{f, g^m}$. The m in this term represents some wiggle room in this definition: the original assignment g in effect during the interpretation of α may be modified slightly in order to give α a focus antecedent β .

I should immediately note some borderline cases that I will not explain fully in this paper. First and foremost, I will have little to say about what makes a node “salient” or how to choose between two or more salient antecedents. I will assume for now that nodes with multiple potential antecedents are in principle ambiguous, and other factors, such as world knowledge or a richer structure of discourse, may decide the most felicitous antecedent. Second, even though (27) allows an assignment modification m , there should be no index i in the domain of m that affects the meaning of the antecedent β without also affecting the meaning of α . For instance, consider the short discourse in (28):

- (28) Mary λ_i thinks she _{i} is smart. Jane_G really is smart.

The pronoun *she _{i}* in (28) should not count as a focus antecedent for the name *Jane* merely because there is a modification m to the contextual assignment g such that $g^m(i)$ returns Jane. An economy condition akin to that in Fox (1999) could potentially rule out such cases, since modifying the assignment in such a manner has no effect on the interpretation of the name *Jane*. (Fox (1999) argues that certain syntactic operations at LF must make a difference in interpretation.) Last, the assignment modification used in the principle in (27) should not be allowed to alter indices bound by higher λ operators. If it did so, there would be λ functions that did not depend on their arguments; this scenario could potentially be ruled out via a ban on vacuous quantification (see Bittner 1994). I leave it to future research to flesh out these cases.

To see a little more closely how the normal cases of interpretation of GIVEN nodes works, let us consider our original example (2), repeated here in (29) with an approximate LF structure and appropriate G-marking:



For the sentence S in (29) to be interpreted under an assignment g , each node dominated by S must also be interpreted. Let us assume this sentence arises in a discourse about Sherlock Holmes and thus the name *Sherlock* is GIVEN based on prior discourse. The words *intellect*, *exceeds*, and *patience* are all NEW and are not G-marked. The phrase DP^a (*Sherlock's intellect*) is also NEW; but, as we will see, DP^b (*his_i patience*) can actually find an antecedent in DP^a and therefore count as GIVEN. The same goes for *his_i*, whose antecedent will be *Sherlock*. Finally, depending on the prior discourse, the VP is probably NEW, but the S is probably GIVEN.¹⁰

Let us start by examining the node DP^b in (29) and its semantic values under a contextually supplied global assignment g . Since DP^b is GIVEN, its focus semantic value is the pointwise combination of the focus semantic values of its children, yielding a set like (30) where the NEW node NP^b has been replaced with salient alternatives:

$$(30) \quad \llbracket DP^b \rrbracket^{f.g} = \{ \llbracket \mathbf{his}_i \text{ patience} \rrbracket^g, \llbracket \mathbf{his}_i \text{ intellect} \rrbracket^g, \llbracket \mathbf{his}_i \text{ courage} \rrbracket^g, \dots \}$$

Next, according to the principle in (27), DP^b will only receive an ordinary semantic value if one of the items in this set matches a discourse antecedent under some modified assignment. The principle in (27) allows us to use the modified assignment $g' = g^{\text{Sherlock}/i}$ to interpret DP^b . Under this assignment, $\llbracket D^b \rrbracket^{g'} = \llbracket \mathbf{his}_i \rrbracket^{g'} = \llbracket \mathbf{Sherlock's} \rrbracket$, which means that $\llbracket DP^b \rrbracket^{f.g'}$ will contain a value matching the interpretation of the discourse antecedent DP^a . We have thus derived the focus-bound value for the pronoun *his_i*. The interpretation of DP^a , VP, and S proceed entirely normally (i.e., as specified in Heim and Kratzer 1998) with the one added requirement that *Sherlock* must have been mentioned before, as we assumed up front.

This derivation provides an explanation for why (29) licenses later sloppy identity readings, despite the lack of a c-command relation between *his* and its antecedent *Sherlock*. In a subsequent sentence such as (31), the structure of any elided or deaccented material can be identical, down to the very indices, but receive a different interpretation, due to the changed discourse context:

¹⁰This part of the G-marking is not crucial. I am simply assuming that there are no previous VP's of the form "V *his* NP" but that there are previous S's of the form DP VP.

(31) Watson’s intellect does NOT exceed [_{DP} his_i patience].

In particular, there is now another available antecedent for the DP *his_i patience* – namely *Watson’s intellect*. With this new antecedent, the DP can be interpreted under a modification m of the assignment g such that $g^m(i)$ is Watson, not Sherlock. Thus, the pronoun *his* may satisfy the focus constraints and the deaccenting constraints while receiving a different interpretation.

We can also now explain the case in (20), repeated in (32) with deaccenting:

(32) a. Kennedy looked good. People VOTED for [_{him_i}]_G.
 b. Nixon looked_G bad. People_G DIDN’t vote_G for_G [_{him_i}]_G

Here again, since *him_i* is GIVEN in (32a), it must find a matching antecedent. One particularly salient antecedent, and the only one when the example is presented out-of-the-blue, is *Kennedy*, and thus the pronoun is interpretable under a modified assignment g^m that assigns Kennedy to index i . This local assignment is constructed despite the fact that *Kennedy* is found in a separate sentence and cannot c-command the pronoun. In (32b), on the other hand, while *Kennedy* is a potential antecedent for *him_i*, another antecedent is available: *Nixon*. Thus, the sloppy reading is available for the pronoun in (32b).

2.3 Previous analyses

The case in (32) is a counterexample to most other theories of unusual sloppy identity, but it will still be instructive to examine a few previous theories related to the phenomena presented so far.

2.3.1 Unusual syntactic binding

The contrarian reader might have wondered above whether a possessor such as *Sherlock* in *Sherlock’s intellect* might indeed syntactically bind a later pronoun. In fact, several researchers have proposed irregular binding techniques to account for cases like the following:

(33) *Every boy’s* father thinks *he’s* a genius. (Higginbotham 1980, p. 691)
 (34) Somebody from *every city* despises *it*. (May 1985, p. 68)

In (33) and (34), a universal quantifier (*every boy* or *every city*) co-varies with a later pronoun, seemingly without c-commanding this pronoun. This goes against theories requiring c-command for such co-variation. To capture the binding in (33), Higginbotham (1980) therefore proposes that quantifier raising (QR) can raise possessors to c-command later pronouns, and other researchers have proposed several other methods as well (see Reinhart 1987, Kayne 1994). Similarly, various analyses have been proposed to account for so-called **inverse linking** contexts like (34), where a universal quantifier inside an existential DP appears to scope above this existential (see May and Bale 2005).

However, there are plenty of cases of focus binding whose antecedents are not in positions where quantifiers may bind a later pronoun. For instance, consider the two pairs of sentences below: (35a) and (36a) show unsuccessful attempts for a quantifier to bind a later pronoun; and (35b) and (36b) show focus-bound pronouns whose antecedent is in the same position as the quantifier in the previous sentence. Furthermore, these focus-binding sentences both still allow sloppy readings:

- (35) a. *At least one woman with *every lipstick color* appeared on the news wearing *it*. (after May and Bale 2005, p. 641)
 b. At least one woman with *Electric Orange lipstick* appeared on the news wearing *it*. At least one woman with Vivid Rose lipstick did, too. [sloppy preferred]
- (36) a. *A boy that annoyed *every mother* asked *her* for another cookie. (after May and Bale 2005, p. 641)
 b. A boy that annoyed *Mary* asked *her* for another cookie. A boy that annoyed Sally did, too. [strict, sloppy]

I will therefore assume that focus-bound pronouns are neither derived via QR nor any extraordinary scoping method proposed to capture cases like (33) or inverse linking cases like (34). Instead, the focus constraints presented above allow the assignment to change slightly in order to give the GIVEN, focus-bound pronouns antecedents.

2.3.2 E-type analyses

Example (37) is an additional case where a pronoun (*him*) allows a sloppy interpretation despite having an antecedent (*John*) in a syntactic island and hence unable to c-command the pronoun (Wescoat 1989, Dalrymple et al. 1991, Fiengo and May 1994, Hardt 1993).¹¹ Tomioka (1999) suggests that the pronoun *him* is an E-type pronoun (Evans 1980), whose meaning approximates the definite description in (38). Thus, the pronoun is not bound to *John*, but rather contains a pronoun bound to the relative pronoun below *officer*:

- (37) The police officer who arrested John_{*i*} insulted him_{*i*}, and the one who arrested Bill_{*j*} did ~~insult him_{*i,j*}~~, too. (strict, sloppy)
- (38) The police officer who_{*i*} arrested John insulted the man he_{*i*} arrested, and the one who_{*j*} arrested Bill did ~~insult the man he_{*i,j*} arrested~~, too. (strict, sloppy)

Although this approach works well for (37), it is unclear how Tomioka's system would handle cases like (39), where the two relative clauses use different verbs. Furthermore, several authors have pointed out an erroneous prediction of this analysis (Elbourne 2001, 2005, Hardt 2003): the sentence in (40a), which features an explicit definite description, allows both a strict interpretation –

¹¹See also Lappin (1984) and Evans (1988), cited in Hardt (2003).

where Officer Jones and the arresting officer insult the same man – and a sloppy one – where the two officers each insulted the (possibly different) men they arrested. However, the sentence in (40b), which features a pronoun, lacks the sloppy reading, casting doubt on whether the pronoun actually has a meaning approximating the definite description.

- (39) The officer who arrested John insulted him, and the one who booked Bill did, too.
- (40) a. The police officer who_i arrested John insulted the man he_i arrested, and Officer Jones_j did, too. (strict, sloppy)
 b. The police officer who_i arrested John insulted him, and Officer Jones_j did, too. (strict, *sloppy)

Instead, I propose that these cases, too, are captured via focus binding, as sketched in (41). The GIVEN pronoun *him* takes *John* as an antecedent, and therefore is interpreted under an altered assignment returning John for index *i*. This makes the pronoun a suitable antecedent for a sloppy identity reading, because in another discourse context, the pronoun could receive a different interpretation.

