

# E-Type Readings of Quantifiers under Ellipsis<sup>1</sup>

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**Abstract.** It is observed that quantifiers in ellipsis antecedents systematically give rise to two different readings in the ellipsis site, which we call *Q-* and *E-type readings*. Contrary to previous studies, we show that both readings are attested under both sluicing and VP ellipsis, although their availability is constrained by independent discourse requirements. Our findings have theoretical consequences for ellipsis licensing, in particular, for the *identity condition* on ellipsis. Focusing here on sluicing, we put forward a dynamic semantic formulation of the identity condition in terms of mutual dynamic entailment, which we call *d-GIVENness*.

**Keywords:** E-type anaphora, quantification, VP ellipsis, sluicing, dynamic semantics

## 1. Introduction

Elliptical phenomena in natural languages are observed with a number of different syntactic categories (e.g. VP ellipsis vs. sluicing) and sometimes come with idiosyncratic syntactic restrictions (e.g. gapping), but one common feature is that elided phrases must be ‘sufficiently similar’ to some antecedent phrase in the discourse.<sup>2</sup> This condition is called the *identity condition* on ellipsis. The strictest formulation of the identity condition demands the antecedent phrase,  $XP_A$ , and the elliptical phrase  $XP_E$ , to be identical in all respects (naturally excluding phonological content). However, there is ample evidence that this strict formulation is untenable. For example, phenomena discussed under the rubric of *vehicle change* show that  $XP_A$  and  $XP_E$  may differ in certain formal features (Fiengo and May, 1994). Concretely,  $VP_A$  and  $VP_E$  in the following example differ in the gender feature on the pronoun, but the VP ellipsis is licensed.

- (1) John [<sub>VP</sub> submitted his paper to LI], but Mary didn’t [<sub>VP</sub> submit her paper to LI].

See also Kehler (2002) and Merchant (2013) for cases involving voice mismatches and NP-antecedents for VP ellipsis, which also show that  $XP_A$  and  $XP_E$  need not be completely identical.

In the present paper, we discuss instances of sluicing and VP-ellipsis where  $XP_A$  contains a quantificational noun phrase (QNP). We observe that in such situations,  $XP_E$  systematically gives rise to two interpretations. One interpretation, which we call the *Q-reading*, is the reading that is expected under total identity of  $XP_A$  and  $XP_E$ . The other reading, on the other hand, involves a

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<sup>2</sup>Throughout this paper, we speak of elided phrases, adopting the idea that elliptical phrases are phonologically elided but syntactically and semantically active. However, nothing crucial in our analysis hinges on this assumption.

definite phrase in  $XP_E$  in place of the QNP, that is anaphoric to the QNP in  $XP_A$ . We call this reading the *E-type reading*.

The E-type reading is of particular interest here, as it constitutes additional evidence that the notion of similarity between  $XP_A$  and  $XP_E$  relevant for ellipsis licensing cannot not be total identity, and must allow a certain degree of difference. In particular, the licensing needs to refer to the anaphoric dependency between the QNP in  $XP_A$  and the anaphoric term in  $XP_E$ . In order to capture this, we put forward a semantic formulation of the identity condition in terms of mutual dynamic entailment, or *d-GIVENNESS*. We take this to be showing that ellipsis licensing cannot be entirely syntactic, and must refer to the semantics of  $XP_A$  and  $XP_E$ , following, e.g. Rooth (1992b) and Merchant (2001) in spirit if not implementation.

The present paper is structured as follows. In Section 2, we show that both Q- and E-type readings are available both under sluicing and under VP ellipsis, contrary to previous studies. We also point out that the availability of the E-type reading is subject to independent discourse restrictions. After critically discussing previous analyses of the E-type reading of sluicing in Section 3, we will propose our identity condition using the notion of mutual dynamic entailment between  $XP_A$  and  $XP_E$  (*d-GIVENNESS*) in Section 4.

## 2. The Data

In this section we show that the ambiguity between the Q- and E-type readings is observed with both sluicing and VP ellipsis. This is contrary to Romero (2003) and Chung et al. (2011), who claim that the E-type reading is obligatory for sluicing and the Q-reading is obligatory for VP ellipsis. We show that there are independent discourse restrictions on the availability of the E-type reading, and when they are properly controlled for, both readings can be observed with both types of ellipsis.