- (41) [s The officer who [VP^a arrested John] [VP_G^b insulted him_i]]
- 

Elbourne (2008) instead analyzes (37) using the phenomenon of NP ellipsis with split antecedents shown in (42). NP ellipsis is similar to VP ellipsis, except that the material that is elided (i.e., unpronounced) is an NP instead of a VP. As Elbourne points out, though, the simple structure in (42a) is not quite right for split antecedent cases, since it could mean that Mary borrowed Bill’s screwdriver instead of his hammer. Thus, he proposes a richer structure, akin to that shown in (42b). This suggests the meaning shown in (43) for (37):

- (42) Mary needed a hammer. Jill needed a screwdriver. Each borrowed Bill’s.
 a. ... Each borrowed Bill’s ~~hammer or screwdriver~~.
 b. ... Each_i borrowed Bill’s ~~unique item out of {hammer, screwdriver} that she_i needed~~.
- (43) The police officer who_i arrested John insulted him [≈ the member of {John,Bill} who he_i arrested], and the one who_j arrested Bill did ~~insult the member of {John,Bill} who he_{i,j} arrested~~, too.

This analysis avoids the problem in (39), but a number of issues remain. First, it suffers from the same problem Elbourne (2001, 2005) pointed out via (40). Imagine that a different officer arrested John and Officer Jones arrested Bill. Thus, the relation “the member of {John,Bill} who *x* arrested” is salient, but even so, (40b) can only mean that Officer Jones insulted John (the strict reading) not Bill (the sloppy reading).

Also, there are cases of sloppy identity where analogous structures do not allow NP ellipsis. For instance, (44a) shows a case of VP ellipsis where sloppy identity shifts the referent of a pronoun from Obama to Romney, but the same configuration in (44b) does not allow NP ellipsis at all (cf. *I love Democrats and have dated several*). Similarly, (45a) is a case of where a deaccented pronoun can receive a sloppy identity reading but the same configuration in (45b) does not allow NP ellipsis. Interestingly, (45a) is a case where an E-type or Elbourne (2008) analysis would predict an i-within-i violation akin to that shown in (45c), but none is found.

- (44) a. Articles that portrayed him_i as conservative never bothered Obama_i as much as articles that DIDN't ~~portray him_{i,j} as conservative~~ bothered Romney_j. (strict, sloppy)
 b. *Articles that portray one/at least two/several/most/Clinton's as conservative never bothered Democrats (... as much as articles that DIDN't bothered Republicans).
- (45) a. Rumors about him never bothered Biden as much as FACTS about him bothered Ryan.
 b. *Rumors about mine never bothered your mom (... as much as FACTS about mine bothered your dad).
 c. *[Rumors about the man they_i bothered]_i ...

Therefore, E-type and related analyses of such unusual sloppy identity are not empirically adequate.¹²

2.3.3 Previous discourse analyses

Two other relevant approaches to sloppy identity are much closer in spirit to the current approach I take in this paper. First, in Hardt (1993) and subsequent papers (Hardt 1999, 2003), Daniel Hardt has argued for a discourse account of sloppy identity. He uses the Centering Theory (Grosz et al. 1995) notion of a **discourse center** – the individual a phrase or sentence is most centrally “about.” Hardt analyzes sloppy identity readings as cases where a pronoun refers inherently to a discourse center (marked below with a subscript *), which shifts from one clause to the next:

- (46) Sherlock* saw his* hat, and Watson* did ~~saw his* hat~~, too.

The expression introducing a discourse center (such as *Sherlock* and *Watson* in (46)) need not c-command co-referent pronouns, and therefore Hardt's system does allow pronouns without c-commanding antecedents to license sloppy identity readings.

Since pronouns referring to the discourse center would presumably typically be unaccented (Hirschberg and Ward 1991, Nakatani 1997), the predictions of Hardt's theory and the focus-binding account align pretty well. However, there

¹²See Section 5.4 below for a suggestion of how the focus-binding account might handle cataphoric cases such as these.

are cases that can distinguish the two. For instance, consider the following cases of “double” sloppy identity (where indices merely indicate co-reference):

- (47) Whenever John_{1*} plays Sally₂, he_{1*} later claims that he_{1*} has beaten her₁. Whenever Bill_{3*} plays Mary₄, he_{3*} does ~~later claim that he_{3*} has beaten her₄~~, too.
- (48) Glenda₁’s husband Fred_{2*} think she₁ left him_{2*}, and Bertha₃’s husband Edwin_{4*} does ~~thinks she₃ left him_{4*}~~, too.

Here, Hardt’s analysis works well for the unspoken pronouns *he* and *him* in the second clauses of (47) and (48). However, since under Centering Theory each phrase has only one discourse center¹³, Hardt’s system does not explain how the unspoken pronouns *her* and *she* receive their reference. A focus-binding account has no such constraint on the number of sloppy pronouns.

The second discourse-based approach, due to Claire Gardent, is even closer to the approach taken in this paper. Gardent (1997) argues that sloppy identity – wherever it appears – is due to strong constraints on parallel phrases (akin to Rooth’s (1992) contrasting phrases). Gardent (2000) extends this analysis to explain the properties of any pronoun in a deaccented context: such pronouns, she claims, must refer back to an item in a parallel phrase.

Gardent’s analysis attempts to explain the interpretation of the second pronoun in a sloppy identity case (the one that is either elided or severely deaccented). This paper, on the other hand, explains the interpretation of the first pronoun in sloppy identity cases (whether or not it is followed up by a second elided or deaccented pronoun). For instance in (20) above, repeated here with deaccenting instead of ellipsis, Gardent’s analysis would apply to the second, underlined pronoun *him*, within the deaccented phrase:

- (49) Kennedy looked good. People voted for him.
Nixon looked bad. People didn’t vote for him.

Gardent has nothing to say about the first pronoun *him*, which I call a focus-bound pronoun even when no subsequent ellipsis or deaccented phrase targets it. In fact, Gardent’s analysis would fail on this pronoun, since its antecedent *Kennedy* is in a highly non-parallel clause. Still, my analysis can be viewed as a generalization of Gardent’s basic idea, applied outside the contexts where sloppy identity arises, extended to non-parallel clauses, and couched in a general theory of focus.

2.4 Interim conclusion

This section has provided a new formalization of the focus constraint GIVENness introduced by Schwarzschild (1999). This formalization included a mechanism for creating a local assignment function for the interpretation of GIVEN pro-

¹³Technically, it has one **backward-looking center** and several **forward-looking centers** (Grosz et al. 1995), but it is the backward-looking center that Hardt (1993, 1999) employs.

nouns. Such pronouns are interpreted so as to satisfy the GIVENNESS requirements of phrases that contain them, even if it means assigning a value to the pronoun different from the value assigned by the contextually provided global assignment. This is the formal definition, then, of a focus-bound pronoun: one whose value is set in order to satisfy GIVENNESS.

3 Paycheck pronouns

This section will demonstrate how the focus binding account can capture the phenomenon known as paycheck pronouns. A **paycheck pronoun** is the name for a pronoun that co-varies not with some c-commanding quantifier but rather with an item merely related to some c-commanding quantifier. For instance, the pronouns *it* in (50a) and (51a) represent the paycheck related to the employees being quantified over. All major proposals have concluded that paycheck pronouns are complex, effectively containing a pronoun bound by a higher quantifier.¹⁴ This view is supported by the fact that the (a) sentences in (50) and (51) are roughly synonymous with the (b) sentences, where the paycheck pronoun has been replaced by a definite description containing a bound pronoun:

- (50) a. The woman who deposited her paycheck was wiser than the woman who spent it. (cf. Karttunen 1969, Ex. (18), p. 114)
 b. The woman who deposited her paycheck was wiser than [the woman]_{*i*} who spent her_{*i*} paycheck.
- (51) a. Philip deposited his paycheck. Everyone else spent it. (cf. Cooper 1979, Ex. (48), p. 77)
 b. Philip deposited his paycheck. [Everyone else]_{*i*} spent their_{*i*} paycheck.

The proposals vary in how this meaning is derived: in some, a process of ellipsis deletes the noun *paycheck* in the second clause under identity to the previous mention of this noun; in others, a hidden pronoun picks up the relational meaning of the previous mention of the noun *paycheck*, namely $\lambda x.x$'s paycheck. Even Gardent (1997), whose system involves strong parallelism constraints akin to mine above, assumes a special complex meaning for paycheck pronouns, different from that for referential and bound pronouns.

Keshet (2011) gives several empirical arguments against such proposals, including an argument involving so-called **Weak Crossover** effects (Postal 1971).¹⁵ Consider, for instance, (52), which presents a question followed by two different answers: an answer using a paycheck pronoun in (52a) and an answer using a full definite description in (52b):

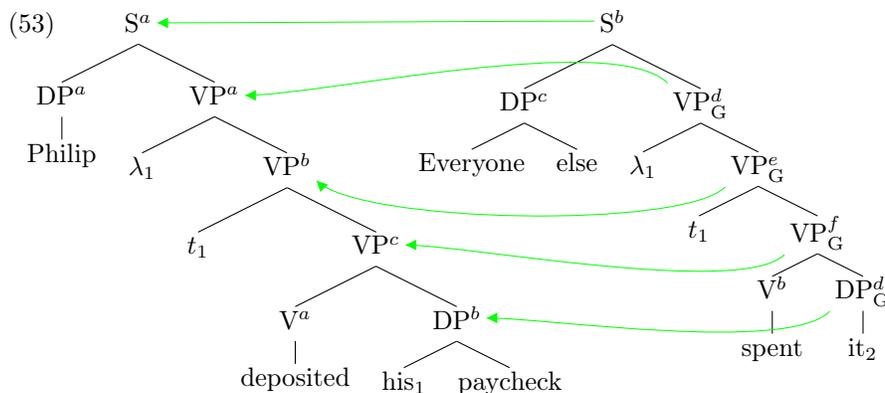
¹⁴See Karttunen (1969), Partee (1970, 1975), Jacobson (1977, 2000), Cooper (1979), Engdahl (1986), Heim (1990), and Elbourne (2005). Or, for a thorough summary, just read Jacobson (2000, Section 2.3, pp. 87-90).

¹⁵Jacobson (1977, 2000) argues that paycheck pronouns obey Weak Crossover constraints. See Keshet (2011, Section 5) for a refutation of Jacobson's arguments.

- (52) Q: Which man at the surgery clinic is happier?
- The man whose surgery cured him is happier than the man whom it paralyzed for life.
 - *The man whose surgery cured him is happier than the man whom_{*i*} his_{*i*} surgery paralyzed *t_i* for life.

Weak Crossover constraints rule out (52b), due to the fact that the bound pronoun *his* intervenes between the relative operator *whom* and its corresponding gap/trace. If the paycheck pronoun *it* in (52a) truly contained a bound pronoun akin to the one in (52b), this sentence would be ruled out as well. However, the version with the paycheck pronoun sounds fine, casting doubt on the theories where paycheck pronouns contain bound variables. Instead, I will explain how the focus binding account explains paycheck sentences without complex meanings for these pronouns.

The machinery introduced for independent reasons in Section 2 above suffices to capture paycheck pronouns. In other words, what have been known as paycheck pronouns heretofore are just focus-bound pronouns whose antecedents are definites containing bound pronouns. To see how this works, consider the structure in (53) for (51a) above. In a context where (53) is spoken out-of-the-blue, most nodes in S^a will not be GIVEN. However, as illustrated by the arrows in (53), many nodes in S^b can find a suitable antecedent in S^a and therefore be GIVEN:



Crucially, under the interpretation principle in (27) above, the node DP^d (*it₂*) can match the node DP^b (*his₁ paycheck*) under an assignment g . In order to establish such a match, there must be a modification m such that $[[DP^b]]^{g^m} \in [[DP^d]]^{f.g^m}$. But any modification m where $m(2)$ returns $g(1)$'s paycheck will satisfy this requirement. For instance, the modified functions $[1 \rightarrow \text{Philip}, 2 \rightarrow \text{Philip's paycheck}]$, $[1 \rightarrow \text{Mary}, 2 \rightarrow \text{Mary's paycheck}]$, and indeed any of the form $[1 \rightarrow x, 2 \rightarrow x\text{'s paycheck}]$ for an individual x would fit the bill. Now, assuming that the λ_1 operator under VP^d introduces the variable x , we can choose the modified assignment g^m corresponding to this individual x , namely $[1 \rightarrow x, 2 \rightarrow x\text{'s paycheck}]$. Therefore, DP^d will denote x 's paycheck, where x is

the argument to the λ function denoted by VP^d . This yields a meaning for this function as follows: $[\lambda x . x \text{ spent } x\text{'s paycheck}]$. In this case, since the quantifier *Everyone else* combines with VP^d , DP^d will effectively denote each employee's paycheck (in turn), the correct, co-varying meaning for the paycheck pronoun.¹⁶

The case in (50a) above proceeds similarly. Although the overall structure of (50a) is distinct from the case in (53), the node labeled VP^d in (53) is almost precisely the structure needed to represent the relative clause *who spent it* in (50a). In addition, VP^a in (53) is essentially a suitable structure for the relative clause *who deposited her paycheck* in (50a). Thus, the analysis for this node can proceed analogously, yielding the same denotation: $[\lambda x . x \text{ spent } x\text{'s paycheck}]$. This is again the correct meaning for this paycheck example.

One further advantage to the focus binding account of paycheck pronouns is how it handles more complex examples, such as the following case based on Cooper (1979, p. 79):

- (54) The new ruling requires [each professor]₁ to make public to [each student of theirs]₁₂ the semester report which they₁ wrote about them₂. However, [each professor we interviewed]₁ told us that [not every student]₂ would want to see it₃.

The pronoun *it*₃ in (54) can be interpreted like the definite description *the semester report which they₁ wrote about them₂*. Notice that this contains two bound variables, requiring a generalization of most other accounts of paycheck pronouns from one-place to two-place predicates. Not so under the focus binding account, though: since the pronoun is GIVEN, it is interpreted under a modification g^m of the original assignment g such that $g^m(3)$ returns the report that $g(1)$ wrote about $g(2)$. Thus, the focus binding hypothesis, along with the independent rules of focus structure can handle paycheck pronouns more adequately and simply than existing proposals.

4 Alternatives

The antecedents considered thus far for GIVEN nodes have all been type- $\langle e \rangle$, and have all been singular, non-conjoined items. But other types of expressions can provide focus antecedents, as shown in the following series of examples

- (55) a. (i) Who were you talking to at the party? (ii) I liked her.
 b. (i) I met a woman at the party. (ii) I liked her.
 c. (i) I saw Sherlock or Watson from afar.
 (ii) I wasn't close enough to recognize him.

In (55a), the apparent antecedent for the pronoun is the wh-word *who*; in (55b), it is an indefinite DP (*a woman*); in (55c), a disjunction (*Sherlock or Watson*)

¹⁶Note, too, that this analysis correctly predicts the obligatory prosody of S^b : accents on the NEW items *Everyone else* and *spent* but none on the GIVEN item *it*.

seems to act as the antecedent. Just to verify that the pronouns in (55) are really focus bound, consider the following sloppy identity contexts:

- (56) a. Who_i was John talking to at the party? I liked her_i.
 Who_j was BILL talking to at the party? I sure DIDN'T ~~like her_j~~.
 b. I met a woman_i at the party. I liked her_i.
 I met a woman_j onLINE. I DIDN'T ~~like her_j~~.
 c. When I see [Holmes or Watson]_i, I recognize him_i.
 When I see [Hopkins or LESTRADE]_j, I DON'T ~~recognize him_j~~.

Since these sloppy identity readings are allowed despite a lack of c-command, I will assume that these are indeed cases of focus binding.

The feature all the antecedent sentences in (55) share is that they can all be analyzed using sets of alternatives. For instance, the (i) sentences in (55) can be understood using the sets in (57):

- (57) a. $\left\{ \begin{array}{l} \text{You were talking to Sally,} \\ \text{You were talking to Jill,} \\ \text{You were talking to Dara,} \\ \dots \end{array} \right\}$ b. $\left\{ \begin{array}{l} \text{I met Sally at the party,} \\ \text{I met Jill at the party,} \\ \text{I met Dara at the party,} \\ \dots \end{array} \right\}$
 c. $\{ \text{I saw Sherlock from afar, I saw Watson from afar} \}$

The sets in (57) each contain only sentences created using single proper names – no conjunctions or disjunctions of names or more complex DPs are used. The set in (57a) represents potential answers to the question in (55a). The elements of (57b), when combined via disjunction, form a meaning synonymous with the (i) sentence of (55b); similarly, the disjunction of (57c)'s elements derives the (i) sentence in (55c). This section examines such **alternative-denoting** antecedents.

Recall that the basic project of this paper is to explore how the Focus Binding Hypothesis from (5) – along with independent rules of focus structure – can explain the interpretation of GIVEN pronouns. In order to understand these new cases, therefore, I will first explore the focus structure constraints in effect in similar cases without pronouns. To that end, the first three subsections below adapt existing rules of focus theory to account for alternative-denoting antecedents. The rest of the section then explains how this system affects pronoun interpretation, deriving the cases in (55) above, among others.

4.1 Generating alternatives

Even before we can see how alternative-denoting sentences affect focus structure, we must see how these sentences derive their interpretations. Hamblin (1973) proposed that questions denote the set of their potential answers, as shown in (56a) for (55a). These sets are calculated using a procedure almost identical to the one used to calculate focus semantic values. Hamblin assigned a set of individuals as the (ordinary) semantic value of a *wh*-word, for instance {Sally, Jill, Dara, ...} for *who* in this case. These sets then combined pointwise with

higher material such as *talking to* to form sets of higher-type denotations, up to the matrix level shown in (56a). A valid response to a question generally is a member of its denotation set.

Later, Kratzer and Shimoyama (2002), following Ramchand (1997), Hagstrom (1998) and Shimoyama (1999, 2001), extended the Hamblin system to analyze quantified DPs such as *a woman* in (56b). They proposed that all ordinary semantic values – not just those representing questions – are sets. Most items simply denote the singleton set containing their traditional denotation, as shown in (58a). However, indefinites like *a woman* denote larger sets, as shown in (58b):

- (58) a. $\llbracket \text{Sally} \rrbracket = \{\text{Sally}\}$ b. $\llbracket \text{a woman} \rrbracket = \{\text{Sally, Jill, Dara, \dots}\}$

Just as in the previous systems, these denotation sets combine pointwise to form the denotations of higher nodes, such as the sentence denotation in (57b). Last, Kratzer and Shimoyama (2002) assume an existential closure operator \exists that applies to sets of propositions such as (57b) to return the proposition that is true whenever at least one of the alternative propositions is true. This is equivalent to taking the disjunction of all these alternative propositions, yielding the correct interpretation for such a sentence.

Alonso-Ovalle (2006) extends this system further to capture disjunctions like the subject of (55c). He proposes that *or* forms the union of its two argument sets, as shown in (59). These sets combine pointwise with higher nodes, as before, to form a denotation set as in (57c). And again, the \exists operator combines with a sentence containing a disjunction to return the proposition that is true when one alternative proposition in the denotation of the sentence is true.

- (59) a. $\llbracket \text{Sherlock} \rrbracket = \{\text{Sherlock}\}$, $\llbracket \text{Watson} \rrbracket = \{\text{Watson}\}$
 b. $\llbracket \text{Sherlock or Watson} \rrbracket = \llbracket \text{Sherlock} \rrbracket \cup \llbracket \text{Watson} \rrbracket$
 $= \{\text{Sherlock, Watson}\}$

4.2 Alternatives as focus antecedents

With these denotations in place, I will next consider non-pronominal GIVEN items whose antecedents are alternative-denoting clauses, such as those in the three examples below. In each case, an alternative-denoting sentence is shown, along with two potential subsequent sentences. The (a) sentences, while somewhat repetitive, are much more felicitous than the (b) sentences, where an item that ought to be GIVEN is instead accented as if it were NEW.¹⁷ This pattern indicates that alternative-denoting items can in fact act as focus antecedents for later GIVEN items.