### 2.1. Sluicing

Let us first convince ourselves that quantifiers under sluicing may give rise to E-type readings. In the following example, the relevant quantifier in the antecedent clause  $TP_A$  is an indefinite *a mathematical theorem*, which most naturally gives rise to an anaphoric reading in the ellipsis site. Here and below, we represent the E-type reading with a definite description, but we do not (yet) make commitments about what exactly is elided.<sup>3</sup>

- (2) If John asks me how [ $TP_A$  a mathematical theorem was proved],  
a. #I will also tell him by whom [ $TP_E$  a mathematical theorem was proved]. Q-reading

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<sup>3</sup>In the final analysis (§4), we crucially assume that the elided definite has descriptive content.

- b. I will also tell him by whom [<sub>TP<sub>E</sub></sub> ~~the mathematical theorem was proved~~].  
E-type reading

It becomes especially clear that the felicitous reading corresponds to the E-type reading when we consider overt continuations corresponding to the two potentially elided TPs in (2a) and (2b):

- (3) If John asks me how a mathematical theorem was proved,  
a. #I will also tell him by whom a mathematical theorem was proved.  
b. I will also tell him by whom the mathematical theorem was proved.

Since (2) is felicitous with sluicing, it must receive the E-type reading. This observation itself does not say anything about the availability of the Q-reading, however, as the Q-reading is simply pragmatically ruled out here.

The following examples show that the Q-reading is in principle available under sluicing. Here again, in order to see the difference between the two readings, it is useful to consider overt continuations corresponding to the putative ellipsis sites.

- (4) [<sub>TP<sub>A</sub></sub> John applied to five graduate schools].  
a. I don't know why [<sub>TP<sub>E</sub></sub> ~~John applied to five graduate schools~~]. Q-reading  
b. I don't know why [<sub>TP<sub>E</sub></sub> ~~John applied to the five graduate schools~~]. E-type reading

What is crucial here is that the remnant *wh*-phrase is *why*. In embedded *why*-questions, the Q- and E-type readings give rise to truth-conditionally distinct readings. According to the Q-reading, the relevant reason (that the speaker doesn't know) is why John applied to so many graduate schools. On the other hand, under the E-type reading, the relevant reason is why John chose those five schools, and not others. With sluicing (4) is ambiguous between these two readings, while without ellipsis, there is only one reading. Therefore, (4) with sluicing is ambiguous between the Q- and E-type readings.

It should be noted here that in the previous literature, most observations are based on data involving different types of *wh*-remnants, but with them, the distinction between the two readings is obscured. For instance, consider the following examples adapted from Chung et al. (2011: 43).

- (5) We know that [<sub>TP<sub>A</sub></sub> someone was reading],  
a. but we don't know to whom [<sub>TP<sub>E</sub></sub> ~~someone was reading~~]. Q-reading  
b. but we don't know to whom [<sub>TP<sub>E</sub></sub> ~~they were reading~~]. E-type reading

Although Chung et al. (2011: 43) remark that the most natural interpretation is about a single person, and so the elided clause does not seem to introduce a new discourse referent, we think that the distinction between the two readings is not as clear as Chung et al. seem to assume, given that the Q-reading of (5) without the ellipsis seems to be able to mean a very similar thing (perhaps under the specific reading of *someone*). In our example with *why* in (4), on the hand, the truth-conditional distinction between the readings is palpable, and it shows that the two readings are indeed both available, as explained above.

## 2.2. VP Ellipsis

Let us now turn to VP ellipsis. The following example with donkey anaphora shows that both interpretations are possible. As in the case of examples with sluicing, the interpretive distinction between the two readings is clear when the overt continuations corresponding to the putative ellipsis sites are considered.

- (6) Whenever Prof. Jones is [<sub>VP<sub>A</sub></sub> working on a paper],  
 a. the postdocs cannot [<sub>VP<sub>E</sub></sub> ~~work on a paper~~]. Q-reading  
 b. the postdocs cannot [<sub>VP<sub>E</sub></sub> ~~work on the paper~~]. E-type reading

Specifically, under the Q-reading, the postdocs cannot work on any paper whatsoever, when Prof. Jones is working on a paper. The E-type reading is weaker than this, meaning only that the postdocs cannot work on the paper that Prof. Jones is working on.

In order to reinforce our point here, we present a few more pieces of evidence that both interpretations are available with VP ellipsis. Firstly, in the following example, only the Q-reading is pragmatically felicitous. This is because, in an out-of-the-blue context, *John being anxious* explains why he would apply to *so many* graduate schools (Q-reading), whereas it does not provide a plausible explanation for why he would apply to a particular set of graduate schools. Crucially, the same contrast obtains without ellipsis.