- (60) Who were you talking to at the party?
 a. I liked [the woman you were talking to]_G.
 b. #I liked the woman you were TALKing to.

¹⁷See Section 4.3 below for more details on why this sounds odd.

- (61) I met a woman at the party.
 a. I liked [the woman I met]_G.
 b. #I liked the woman I MET.
- (62) I saw Sherlock or Watson from afar.
 a. I wasn't close enough to recognize [the man I saw]_G.
 b. #I wasn't close enough to recognize the man I SAW.

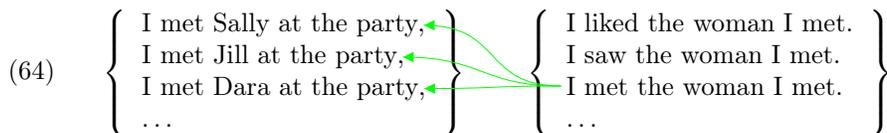
This raises some questions for the focus theory presented thus far, however, because the denotations of the definite descriptions above and their apparent antecedents do not match. For instance *a woman* does not match (any focus alternative of) *the woman I met*, as required by GIVENness.

Since we are taking these antecedents to denote sets of alternatives, though, a potential amendment immediately comes to mind: why not simply require that (one focus alternative of) a GIVEN phrase be a member of the denotation of the antecedent phrase? This does indeed seem to be a necessary condition for such phrases – e.g., the woman the speaker met is indeed a woman; but unfortunately it is not a sufficient condition. For instance, under this understanding of GIVENness, any definite description denoting a woman should be GIVEN after the phrase *a woman*, contrary to fact:

- (63) I met a woman at the party.
 a. # I liked [the woman I didn't meet]_G (better than her).
 b. I liked the woman I DIDN't meet (better than her).

In (63), the phrase *the woman I didn't meet* cannot be GIVEN, even after the mention of the phrase *a woman*. It seems that not only the DP *a woman* but also the surrounding material *I met . . . at a party* is important for determining GIVENness of a later definite description. In other words, only the woman the speaker actually met at the party counts as GIVEN.

I will capture this intuition in two steps. First, I propose that in such cases, the whole second sentence containing the GIVEN definite description must be GIVEN itself. (More on this in Section 4.3.) Second, I propose that this GIVEN sentence takes as its focus antecedent the alternative in the denotation of the first sentence that is actually true in the world of evaluation. To illustrate this approach, consider in (64) the alternative set denoted by (61) and the focus semantic value of (61a):



The focus alternative of interest here is *I met the woman I met*. Although this may seem like a tautology, under certain assumptions it is not. In particular, I assume that the definite description *the woman I met* here is fixed/rigid in its denotation, at least for the purposes of generating focus alternatives. In other

words, if the woman the speaker met in the world of evaluation is actually Jill, then the relevant focus alternative will be the proposition “ $\lambda w . \text{I met Jill in } w$ ” and not “ $\lambda w . \text{I met [the woman I met in } w] \text{ in } w$.”

Under this view, then, this focus alternative will match whichever alternative in the first set is actually true in the world of evaluation. For instance, if the speaker met Sally, one focus alternative will be *I met Sally*, and this matches the first alternative shown in the set to the left in (64). Similarly, the focus alternative will find an antecedent if the speaker met Jill or Dara, too. Thus (61a) is GIVEN in this context. On the other hand, (63a) is not GIVEN under this view. Even if we interpret *the woman I didn't meet* as denoting one specific woman, this woman will never be the woman the speaker met in the world of evaluation. Therefore, no focus alternative of (63a) will ever match the alternative of the antecedent sentence that is true in the world of evaluation.

In order to formalize these observations, I will borrow terminology from quantum physics. We can imagine an alternative-denoting sentence as existing in a number of potential states, each represented by one alternative proposition in its denotation. In a given world and time of evaluation, these states collapse into a single proposition – the one true in that world and time. I define the following function to represent the “collapse” of a set of alternatives at a world/time:

- (65) Collapse of a Proposition Set (to be revised):
 $\text{COLLAPSE}(\Phi)(w)$, for a set of propositions Φ and a world/time w , only returns a value if exactly one proposition $\phi \in \Phi$ is such that $\phi(w) = 1$. If so, $\text{COLLAPSE}(\Phi)(w)$ returns this ϕ .

An updated condition on the interpretation of GIVEN items based on the ideas just developed is shown below:

- (66) Interpretation of GIVEN Nodes (final version)
 For any GIVEN node α_G , world/time w , and assignment g , $\llbracket \alpha \rrbracket^{w,g}$ returns a value iff there is a salient node β and an assignment modification m such that
- a. $\llbracket \beta \rrbracket^{g^m} \cap \llbracket \alpha \rrbracket^{f,g^m} \neq \emptyset$, and
 - b. if $\llbracket \alpha \rrbracket^{g^m} \subseteq D_{(st)}$, $\text{COLLAPSE}(\llbracket \beta \rrbracket^{g^m})(w) \in \llbracket \alpha \rrbracket^{f,g^m}$.
- If so, $\llbracket \alpha \rrbracket^g = \llbracket \alpha \rrbracket^{g^m}$.

Under this new principle, the focus semantic value of each GIVEN node α must overlap with the ordinary semantic value of some antecedent. If the node is a proposition (technically a set of propositions under the Kratzer and Shimoyama system), though, there is an added requirement that the collapse of this antecedent be one of α 's focus alternatives. Again, all of these requirements may hold under a modification to the contextual assignment function.

4.3 Constraints on G-marking

I crucially assumed above that certain whole sentences were GIVEN when items within these sentences were GIVEN. Now I will explore why this might be the case. One aspect of the system due to Schwarzschild (1999) that I have not mentioned so far is that structures with more G-marking – as long as it is valid – are preferred over those with less G-marking. This explains the contrast between (67a) and (67b) as an answer to the question *Where is Sherlock?*:

- (67) a. #SHERlock is upSTAIRS. b. Sherlock_G is upSTAIRS.

In (67a), the node *Sherlock* could validly be G-marked, as it is in (67b), and yet it is not. Therefore (67a) is ruled out in competition with (67b). This observation is captured via the following optimality-theoretic constraint (cf. the AVOIDF constraint in Schwarzschild 1999):

- (68) MAXIMIZE_G: G-mark as many GIVEN nodes as possible.

Schwarzschild (1999) also presents sentences where two different patterns of G-marking are possible having the same number of G-marked nodes. Take, for instance, the sentence in (69), and the two G-marked structures in (70) representing different completions of (69):

- (69) John telephoned Mary and then ... (Schwarzschild's (64a), p. 171)

- (70) a. ... [_{S_G} [_{DP} MARY] [_{VP_G} [_{V_G} telephoned] [_{DP} SUE]]]]
 b. ... [_S [_{DP_G} Mary] [_{VP_G} [_{V_G} telephoned] [_{DP} SUE]]]]

Schwarzschild notes that the version in (70b), where *Mary* is not accented, is odd in this context. In our system, the difference in accenting corresponds to whether *Mary* is G-marked, as in (70b), or not, as in (70a). Now, both versions in (70) have the same number of G-marked constituents, and yet the version in (70a) is apparently preferred over the one in (70b). Schwarzschild does not explain why this “tie” seems to favor G-marking the sentence over G-marking the DP within the sentence, and I will not offer a real explanation either; it is enough for our purposes to note that the DP is obligatorily accented in such situations. For now, we can simply stipulate the following constraint (to be ranked lower than MAXIMIZE_G):

- (71) HIGHEST_G: Prefer structures where higher nodes are G-marked.

These two constraints conspire to ensure that no DP may be GIVEN without the sentence containing it also being GIVEN, as assumed above.¹⁸

¹⁸There also seems to be a constraint favoring larger antecedents over smaller ones. For instance, even though the sentence *John telephone[s] Sue* is part of the question in (i), the answer requires an accent on Sue. This would make sense if the antecedent had to be the entire question and not just the sub-clause *did John telephone Sue*.

- (i) Did John telephone Mary or did John telephone Sue? (cf. Schwarzschild 1999, p. 166)
 a. He_G telephoned_G SUE. b. # He_G telephoned_G Sue_G.

4.4 Alternatives as pronoun antecedents

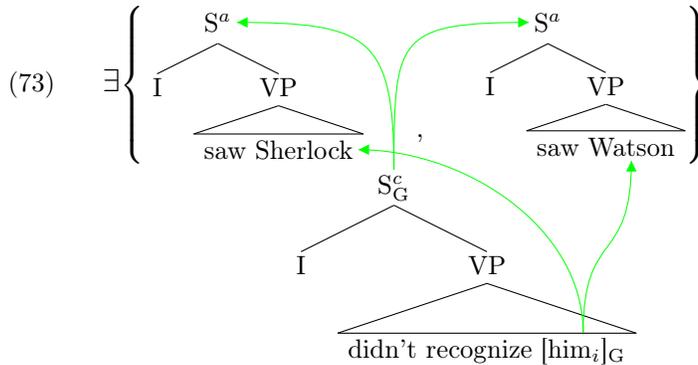
Our system is now able to analyze the cases in (55) that began this section. Before I go through this analysis, though, notice once more that the machinery has been designed for expressions other than pronouns. In this subsection, I will apply the same machinery to cases with GIVEN pronouns, yielding the correct meanings based solely on these independently motivated focus constraints.

Beginning with (55c), repeated in (72a), we can now see how a subsequent sentence with a pronoun such as (72b) is interpreted:

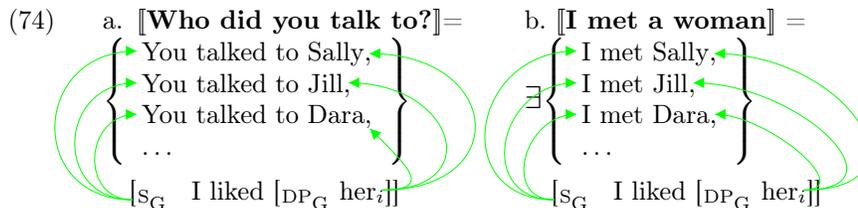
- (72) a. I saw Sherlock or Watson from afar.
 b. I wasn't close enough to recognize $[\text{him}_i]_G$.

According to the definition in (66), (72b) will only have a focus antecedent in a world w and under an assignment g if the collapse of a previous sentence in w matches one of (72b)'s focus alternatives under some modification of g . In evaluation worlds where Sherlock is upstairs, an appropriately modified assignment – call it g^S – under which (72b) has an antecedent is one where $g^S(i)$ returns Sherlock; in worlds where Watson is upstairs, we need a modified assignment g^W such that $g^W(i)$ returns Watson. Either way, though, there is an assignment that gives (72b) a focus antecedent. Similarly, under either assignment g^S or g^W , the pronoun itself will find an antecedent in one of the proper names in (72a). In this way, the pronoun comes to have a meaning quite similar to the definite description *the man I saw* or *the one out of Sherlock and Watson I saw*.

I have illustrated these antecedent relationships in the diagram in (73), which shows two different sets of arrows from the GIVEN items to their antecedent alternatives. The alternative labeled S^a is the collapse of (72a) when Sherlock is upstairs, and the arrows to nodes of S^a represent antecedents under g^S . The alternative labeled S^b is the collapse when Watson is upstairs, and the arrows leading there represent antecedents under g^W .



Similar diagrams for (55a) and (55b) are shown in (74a) and (74b):



The ordinary semantic value for the question in (74a) denotes the set of propositions shown – i.e., the question’s potential answers. The collapse of this denotation in a world w is the answer true in w . In different worlds w , a possibly different modification m to the assignment g can be used to evaluate S, but in each case, $g^m(i)$ will return the woman the addressee talked to in w . This allows S to take whichever alternative answer in (74a) is the collapse in w , as illustrated by the arrows on the left of the alternative set. The GIVEN pronoun will then take one of the alternatives in the denotation of the DP object as its focus antecedent, as illustrated by the arrows on the righthand side of the alternative set.

The ordinary semantic value for the sentence in (74b) denotes the existential closure (i.e., the disjunction) of the set of propositions shown. The collapse of this denotation in a world w is the (sole) proposition in this set that is true in w . In each world of evaluation w , a possibly different modification m of the assignment g can be used to evaluate S, but in each case, $g^m(i)$ will return the woman the speaker met in w . This allows S to take whichever alternative proposition in (74b) is the collapse in w , as illustrated by the arrows on the left of the alternative set. The GIVEN pronoun will then take one of the alternatives in the denotation of the DP object as its focus antecedent, as illustrated by the arrows on the righthand side of the alternative set.

4.5 Downward entailing antecedents

This system also easily explains the case due to Evans (1977, 1980) in (75). Evans points out that (75) is a perfectly fine sentence, but it has an interesting meaning. The pronoun *he* in the second clause seems to pick out the same man as the subject of the first clause – as if *he* were a bound pronoun – but (75) does not have the same meaning as (76), which clearly has bound pronouns:

(75) Just one man drank champagne, and he_{*i*} was ill.
(Evans 1980, Ex. (20), p. 342)

(76) Just one man is such that he drank champagne and he was ill.

The case in (76), but not the one in (75), is true when two men drank champagne (but only one of them got sick). This observation is easily captured in the system presented above, if we give the first clause of (75) the following denotation:

$$(77) \quad \exists \left\{ \begin{array}{l} \text{Just Bill drank champagne, Just John drank champagne,} \\ \text{Just Fred drank champagne, } \dots \end{array} \right\}$$

The collapse of the proposition set in (77) in different worlds will always contain only one man: Bill, or John, or Fred, etc. This man will be the referent for *he*.

Evans also points out that negated versions of many quantifiers sound odd with a subsequent pronoun. Many of his cases, such as (78), simply provide no suitable focus antecedent to the sentence containing the pronoun. However, let us examine a related sentence that at first blush seems to present a problem for the system presented here; this case is shown in (79), with a suitable structure:

(78) #John owns no sheep and Harry vaccinates them in the spring. (Evans 1980, Ex. (15), p. 340)

(79) #Not [S^a one man drank champagne], and he_i was ill.

At first glance, it seems as though the second clause should be able to take the collapse of the clause labeled S^a in (79) as its focus antecedent, exactly as in the good case in (75). In fact, though, $\text{COLLAPSE}(\llbracket S^a \rrbracket)(w)$ for the world w used to evaluate (79) does not return a value. This is because each collapse of S^a will be a proposition that some man drank champagne, and the first clause of (79) clearly asserts that no such proposition is true in w . Therefore, there can be no assignment that returns a proper value for i , and the interpretation fails.

4.6 Plurals

I next turn to focus antecedents denoting more than one entity. I will adopt the concept of plural individuals due to Link (1983), wherein the grouping of two individuals such as John and Mary – notated $\text{John} \oplus \text{Mary}$ – is itself an individual, a member of D_e . To start, consider the following short discourse:

(80) Larry, Moe, and Curly walked into a bar.
After that, $[\text{the three stooges}]_G$ needed STITCHes.

So far, so good: the definite DP *the three stooges* is GIVEN under our current system, since the antecedent phrase *Larry, Moe, and Curly* has the same denotation, namely $\text{Larry} \oplus \text{Moe} \oplus \text{Curly}$. However, examples quite similar to (80) do not allow GIVEN subjects, as shown in (81):

(81) Larry, Moe, and Curly walked into a bar.
a. # Curly_G needed STITCHes. (cf. $\checkmark \text{Curly}$ needed. . .)
b. # $[\text{Moe and Curly}]_G$ needed STITCHes. (cf. $\checkmark [\text{Moe and Curly}]$. . .)

Here we see that it sounds odd to treat an DP as GIVEN if it only refers to a subset of a potentially larger group of GIVEN individuals. In (81a), the single name *Curly* does not count as GIVEN in this context, despite the quite recent mention of this very name. Similarly, in (81b), the conjunction of two out of the three names fares no better as a GIVEN item. It seems as though only the maximally large potentially GIVEN item actually counts as GIVEN.

As discussed above, the HIGHESTG constraint requires a sentence containing a GIVEN DP to be GIVEN itself. The only way, therefore, for a subsequent DP to be GIVEN in this two-sentence discourse is for the whole sentence containing the DP to take the sentence *Larry, Moe, and Curly walked into a bar* as focus antecedent. This means the subsequent DP must refer to all three stooges, as in (80), rather than a subset, as in (81). Similarly, a pronoun can be GIVEN in the same context, but only under an assignment that gives the pronoun an interpretation denoting all three stooges – i.e., $\text{Larry} \oplus \text{Moe} \oplus \text{Curly}$:

- (82) Larry, Moe, and Curly walked into a bar.
 $[\text{They}_i]_G$ needed STITCHes (#but not Curly).

Plurals involving alternatives provide some further data; these cases will motivate a slight change to our system. Consider first the disjunction of plurals with its denotation set in (83) and potential subsequent sentences in (84):

- (83) a. Larry and Moe or Larry, Moe, and Curly walked into a bar.
 b. $\left\{ \begin{array}{l} \text{Larry} \oplus \text{Moe} \text{ walked into a bar,} \\ \text{Larry} \oplus \text{Moe} \oplus \text{Curly walked into a bar} \end{array} \right\}$
- (84) a. $\#[\text{Larry and Moe}]_G$ needed STITCHes.
 b. $[\text{The stooges who walked into a bar}]_G$ needed STITCHes.
 c. They_G needed STITCHes.

It seems that in a given world w , only the strongest member of (83b) that is true in w is available as a focus antecedent. For instance, in a world where all three stooges walked in, (84b) and (84c) can only denote the proposition that all three stooges needed stitches, not just Larry and Moe. (84a) is ruled out because after (83a), although we know that Larry and Moe walked in, we do not know that this is the strongest true proposition in (83b), and therefore, we do not know that (84a) is GIVEN. Evans points out a similar pattern for (85): the pronoun *them* seems to pick out all of John's sheep, in a way that a bound pronoun such as *them* in (86) does not:

- (85) John owns some sheep, and Harry vaccinates them in the spring.
 (Evans 1980, Ex. (8), p. 340)
- (86) There are some sheep such that John owns them and Harry vaccinates them in the spring.

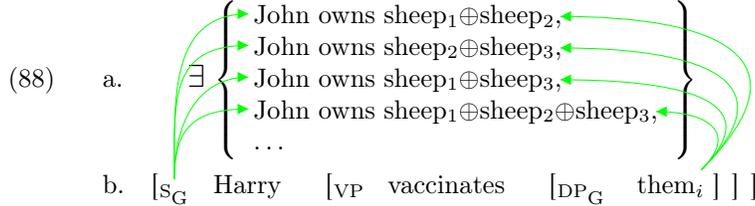
This, too, would be explained if the only alternative in the denotation set of *John owns some sheep* available as a focus antecedent is the strongest alternative true in the world of evaluation.

We will have to slightly change our definition for the COLLAPSE function in order to capture these facts:

- (87) Collapse of a Proposition Set (final official version):
 $\text{COLLAPSE}(\Phi)(w)$, for a set of propositions Φ and a world/time w , only returns a value if $\exists \phi \in \Phi$ such that $\forall \psi \in \Phi [\psi(w) = 1] \rightarrow [\phi \subseteq \psi]$. If

so, $\text{COLLAPSE}(\Phi)(w)$ returns this ϕ .

With this new definition, (85) is brought into the fold, as shown in the diagram in (88), where $\text{sheep}_1 \dots \text{sheep}_n$ are individual sheep:



The plural indefinite *some sheep* denotes the set of all groups of more than one sheep. This set combines pointwise with the rest of the sentence to form the alternative set shown in (88a). In each world w , there is a focus alternative to (88b) that matches $\text{COLLAPSE}(\llbracket(88a)\rrbracket^{g^m})(w)$ under the modified assignment g^m such that $g^m(i)$ returns the largest group of sheep that John owns in w . In particular, the focus alternative “John owns them_{*i*}” matches the collapse of (88a) under this g^m .

Thus, this section has shown how independently motivated constraints on GIVEN items whose antecedents are alternative-denoting can explain the interpretation of GIVEN pronouns with alternative-denoting antecedents. Simple cases, such as (55), were captured, as well as more complex cases presented in Evans (1980).