- (7) John [<sub>VP<sub>A</sub></sub> applied to five graduate schools], because he was anxious.  
 a. Why else would he [<sub>VP<sub>E</sub></sub> ~~apply to five graduate schools~~]? Q-reading  
 b. #Why else would he [<sub>VP<sub>E</sub></sub> ~~apply to the five graduate schools~~]? E-type reading

On the other hand, in the following example, only the E-type reading is felicitous.

- (8) John [<sub>VP<sub>A</sub></sub> applied to five graduate schools], because they were high in the league tables.  
 a. #Why else would he [<sub>VP<sub>E</sub></sub> ~~apply to five graduate schools~~]? E-type reading

- b. Why else would he [<sub>VP<sub>E</sub></sub> ~~apply to the five graduate schools~~]?

In an out-of-the-blue context, that the graduate schools were high in the league table provides a plausible explanation for why John would apply to *them* (E-type reading), but it fails to provide a plausible explanation for why he would apply to *so many* graduate schools (Q-reading).

These two examples constitute strong evidence that the Q- and E-type readings are separate readings, and moreover that they are both available with VP ellipsis.

This conclusion is in direct conflict with what Romero (2003) and Chung et al. (2011) assume, namely that the E-type reading is unavailable with VP ellipsis. We note that in many canonical instances of VP ellipsis, such as (9), only the Q-reading is available. This is the residue that our analysis must explain.

- (9) John [<sub>VP<sub>A</sub></sub> read two novels], and
- |   |                |
|---|----------------|
| a. Bill did [ <sub>VP<sub>E</sub></sub> <del>read two novels</del> ], too.      | Q-reading      |
| b. *Bill did [ <sub>VP<sub>E</sub></sub> <del>read the two novels</del> ], too. | E-type reading |

We claim in §2.3 the unavailability of the E-type reading in this example is due to independent restrictions on discourse coherence. In fact, the same restrictions apply to sluicing as well, as we will see below.

### 2.3. Coherence Relation

We claim that the crucial feature of examples like (9) that blocks the E-type reading is that they involve two sentences that stand in the *parallel relation*, in the sense that the sentences containing XP<sub>A</sub> and XP<sub>E</sub> are answering the same (implicit or explicit) question. In the case of (9), the most natural implicit question is *who read two novels?*. Then, for reasons of discourse coherence, the E-type reading is simply not available, because it would be infelicitous as an answer to this implicit question.

To be more precise, answers to a question are felicitous only if they satisfy the following condition (cf. Krifka 2001; Roberts 2012 among others). Here  $\|\alpha\|$  is the focus semantic value of  $\alpha$  in the sense of Rooth (1992a).

- (10) **The Question-Answer Congruence Condition:**  
 A declarative sentence  $A$  is *congruent* to a question  $Q$  iff  $\|A\| = \llbracket Q \rrbracket$ .

For concreteness, we assume a Hamblin-Karttunen semantics for questions, according to which they denote sets of possible answers. for example:

$$(11) \quad \llbracket \text{who read two books} \rrbracket = \{p \mid p = \lambda w. \exists x, X [\text{books}(X) \wedge |X| = 2 \wedge x \text{ read two books in } w]\}$$

Intuitively, in order to derive the focus semantic value of a sentence, we replace each F-marked expression of type  $\tau$  with a variable ranging over expressions of type  $\tau$ , and take the set of propositions corresponding to every possible valuation of the variable. To derive the semantic value of a *wh*-question, we do the same thing, only rather than replacing F-marked expressions with variables, we reconstruct the *wh*-phrases to their base-positions and replace them with variables.

Under a Roothian focus semantics, the focus semantic value of *John<sub>F</sub> read two novels* is the same set as (11), so Question-Answer Congruence holds, and it can be given as a felicitous answer to (11). Similarly for *Bill<sub>F</sub> read two novels*. On the other hand, the focus semantic value of *Bill<sub>F</sub> read the two novels* is as follows:

$$(12) \quad \llbracket \text{Bill}_F \text{ read the two novels} \rrbracket = \{p \mid p = \lambda w. \exists x [x \text{ read } \iota X [\text{novels}(X) \wedge |X| = 2] \text{ in } w]\}$$

Note that the set of propositions denoted by (12) is a strict subset of the set of propositions denoted by (11). Consequently, the E-type reading of (9) would not comply with the Question-Answer Congruence Condition, and hence it would not be a felicitous answer to the implicit question. For this reason, the E-type reading of (9) is unavailable.

To further buttress this point, we observe that when the example (9) is manipulated so that the two sentences are no longer in a parallel relation, the E-type reading indeed becomes available. For example,

- (13) Right after John read two novels,
- |   |                |
|---|----------------|
| a. Bill did <del>read two novels</del> , too.     | Q-reading      |
| b. Bill did <del>read the two novels</del> , too. | E-type reading |

Further support of this analysis comes from the observation that sluicing is subject to the same constraint (cf. Romero 2003). For example, the following example does not have the E-type reading, as the two sentences stand in a parallel relation.