5 Donkey anaphora

Donkey anaphora was brought to the attention of modern linguists by Geach (1962) via examples like the following:

- (89) a. Every farmer who owns a donkey beats it.
b. If a farmer owns a donkey, he beats it.

The main mystery about donkey pronouns like *it* in (89) is how they come to co-vary with an indefinite in the absence of the usual c-command relation. For instance, each farmer referenced in (89) is taken to only beat his own donkey – a co-varying interpretation – and yet in neither case does the DP *a donkey* c-command the pronoun *it*.

The topic of donkey anaphora has a deep and rich literature which I will only gesture at in this section. For the most part, I will present a positive argument for the approach described in this paper, but I will compare this approach to other major theories as I describe my own, especially that of Heim (1990). For a full introduction to the topic, I refer readers to the excellent discussion in Elbourne (2005).

5.1 Heim’s analysis

Heim, building on work due to Cooper (1979), Evans (1980), Berman (1987), and Kadmon (1987), among others, proposes that donkey pronouns are interpreted via functions made salient by prior discourse. In (89a), for instance, the pronoun *it* will denote $f(x)$ where x is the variable bound by the quantifier *every farmer who owns a donkey* and $f(x)$ is the unique donkey owned by x . As mentioned before, this is quite close to the focus binding proposal; given the indexing in (90) for Heim’s version of the example, we can describe the relationship between Heim’s proposed function f and the focus-binding account’s assignment modification m as follows: $g^m(j) = f(g^m(i))$. Since f relates a man to the only donkey he owns, and $g^m(i)$ is a man, $g^m(j)$ will be the only donkey that $g(i)$ owns.

(90) [Every man who owns a donkey]_{*i*} *t_i* beats *it_j*.

Immediately, though, this analysis (called the **E-type** analysis) runs into a problem: what happens if there are men with more than one donkey? Are such men covered by (90)? If so, in order for (90) to be true, do those men have to beat only one of their donkeys (the so-called **weak** or \exists -reading)? Or do they have to beat all of their donkeys (the **strong** or \forall -reading)?¹⁹ Although judgments vary (see Geurts 2002), most speakers agree that (90) is false if a man who owns multiple donkeys fails to beat any of them.

To tackle this problem, Heim (extending work due to Berman 1987) proposes that quantifiers like *every* and *always* quantify over **situations**, i.e., subparts of possible worlds. In particular, such quantifiers take two arguments and return the proposition that the minimal situation in which their first argument is true can be extended to a situation where their second argument is true. This move to minimal situations guarantees a unique antecedent for the pronoun, even when the larger world containing this situation does not. To see how this works, consider the following salient function f_1 and truth conditions for (90):

(91) a. $f_1(x, s) =$ the unique donkey owned by individual x in situation s
 b. For every individual x and situation s_1 such that x is a man and s_1 is a minimal situation in which x owns a donkey, there is a situation s_2 extending s_1 such that x beats $f_1(x, s_1)$ in s_2 .

These truth conditions capture our intuitions about these cases rather well. And they do indeed make claims about men that own multiple donkeys, because the minimal situation in which a man owns a donkey necessarily does not include more than one donkey that he owns. Each such minimal man-donkey situation is therefore quantified over separately, yielding the (strong) reading that each man beats each donkey he owns.

There is one problem with the Berman/Heim move to minimal situations, which I believe has gone unnoticed, involving the following variants of (89):

¹⁹See Chierchia (1992, 1995) for details on these distinct readings.

- (92) a. Every farmer who owns exactly one donkey beats it.
 b. If a farmer owns exactly one donkey, he beats it.

Intuitively, the sentences in (92) and (89) have different truth conditions. In a scenario where all single-donkey-owners beat their donkey, but some multiple-donkey-owners do not beat any of their donkeys, we generally judge the sentences in (89) to be false. However those in (92) are true in this scenario. Heim’s analysis predicts these pairs of sentences to be synonymous, though, because the set of minimal situations in which a farmer owns a donkey will be identical to the set of minimal situations in which a farmer owns exactly one donkey.

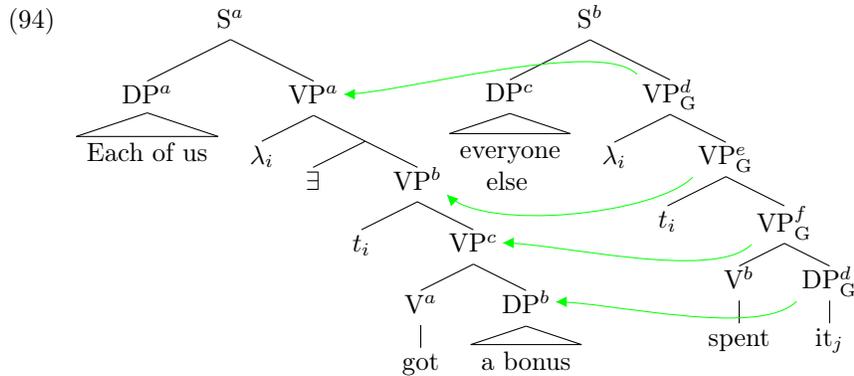
Partly for this reason, I will not adopt the minimal situation analysis. Instead, I will assume that nominal quantifiers like *every* quantify over individuals and adverbial quantifiers like *always* quantify over alternative propositions (see Sections 5.2 and 5.3 for details). This analysis will allow for a handy solution to the so-called problem of the formal link in Section 5.4 and the proportion problem in Section 5.6. I will return to the problem of uniqueness in Section 5.7.

5.2 From paychecks to donkeys

Before tackling full donkey anaphora cases, I’d like to start with the following example, which is a hybrid of a donkey pronoun and a paycheck example:

- (93) Each of us got a bonus. Sue deposited it, but everyone else spent it.

Here, the pronouns *it* have a paycheck-like meaning, akin to *his/her bonus*, despite the fact that their apparent focus antecedent is an indefinite (*a bonus*). This can be illustrated via the diagram in (94), again with arrows from GIVEN nodes to their focus antecedents.²⁰



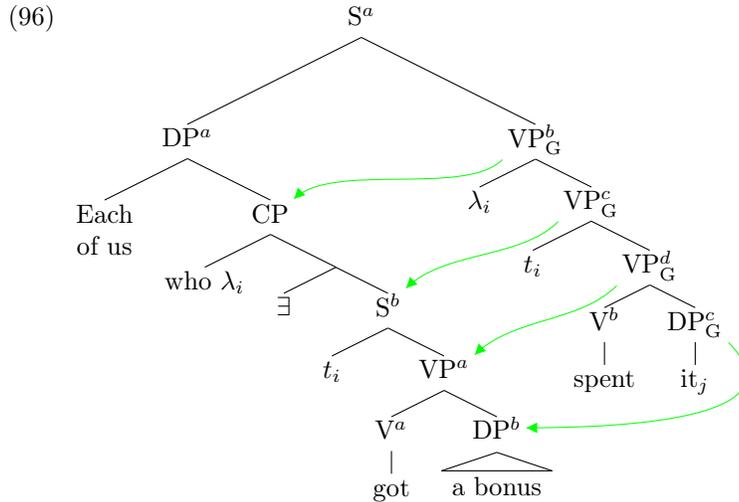
One focus alternative for VP^e above is shown in (95). In a world of utterance w and under a modified assignment g^m such that $g^m(i)$ is an employee x and

²⁰ VP^b is shown as the focus antecedent for VP^e , although technically the antecedent is the collapse of VP^b . Similarly, VP^c and DP^b are shown as focus antecedents, even though technically only one alternative in their denotations is a focus antecedent for a later node.

$g^m(j)$ is x 's bonus, $\text{COLLAPSE}(\llbracket \text{VP}^b \rrbracket^{g^m})(w)$ will return a proposition identical to $\llbracket (95) \rrbracket^{g^m}$: the proposition that employee x got x 's bonus in the world of utterance. Therefore, VP^e has a focus antecedent and will be interpreted under this assignment g^m . The rest of the GIVEN nodes will fall in line after this, yielding the correct denotation for the sentence S^b as a whole. In particular, VP^d will denote the property true of individuals who spent their own bonuses.

(95) $\lambda w . t_i$ got it_j in w

We can easily turn this example into a donkey anaphora case akin to (89a), as shown in (96), while maintaining the antecedent relationships in (94):



This time, it is the node VP^c that has (95) as its focus alternative, but the analysis proceeds analogously: in a world w and under a modified assignment g^m such that $g^m(j)$ is $g^m(i)$'s bonus, $\text{COLLAPSE}(\llbracket S^b \rrbracket^{g^m})(w)$ will return a proposition identical to $\llbracket (95) \rrbracket^{g^m}$. Therefore, VP^b will also denote the property true of individuals who spent their own bonus. In this way, once the machinery is in place to handle alternative-denoting expressions as focus antecedents, non-conditional donkey anaphora cases reduce to paycheck cases.

5.3 Conditionals

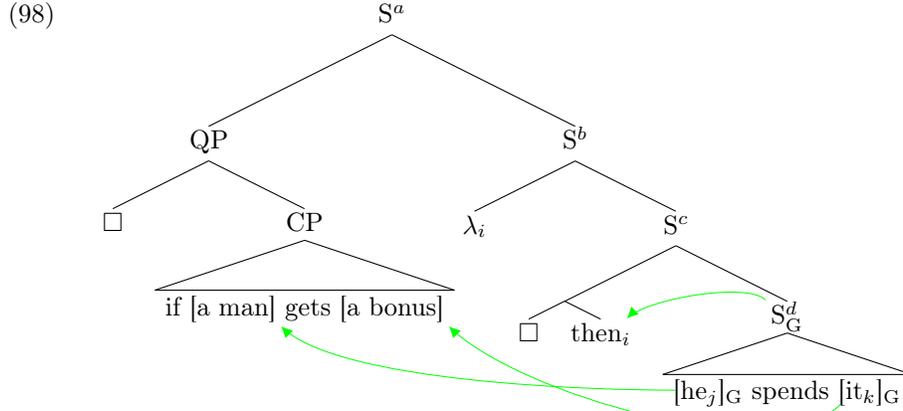
To handle conditional donkey anaphora cases, I will adapt an analysis due to Alonso-Ovalle (2006), who follows many researchers in analyzing conditionals as correlatives: constructions where a quantifier binds a resumptive pronoun later in the sentence.²¹ In an English conditional, this resumptive pronoun is either the word *then* or a silent counterpart of this word. In Alonso-Ovalle's analysis, this pronoun *then* is bound by a quantifier that ranges over the alternative

²¹Alonso-Ovalle adapts his analysis from Srivastav (1991a,b) and Dayal (1995, 1996), but analyses of correlatives go further back. See von Stechow (1994), Section 3.3 for discussion.

propositions in the denotation set of the *if*-clause. Finally, another quantifier applies in the lower clause to express the relationship between the particular proposition denoted by *then* and the consequent of the conditional.