- (14) (Do you know which students like most of the professors?)  
I know which BOYS like most of the professors.
- |  |                |
|--|----------------|
| a. But I don't know which GIRLS <del>like most of the professors</del> . | Q-reading      |
| b. *But I don't know which GIRLS <del>like the professors</del> .        | E-type reading |

In sum, we have observed that both Q- and E-type readings are available under sluicing and VP ellipsis, contrary to Romero (2003) and Chung et al. (2011), although their availability is sometimes restricted due to independent discourse considerations.

### 3. Previous Analyses of the E-type readings of sluicing

The Q-reading is straightforward to account for under any theory of ellipsis, as what one needs to assume is total identity (modulo vehicle change). The E-type reading, on the other hand, is more problematic, as it seems that  $XP_A$  and  $XP_E$  need to mean different things. In fact, as far as we can see, many recent theories of sluicing such as AnderBois (2010, 2014) and Barker (2013) simply cannot account for the E-type reading (the details are suppressed here for reasons of space), and one can only find several previous analyses of the E-type reading under sluicing, but we claim now that they are all unsatisfactory.

Firstly, assuming the false generalisation that sluicing only allows the E-type reading and VP ellipsis only allows for the Q-reading, Romero (2003) and Chung et al. (2011) tailor-made their analyses to derive this generalisation. In light of the data in the previous section, their analyses are simply empirically inadequate.

Merchant (2001) (cf. Merchant 1999), on the other hand, recognizes the existence of both E-type and Q-readings with sluicing, illustrating this with examples such as (15).

- (15) a. Exactly five officers were fired, but I don't know why  
b. =...why exactly five were fired.  
c. =...why exactly they<sup>E-type</sup> were fired. (Merchant, 2001: p. 212)

Merchant argues at length that ellipsis is subject to the following focus condition.

- (16) **Focus condition on ellipsis**  
A phrase  $XP$  can be deleted only if  $XP$  is e-GIVEN.

A phrase  $XP_E$  is e-GIVEN if its focus closure,  $F\text{-clo}(XP_E)$ , and the focus closure of its antecedent,  $F\text{-clo}(XP_A)$ , entail each other.  $F\text{-clo}(XP)$  is the result of replacing F-marked constituents of  $XP$  with existentially bound variables of the appropriate type.

Under the Q-reading, Merchant assumes that both  $TP_A$  and  $TP_E$  contain the relevant quantifier, which results in satisfaction of the focus condition. To see this more concretely, let us apply this analysis to (4). We assume a representation where the quantifiers have undergone QR.

- (17) a.  $\overbrace{[\text{TP} [\text{five graduate schools}] \lambda 1 [\text{TP} \text{John applied to } t_1]]}^{\text{TP}_A}$   
           b. but I don't know why  $\overbrace{[\text{TP} [\text{five graduate schools}] \lambda 1 [\text{TP} \text{John applied to } t_1]]}^{\text{TP}_E}$

As  $\text{TP}_A$  and  $\text{TP}_E$  are totally identical, their F-closures entail each other and so  $\text{TP}_E$  is e-GIVEN. Consequently,  $\text{TP}_E$  can be elided.

Under the E-type reading, on the other hand, Merchant assumes that  $\text{TP}_A$  does not contain the quantifier, but only its trace, whereas  $\text{TP}_E$  contains a co-indexed E-type pronoun.

- (18) a.  $[\text{TP} [\text{five graduate schools}] \lambda 1 \overbrace{[\text{TP} \text{John applied to } t_1]}^{\text{TP}_A}]$   
           b. but I don't know why  $\overbrace{[\text{TP} \text{John applied to them}_1^{E\text{-type}}]}^{\text{TP}_E}$

As in Heim and Kratzer (1998) among others, Merchant assumes that pronouns are interpreted as variables. This makes  $\text{TP}_E$  in (18) e-GIVEN with respect to  $\text{TP}_A$ , provided that the trace in  $\text{TP}_E$  and the pronoun in  $\text{TP}_A$  are co-indexed.

In support of this analysis, Merchant observes that in cases where anaphoric pronouns are not licensed, the E-type reading is not available, even though  $\text{TP}_A$  and  $\text{TP}_E$  would satisfy the focus condition.

- (19) No one helped, but I don't know why.  
       a. =...why no one helped.  
       b.  $\neq$ ...\*why they<sup>E-type</sup> helped. (Merchant, 2001: p. 213)

### 3.1. Scope Island in the Antecedent

In large part, we agree with Merchant's analysis. For example, we follow Merchant in claiming that under the E-type reading, there is an E-type pronoun in  $\text{TP}_E$ . We argue that the focus condition is too restrictive however, and rules out attested cases of E-type readings. A crucial piece of evidence for us is the availability of an E-type reading licensed by a quantifier in an embedded clause in  $\text{TP}_A$ .<sup>4</sup>

<sup>4</sup>(20) is in fact four-ways ambiguous (at least). There is both a Q- and an E-type reading corresponding to a 'short' parse of the ellipsis site, illustrated in (ia) and (ib) respectively.

- (20) John claimed that most students<sub>1</sub> in the room cheated,  
 a. but I don't know why ~~he claimed that most students in the room cheated~~. Q-reading  
 b. but I don't know why ~~he claimed that they<sub>T</sub> cheated~~. E-type reading

Recall that under the E-type reading, Merchant assumes that TP<sub>A</sub> does not contain the quantifier, but only its trace. Therefore the representation of TP<sub>A</sub> would have to involve QR of *most students* out of a scope island: the finite clause embedded under *claim*. This is independently ruled out.<sup>5</sup>

- (21) a. \* $[_{TP} [\text{most students in the room}] \lambda 1 \overbrace{[_{TP} \text{John claimed } [_{CP} \text{that } t_1 \text{ cheated}]]}^{TP_A}]$   
 b. but I don't know why  $\overbrace{[_{TP} \text{John claimed } [_{CP} \text{that } they_1^{E\text{-type}} \text{ cheated}]]}^{TP_E}$

### 3.2. $\exists$ -Type Shifting

An additional issue for Merchant's analysis is the inconsistent application of  $\exists$ -binding. Crucially, in deriving the E-type reading, Merchant assumes that the trace of the quantifier in TP<sub>A</sub> is not  $\exists$ -bound. Elsewhere, however, Merchant assumes that the trace of movement (specifically, of a moved *wh*-expression) is  $\exists$ -bound, in order to license sluicing with an indefinite correlate.

- (22)  $[_{TP_A} \text{Someone left the room}]$ , but I don't know  $who_1 [_{TP_E} t_T \text{left the room}]$ .

- (23)  $F\text{-clo}(TP_A) = F\text{-clo}(TP_E) = \exists x.x \text{ left the room}$

Merchant could claim that this is because of some distinction between *wh*-expressions on the one hand, and quantificational DPs on the other. Regardless of whether or not an account of this kind could be made to work, there is a problem. A *wh*-expression in the antecedent clause can license an E-type reading of the ellipsis site. If it were possible for the trace of the *wh*-expression in TP<sub>E</sub> to be  $\exists$ -bound, we predict unattested readings.

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- (i) a. but I don't know why ~~most students in the room cheated~~.  
 b. but I don't know why ~~they<sub>T</sub> cheated~~.

We put these other readings to one side in our discussion, as they are expected under Merchant's focus condition.

<sup>5</sup>To see that this is the case, note that (i) lacks an inverse scope reading (*\*most students in the room > someone*).

- (i) Someone claimed that most students in the room cheated.

- (24) I know what John bought at the OUP bookstore,  
 a. \*but I don't know why John bought something at the OUP bookstore. Q-reading  
 b. but I don't know why John bought it at the OUP bookstore. E-type reading

The unattested Q-reading can be derived via  $\exists$ -binding as follows.

- (25) a.  $TP_A = \text{John bought } t_{wh} \text{ at the OUP bookstore}$   
 b.  $TP_E = \exists x. \text{John bought } x \text{ at the OUP bookstore}$   
 c.  $TP_A = \exists x. \text{John bought } x \text{ at the OUP bookstore}$   $\exists$ -type shifting  
 d.  $F\text{-clo}(25c) = F\text{-clo}(25b) = \exists x. \text{John bought } x \text{ at the OUP bookstore}$

### 3.3. Anaphoric Dependency

Our final issue with Merchant's account is more conceptual. Merchant's account is framed in terms of a static semantics, with no substantive technology for dealing with cross-sentential anaphora. For the E-type reading to be available however, it is clearly necessary for the E-type pronoun in  $TP_E$  to be *anaphoric* on the quantifier in  $TP_A$ . According to Merchant's account, the E-type reading satisfies the focus condition just in case the trace of the quantifier in  $TP_A$  is *co-indexed* with the pronoun in  $TP_E$ . Since the trace of the quantifier comes to be  $\lambda$ -bound over the course of the derivation however, the index on the trace does not in any sense determine the discourse referent of the quantifier (in Heim's 1982 sense). Co-indexation therefore fails to guarantee that the pronoun in  $TP_E$  is anaphoric on the quantifier in  $TP_A$ . We believe that it is desirable for the identity condition on ellipsis to enforce the requirement that the pronoun in  $TP_A$  be anaphoric on the quantifier in  $TP_E$ .