To see how this works, consider the following definitions for adverbial quantifiers in (97)²², and the structure for a conditional donkey sentence shown in (98). The two quantifiers here are represented by \square , the silent version of *always*.

- (97) a. $\llbracket \text{always} \rrbracket = \llbracket \square \rrbracket = \lambda\Phi . \lambda\Psi . \Phi \subseteq \Psi$
 b. $\llbracket \text{usually} \rrbracket = \lambda\Phi . \lambda\Psi . |\Phi \cap \Psi| > \frac{1}{2}|\Phi|$
 c. $\llbracket \text{sometimes} \rrbracket = \lambda\Phi . \lambda\Psi . |\Phi \cap \Psi| > 0$



The *if*-clause marked CP above denotes a set of propositions, such as (99):

- (99) $\left\{ \begin{array}{l} \lambda w . \text{John gets bonus}_1 \text{ in } w, \lambda w . \text{Chris gets bonus}_1 \text{ in } w, \dots, \\ \lambda w . \text{John gets bonus}_2 \text{ in } w, \lambda w . \text{Chris gets bonus}_2 \text{ in } w, \dots, \\ \dots \end{array} \right\}$.

The top \square operator in (98) asserts that each alternative proposition in (99) verifies S^b . S^b in turn is true of a proposition p iff p entails S^d . Finally, S^d takes $then_i$ – which denotes p – as its focus antecedent, giving a co-varying interpretation to the pronouns in S^d . For instance, the proposition that John gets bonus₁ will be in the denotation of S^b iff in all worlds where John gets bonus₁, John spends bonus₁. Together, these yield the following truth conditions for (98):²³

- (100) $\forall x, y$ such that x is a man and y is a bonus,
 $\{w \mid x \text{ gets } y \text{ in } w\} \subseteq \{w \mid x \text{ spends } y \text{ in } w\}$.

The node S^d and the pronouns he_j and it_k are all GIVEN in this structure. The pronouns take the indefinites *a man* and *a bonus* as their focus antecedents. S^d takes the resumptive pronoun $then_i$ as its antecedent. In order to do this, though, S^d must be evaluated using a modification m of the assignment g used

²²More detailed definitions would involve being contingent on the world of evaluation; I have left this out for ease of exposition.

²³This is the strong reading. Section 5.7 explains how to get the weak reading.

to evaluate S^c such that $[\mathbf{then}_i]^{g^m} \in \llbracket S^d \rrbracket^{f.g^m}$. The pronoun $then_i$ will always denote a proposition of the form “man x gets bonus y ” and in order for $\llbracket S^d \rrbracket^{f.g^m}$ to contain such a proposition, $g^m(j)$ must be a man who gets a bonus and $g^m(k)$ must be the bonus he gets according to $[\mathbf{then}_i]^{g^m}$. This derives the correct denotations for the pronouns.

5.4 Formal link

One clear advantage that the focus binding account has over E-type approaches to donkey anaphora is that the **problem of the formal link** described in Heim (1990) does not arise. Heim (1982) argued that E-type analyses could not distinguish between cases like the following:

- (101) (Heim 1990, Exx. (57) & (58), p.165)
- a. Every man who has a wife sits next to her.
 - b. #Every married man sits next to her.

This is actually related to a larger fact about anaphora: pronouns in general require an explicit antecedent. Consider the following case due to Postal (1969):

- (102) a. Max’s parents are dead and he deeply misses them.
 b. #Max is an orphan and he deeply misses them.

In (102a), where the antecedent phrase *Max’s parents* appears, the pronoun *them* is acceptable, but in (102b), where this antecedent is missing, the pronoun sounds odd. These facts are entirely predicted by the focus binding account, since a (GIVEN) pronoun must have a focus antecedent in order to receive an interpretation.²⁴ Even the donkey pronouns in conditional cases have antecedents, as shown above.

As mentioned in Section 2.3.2, Elbourne (2005) proposes a novel solution to the problem of the formal link: he suggests that pronouns are in fact definite descriptions whose NP subparts have undergone NP ellipsis, as shown by the similarity between the two sentences in (103):

- (103) a. Every farmer who owns a donkey beats his neighbor’s ~~donkey~~.
 b. Every farmer who owns a donkey beats it[=the] ~~donkey~~.

In addition to the arguments raised against Elbourne’s analysis above, there are some donkey anaphora cases where parallel NP ellipsis sentences are disallowed:

- (104) a. Every rumor that he was not born here lowers a candidate’s poll numbers.
 b. #Every rumor that mine was not born here lowers your candidate’s poll numbers.

²⁴Patel-Grosz and Grosz (2009) describe intriguing counterexamples to this formal link requirement. Although I will leave the analysis of these cases to future research, my hunch is that they are cases where implicit discourse structure provides focus antecedents.

(104a) is a cataphoric donkey anaphora case: the donkey pronoun comes before its corresponding indefinite. Although the details would need to be worked out, in principle the focus binding account allows such examples: if a hearer’s discourse processing allows her to wait a short time (such as until the end of the matrix sentence) before assigning a focus antecedent to a GIVEN phrase, there is no problem with having an “antecedent” that comes after a pronoun. In this case, the phrase “*t* lowers a candidate’s poll numbers” is the antecedent for “he was not born here.” The order of the antecedent and the GIVEN phrase does not matter: as long as the candidate in question exists in the world in of the rumors (a prerequisite for meaningful rumors!), the antecedent will have a collapse and the pronoun can refer to the candidate in that collapse. NP ellipsis is not allowed in this case, though, as shown in (104b), casting doubt on whether this is truly the process at work in donkey anaphora.

5.5 Indistinguishable antecedents

Another type of example that is problematic for E-type theories, due to Hans Kamp but reported in Heim (1990), is shown in (105):

(105) If a bishop meets a bishop, he blesses him.

The problem for E-type theories is that in situations in which one bishop meets another bishop, even minimal ones, there is no unique bishop who meets another bishop. Therefore there is no unique referent for either pronoun.

For the focus binding account, the **indistinguishable participants problem** boils down to whether the two sentences in (106) (and other analogous pairs) are entirely synonymous. Imagine that John and Peter are bishops. This means that the sentences in (106) are two alternatives in the denotation of the *if*-clause in (105) (namely, *if a bishop meets a bishop*). Next, consider the structure in (107) for (105). In the case where $g(i)$ returns the proposition corresponding to (106a), $g(i)$ will match a focus alternative of the consequent clause he_j *blesses* him_k under a modified assignment g^m such that $g^m(j) = \text{Peter}$ and $g^m(k) = \text{John}$. However if (106b) is synonymous to (106a), this match could also go through under an assignment g^n such that $g^n(j) = \text{John}$ and $g^n(k) = \text{Peter}$ instead. What, then, if under both the alternatives in (106), g^m instead of g^n were used? Then, we would predict contrary to fact that the sentence in (105) could be true when only one of the bishops blesses the other when two bishops meet.

(106) a. John meets Peter b. Peter meets John.

(107) $[\Box [\text{CP if a bishop meets a bishop}] [\text{S } \lambda_i \Box \text{ then}_i \text{ he}_j \text{ blesses him}_k]]$

The easiest solution to this problem is to suggest that (106a) and (106b) are not synonymous. For instance, Kratzer (1996) suggests that external arguments like the subject DPs in (106) carry an extra designation as the Agents of the event described in the sentence. Any such difference between (106a) and (106b) – however slight – would ensure that only one assignment would yield a focus

alternative matching the proposition in question: g^m for (106a) and g^n for (106b).

If we do believe that these sentences are synonymous, though, there is still a possible solution to this problem. Recall that Kratzer and Shimoyama (2002) defines a propositional \exists operator. If this operator appears in our structure for (105), yielding the structure in (108), the two alternatives involving John and Peter are instead as in (109):

$$(108) \quad [\square [\text{CP if a bishop } \lambda_j \exists [\text{VP } t_j \text{ meets a bishop}]] \\ [\text{s } \lambda_i \square \text{ then}_i \text{ he}_j \text{ blesses him}_k]]$$

$$(109) \quad \text{a. John meets a bishop} \qquad \text{b. Peter meets a bishop.}$$

The propositions in (109) are clearly not synonymous, removing the indistinguishable participants problem: when $g(i)$ returns the proposition corresponding to (109a), the modified assignment g^m must be such that $g^m(j)$ is John and $g^m(k)$ is whichever bishop John met.²⁵ The only remaining problematic cases are when John meets more than one bishop (at the same time). This is simply a special case of the uniqueness problem noted in Section 5.1 above, though. I will explore this problem further in Section 5.7.