## 4. Towards a Dynamic Account: d-GIVENNESS

In order to account for the E-type reading, we propose a dynamic semantic version of Merchant's focus condition, which requires  $XP_E$  and  $XP_A$  to *dynamically entail* each other in the sense to be made clear below. As we will see, by using dynamic semantics, we can formally capture the anaphoric dependency between the quantifier in  $XP_A$  and the definite phrase in  $XP_E$ .

### 4.1. File Change Semantics

We adopt *File Change Semantics* (FCS) (Heim, 1982) with some modifications. One of the central ingredients of FCS is files  $F$ , which are sets of pairs consisting of a possible world  $w$  and an

assignment  $a$ . Following Heim (1982), we assume that assignments are total functions from file cards (variables) to individuals.

Declaratives sentences denote *File Change Potentials* (FCPs), which are functions from files to files. We adopt Heim's  $+$  notation here. Presuppositions put definedness conditions on  $+$ .

- (26) a.  $F + \llbracket \text{it is raining} \rrbracket = \{ \langle w, a \rangle \in F \mid \text{it is raining in } w \}$   
 b.  $F + \llbracket \text{it stopped raining} \rrbracket$  is defined only if for each  $\langle w, a \rangle \in F$ , it was raining in  $w$ .  
 Whenever defined,  $F + \llbracket \text{It stopped raining} \rrbracket = \{ \langle w, a \rangle \in F \mid \text{it is not raining now in } w \}$ .

Again following Heim (1982), we crucially assume that both indefinites and pronouns refer to variables, but follow Heim (1991) in assuming that indefinites are subject to the pragmatic condition called the *Novelty Condition*, while definites carry the *Familiarity Condition* as their presupposition.

- (27) a. **Novelty Condition:** Indefinites must denote variables referring to new file cards.  
 b. **Familiarity Condition:** Definites presuppose that they denote variables referring to old file cards.

New and old file cards are defined as follows.

- (28) A file card  $x_i$  is *new* with respect to a file  $F$  if for any  $\langle w_1, a_1 \rangle, \langle w_2, a_2 \rangle \in F$  such that  $a_1$  and  $a_2$  differ at most at  $x_i$ , and for any world  $w$ ,  $\langle w, a_1 \rangle \in F$  iff  $\langle w, a_2 \rangle \in F$ . Otherwise it is *old*.

The idea is that  $x_i$  is new if there is absolutely no information in  $F$  as to what individual  $x_i$  might be.

For example, the following two sentences have identical FCPs, but they are subject to different conditions, namely, *someone<sub>1</sub> coughed* is felicitous as an utterance only if  $x_1$  is new with respect to the file it is updating, while *he<sub>1</sub> coughed* presupposes that  $x_1$  is old.

- (29) a.  $F + \llbracket \text{someone}_1 \text{ coughed} \rrbracket = \{ \langle w, a \rangle \in F \mid a(x_1) \text{ coughed in } w \}$   
 b.  $F + \llbracket \text{he}_1 \text{ coughed} \rrbracket$  is defined if  $x_1$  is old with respect to  $F$ . Whenever defined,  $F + \llbracket \text{he}_1 \text{ coughed} \rrbracket = \{ \langle w, a \rangle \in F \mid a(x_1) \text{ coughed in } w \}$

## 4.2. Dynamic Entailment and d-GIVENNESS

In FCS, we can define the notion of *dynamic entailment* as follows (cf. Groenendijk and Stokhof 1991):

- (30)  $\phi$  *dynamically entails*  $\psi$  if whenever there is a non-empty file  $F'$  such that  $F + \phi = F'$ , there is a non-empty file  $F''$  such that  $F' + \psi = F''$ .

We say a phrase  $XP_E$  is *d-GIVEN* if there is an antecedent phrase  $XP_A$  in the discourse such that  $XP_E$  and  $XP_A$  dynamically entail each other. Using this notion, we define the identity condition on sluicing as follows.

- (31)  $TP_E$  can be elided only if  $TP_E$  is d-GIVEN.

In order to see how this accounts for the E-type reading, let us consider the following example.

- (32)  $[_{TP}$  John applied to a<sub>3</sub> graduate school],  
but I don't know why  $[_{TP}$  ~~John applied to the<sub>3</sub> graduate school~~].

We assume the meanings of the two TPs to be the following.

- (33) a.  $F + \llbracket \text{John applied to a}_3 \text{ graduate school} \rrbracket$   
 $= \{ \langle w, a \rangle \in F \mid \text{John applied to } a(x_3) \text{ in } w \text{ and } a(x_3) \text{ is a graduate school in } w \}$   
 b.  $F + \llbracket \text{John applied to the}_3 \text{ graduate school} \rrbracket$  is defined only if  $x_3$  is old in  $F$  and for each  $\langle w, a \rangle \in F$ ,  $a(3)$  is a graduate school in  $w$ .  
 Whenever defined,  $F + \llbracket \text{John applied to the}_3 \text{ graduate school} \rrbracket$   
 $= \{ \langle w, a \rangle \in F \mid \text{John applied to } a(x_3) \text{ in } w \text{ and } a(x_3) \text{ is a graduate school in } w \}$

It is easy to see that whenever there is a non-empty file  $F'$  such that

$$F + \llbracket \text{John applied to a}_3 \text{ graduate school} \rrbracket = F'$$

$F' + \llbracket \text{John applied to the}_3 \text{ graduate school} \rrbracket$  will be defined and will return  $F'$ . Furthermore, whenever there is a non-empty file  $F'$  such that

$$F' + \llbracket \text{John applied to the}_3 \text{ graduate school} \rrbracket = F'$$

$F' + \llbracket \text{John applied to a}_3 \text{ graduate school} \rrbracket = F'$  as well. Therefore, these two TPs dynamically entail each other, and  $TP_E$  can be elided.

Several remarks are in order. Firstly it is crucial that the anaphoric term has a descriptive content. If it were simply a variable without any restrictions on it, then the dynamic entailment from  $TP_E$  to  $TP_A$  wouldn't go through, as it would not necessarily denote a graduate school. Secondly, it is crucial that the indefinite and definite phrases are co-indexed. If they are not, dynamic entailment doesn't go through, as there is no guarantee that the final update will be a non-empty file. It is also crucial that the Novelty Condition is not a presupposition. If it were a presupposition,  $TP_E$  would not dynamically entail  $TP_A$ , as  $TP_A$  wouldn't be undefined for  $F'$ .

However, this result means that the second TP in the following unacceptable example is also d-GIVEN, since mutual dynamic entailment holds for the two TPs.

- (34) \* $[_{TP}$  John applied to the<sub>3</sub> graduate school],  
but I don't know why  $[_{TP}$  ~~John applied to a<sub>3</sub> graduate school~~].

However, we correctly rule this out with the Novelty Condition on indefinites. That is, although  $TP_E$  here is indeed d-GIVEN, the use of a co-indexed indefinite in the second sentence is pragmatically made infelicitous by the Novelty Condition requiring  $x_3$  to be a new file, which is not the case here, as the opposite is required by the presupposition of  $TP_A$ .

How do we then account for the Q-reading? It is accounted for by contra-indexation. Consider the following example.

- (35)  $[_{TP}$  John applied to a<sub>3</sub> graduate school],  
but I don't know why  $[_{TP}$  ~~John applied to a<sub>5</sub> graduate school~~].

If the two indefinites were co-indexed, the second sentence would incur a violation of the Novelty Condition, but if they are contra-indexed, as indicated here, the Novelty Condition is satisfied provided  $x_3$  and  $x_5$  are both new in the input file. Furthermore, we can show that the two TPs dynamically entail each other even under contra-indexation. That is, whenever

$$F + \llbracket \text{John applied to } a_3 \text{ graduate school} \rrbracket = F'$$

there must a non-null  $F''$  such that

$$F' + \llbracket \text{John applied to } a_5 \text{ graduate school} \rrbracket = F''$$

Given the meaning of the sentence, we have

$$F'' = \{ \langle w, a \rangle \in F' \mid \text{John applied to } a(x_5) \text{ in } w \text{ and } a(x_5) \text{ is a graduate school in } w \}$$

Since for each  $\langle w, a \rangle \in F'$  John applied to  $a(x_3)$  in  $w$  and  $a(x_3)$  is a graduate school in  $w$ , there must be some  $\langle w, a \rangle \in F'$  where  $a(x_3) = a(x_5)$ . Then,  $F''$  must be non-null, and entailment goes through. Therefore, the Q-reading is ruled in.