5.6 Proportional readings

Another issue in donkey anaphora mentioned in Heim (1990) is the so-called **proportion problem**. This problem arises in the following sentence:²⁶

$$(110) \quad \text{If a man owns a donkey, he usually beats it.}$$

The issue is that this sentence is generally taken to count men, and not man-donkey pairs or minimal man-donkey situations: one sadistic man who owns and beats 1000 donkeys does not verify (110) when ten other kind-hearted men own one donkey each and treat it nicely. The view of conditionals as quantifying over alternative propositions allows us to derive the correct meaning of (110), as shown in (111):

$$(111) \quad [\text{usually } [\text{CP if a man } \lambda_j \exists [\text{VP } t_j \text{ owns a donkey}]] \\ [\text{s } \lambda_i \square \text{ then}_i \text{ he}_j \text{ beats it}_k]]$$

Here, the propositional \exists operator proposed in Kratzer and Shimoyama (2002) again closes off the VP within the *if*-clause. This means that the CP will denote a set of alternatives akin to (112):

²⁵Deriving this is a little harder than it might seem, because presumably $[\text{then}_i]^g = g(i)$ is a single proposition, not a set of alternative propositions. However, recall that the VP in the *if*-clause takes the form “ t_j meets a bishop.” This VP will indeed be the appropriate set of alternative propositions. Under our modified assignment g^m , the collapse of this VP will be the proposition wherein John meets a particular bishop, say Peter.

²⁶In some theories, this problem arises with nominal quantifiers, such as *most*, as well as adverbial quantifiers, such as *usually*. My analysis avoids this problem by using the traditional definition of nominal quantifiers as quantifying over individuals.

(112) { John owns a donkey, Bill owns a donkey, ... }

Therefore, there will only be one proposition per man in the denotation of the CP. As defined above, *usually* makes the matrix sentence true when more than half these propositions verify the consequent of the conditional – i.e., the proposition is true in a subset of the worlds where the man in question beats his donkey.²⁷

Of course, this also raises the uniqueness problem mentioned in Section 5.1 above: what happens when a man owns more than one donkey? Does he have to beat all of them to count as a man who “beats it” in (112)? This is the topic of Section 5.7.

5.7 Weak readings, strong readings, and uniqueness

Heim (1990) describes a trade-off in theories of donkey anaphora between solving the proportion problem on one hand, and generating false uniqueness presuppositions on the other. This trade-off is clearly shown in (111). Without the propositional \exists operator, there is no problem with uniqueness – the conditional quantifies over every separate proposition involving a man and a donkey, similar to quantifying over man-donkey pairs in turn; however, this structure does not generate the most salient proportional reading, which counts men instead of man-donkey pairs. With the \exists operator, on the other hand, the proportion problem is solved, but we are no longer guaranteed a unique donkey for the pronoun *it* to refer when the proposition being considered concerns a man who owns more than one donkey. Similarly, the choice to keep the individual-quantifier meaning for nominal quantifiers solves the proportion problem, but raises the uniqueness problem.

Once uniqueness is no longer guaranteed, the question of which reading – weak or strong – is correct becomes a serious problem as well. For instance, consider the following sentences:

(113) (after Rooth 1987)

- a. Every parent who has a son in high school lends him the car on weekends.
- b. No parents who have a son in high school ever lend him the car on a weeknight.

(114) (after Kanazawa 1994)

- a. Everyone who owns an umbrella leaves it home on a sunny day.
- b. No one who owns an umbrella leaves it home on a rainy day.

²⁷This yields an asymmetric reading that counts men, but the configuration in (i) would yield an asymmetric reading counting donkeys. Leaving out the \exists operator yields the symmetric reading, counting man-donkey pairs. Pragmatic knowledge helps listeners choose between these possibilities.

(i) [usually [_{CP} if a donkey $\lambda_k \exists$ [_{VP} a man owns t_k]] [_S $\lambda_i \square$ then_i he_j beats it_k]]

(113a) and (113b) differ drastically on the interpretation of the pronoun *him* in cases where parents have multiple sons: (114a) can be paraphrased as “every parent lends every son of theirs the car” whereas (114b) means something closer to “no parent lends any son of theirs the car.” The sentences in (114), however, seem to treat the pronoun *it* similarly: (114a) means something like “everyone leaves all of their umbrellas” and (114b) means “no one leaves all of their umbrellas.”

Compounding things further, the uniqueness problem even arises outside of donkey sentences, where the proportion problem is not a factor. For instance, (115), from Kamp (1981), can still be true when Pedro owns more than one donkey, but only beats one of them, a weak reading of the pronoun. Strong readings are sometimes possible outside of donkey sentences as well, as shown in (116). If Pedro owns more than one donkey, B will answer “yes” to the question in (116a). However, if B wants to be maximally helpful, she’ll only answer “yes” to the question in (116b) if Pedro keeps all of his donkeys outside.²⁸

- (115) Pedro owns a donkey. He beats it.
 (116) a. A: Does Pedro own a donkey? B: Yes.
 b. A: Does he keep it outside? I’m allergic. B: Yes.

As Geurts (2002) points out, there is little agreement even on the facts here – unique vs. non-unique readings, weak vs. strong readings – let alone the analysis of these facts. Therefore I will not take it as a major flaw in the focus binding account that it does not present an obvious solution to these varied problems – no account of donkey anaphora does. I will only endeavor here to show that it is possible to generate both weak and strong readings in non-unique cases. After this, any number of accounts on the market could be adapted to generate the correct reading in the correct situation.²⁹

²⁸Notice that this dialogue is odd if the questioner A knows that Pedro owns more than one donkey. In general, singular indefinites are best used only when they are in fact unique. For instance, consider the following cases, where world knowledge makes a singular indefinite infelicitous in (a) cases but not the (b) cases:

- (i) a. #Every student who owns a sneaker wears it daily.
 b. Every amputee who owns a sneaker wears it daily.
 (ii) a. ?The barber cut off one of my hairs this afternoon.
 b. The geneticist cut off one of my hairs this afternoon.

Since people with sneakers generally own at least two sneakers, (ia) sounds odd. Similarly, barbers hardly ever cut a single hair without cutting many others.

²⁹One promising account, whose lineage traces back to Kadmon (1987), via Rooth (1987), Barker (1996) and Krifka (1996), involves inferences of **homogeneity**, otherwise known as **the excluded middle**, noted in many areas of grammar. For instance, plural definites are interpreted slightly differently than quantifiers, as shown in (i) (Fodor 1970, Löbner 1987):

- (i) a. (i) Everyone saw the boys \approx (ii) Everyone saw every boy.
 b. (i) No one saw the boys $\not\approx$ (ii) No one saw every boy.

If donkey pronouns work similarly, this would explain the cases in This is quite similar to the donkey pronoun cases in (113) and (114a), although (114b) is still problematic.

To derive focus-bound readings for pronouns whose antecedents do not have a unique collapse, we would have to slightly alter our system to require a GIVEN node to denote the set of all the values of its focus antecedent in the world of evaluation. This could be achieved via a new COLLAPSE function, shown in (117), which returns all the collapses of a proposition.

- (117) Collapse of a Proposition Set (experimental version):
 For any set of propositions Φ and world/time w , $\text{COLLAPSE}(\Phi)(w) = \{\phi \in \Phi \mid \forall \psi \in \Phi [[\psi(w) = 1] \rightarrow [\phi \subseteq \psi]]\}$.

In this speculative system, the VP in (119) would denote, for each man x , the following set of propositions:

- (118) $\{\lambda w . x \text{ beats } y \mid y \text{ is one of } x\text{'s donkeys}\}$

This could be achieved via a modified assignment function g^m such that $g^m(j)$ returns the set of all donkeys that $g^m(i)$ owns. This set would combine pointwise with the verb *beats* and the subject trace to form the set in (118). Then, either the propositional quantifier \exists could apply to the VP (in order to derive the weak reading) or the universal propositional operator \forall – also due to Kratzer and Shimoyama (2002) – could apply (to derive the strong reading):

- (119) $[_S \text{ [DP every man who } \lambda_i \text{ } [_S t_i \text{ owns a donkey}]]$
 $\quad [\lambda_i [\exists/\forall \text{ } [_{VP} \uparrow t_i \text{ beats it}_j]]]]$

Thus, unique, weak, and strong readings are in theory derivable using focus binding. I leave it to future research to determine which one is derived in which context.

6 Conclusion

This paper has made one new assumption regarding the interpretation of pronouns: the Focus Binding Hypothesis, from (5) above, that proposes that pronouns may be given locally derived interpretations specifically to satisfy focus constraints. This hypothesis was motivated empirically with examples of sloppy identity readings not explained by any existing theories of anaphora. Besides the Focus Binding Hypothesis, this has been a paper about the constraints governing GIVEN nodes in discourse. We have seen that GIVEN nodes require a matching antecedent. In simple cases, this antecedent is just another node in the discourse, and this view of focus antecedents – along with the Focus Binding Hypothesis – is enough to capture paycheck pronouns. More complex cases, those involving questions, indefinites, and disjunctions, motivated a slight change to this view of GIVENness. I argued for a system in which one alternative denotation of a node may act as a focus antecedent, even when the node as a whole does not match a GIVEN node. This proposal was motivated without any evidence involving pronouns, and yet – along with the Focus Binding Hypothesis – it formed the basis of a theory of donkey anaphora.

This proposal raises many questions and directions for future work, a few of which I will touch on here. First, I have assumed so far that in addition to focus binding, normal syntactic binding (represented above via a syntactic λ operator) still applies. In addition, I have still assumed a global assignment function provided by context. A more parsimonious system might do away with one or both of these assumptions, or reduce them to a more general mechanism. Second, the proposal here made liberal use of the alternative semantics due to Kratzer and Shimoyama (2002). One interesting question raised at this point is whether such a system is a necessary part of any focus binding account. If the COLLAPSE function could be defined to take a single proposition, instead of a set of propositions, the alternative semantics system would not be required. However, it is unclear to me how this feat could be accomplished.³⁰ Third, the phenomena of deaccenting and ellipsis are quite constrained by focus structure; future work should explore the connections between these and focus bound pronouns more closely.

Finally, there are some obviously related phenomena that I simply did not have space to explore. Modal and quantificational subordination (Roberts 1987, 1989) come to mind, especially since E-type theories often claim to capture this phenomenon. Split antecedent anaphora is another related area for future research. And last, this paper restricted its purview to only cover GIVEN pronouns, assuming that these are all unaccented. However, some accented pronouns seem to be constrained in a similar fashion to the GIVEN pronouns presented here. These pronouns warrant a closer look, as well, to determine how they would fit into a focus-binding account of anaphora.

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³⁰See Keenan and Faltz (1985) for clues about how such a system might be built, though.

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