### 4.3. Plural File Change Semantics

In order to account for plural quantifiers like *five graduate schools*, we need to extend FCS. A number of ways to account for plural quantification have been put forward in the literature (Chierchia, 1995; van den Berg, 1996; Nouwen, 2003, 2007; Brasoveanu, 2007, 2008, 2010a, b). Here we adopt the idea due to van den Berg (1996) and assume from now on that a file  $F$  is a set of pairs consisting of a possible world  $w$  and a *set of assignments*  $A$ , rather than just a single assignment.

The FCPs of simple sentences are not so different than in the original FCS.

- (36) a.  $F + \llbracket \text{it is raining} \rrbracket = \{ \langle w, A \rangle \in F \mid \text{it is raining in } w \}$   
 b.  $F + \llbracket \text{it stopped raining} \rrbracket$  is defined only if for each  $\langle w, A \rangle \in F$ , it was raining in  $w$ .  
 Whenever defined,  $F + \llbracket \text{It stopped raining} \rrbracket = \{ \langle w, A \rangle \in F \mid \text{it is not raining now in } w \}$ .

Sentences containing singular indefinites and definites are analysed as follows. We now encode the number information.

- (37) a.  $F + \llbracket \text{someone}_1 \text{ coughed} \rrbracket$   
 $= \{ \langle w, A \rangle \in F \mid |\{ a(x_1) \mid a \in A \}| = 1 \text{ and } \iota x \in \{ a(x_1) \mid a \in A \} \text{ coughed in } w \}$   
 b.  $F + \llbracket \text{he}_1 \text{ coughed} \rrbracket$  is defined if  $x_1$  is old with respect to  $F$  and for each  $\langle w, A \rangle \in F$ ,  $|\{ a(x_1) \mid a \in A \}| = 1$ . Whenever defined,  $F + \llbracket \text{he}_1 \text{ coughed} \rrbracket$   
 $= \{ \langle w, A \rangle \in F \mid \iota x \in \{ a(x_1) \mid a \in A \} \text{ coughed in } w \}$

Plural indefinites and definites are analysed as follows.

- (38) a.  $F + \llbracket \text{John applied to five}_1 \text{ graduate schools} \rrbracket$   
 $= \left\{ \langle w, A \rangle \in F \mid \begin{array}{l} |\{ a(x_1) \mid a \in A \}| = 5 \\ \text{and for each } x \in \{ a(x_1) \mid a \in A \}, \\ x \text{ is a graduate school in } w \text{ and John applied to } x \text{ in } w \end{array} \right\}$   
 b.  $F + \llbracket \text{John applied to the}_1 \text{ five graduate schools} \rrbracket$  is defined if  $x_1$  is old with respect to  $F$  and for each  $\langle w, A \rangle \in F$ ,  $|\{ a(x_1) \mid a \in A \}| = 5$  and for each  $x \in \{ a(x_1) \mid a \in A \}$ ,  $x$  is a graduate school in  $w$ . Whenever defined,  $F + \llbracket \text{John applied to the}_1 \text{ two graduate schools} \rrbracket$   
 $= \{ \langle w, A \rangle \in F \mid \text{for each } x \in \{ a(x_1) \mid a \in A \}, \text{ John applied to } x \text{ in } w \}$

One can easily verify that these two sentences dynamically entail each other, and thus our earlier results straightforwardly carry over to plural examples like (4).

In addition, this system is capable of accounting for examples like the following, where the antecedent quantifier is a strong quantifier.

- (39) John applied to half of the graduate schools,
- a. but I don't know why ~~John applied to half of the graduate schools~~. Q-reading
  - b. but I don't know why ~~John applied to the half of the graduate schools~~. E-type reading

Zooming in on the E-type reading, the key observation here is that the E-type reading amounts to the *maximal* reading where the definite phrase refers to the maximal plurality of graduate schools that John applied to. This can be accounted for with the following semantics for the strong quantifier *half of the NP*. We assume that strong quantifiers are also subject to the Novelty Condition, so  $x_1$  here must be a new file card. Also, to simplify, we disregard the anaphoricity of *the graduate school* in this partitive noun phrase.

$$(40) \quad F + \llbracket \text{John applied to half}_1 \text{ of the graduate schools} \rrbracket$$

$$= \left\{ \langle w, A \rangle \in F \mid \frac{|\{a(x_1) \mid a \in A\}|}{|\{z \mid z \text{ is a graduate school in } w\}|} = \frac{1}{2} \right. \\ \left. \text{and } \{a(x_1) \mid a \in A\} \text{ is a maximal } S \text{ such that for each } x \in S, \right. \\ \left. x \text{ is a graduate school in } w \text{ and John applied to } x \text{ in } w \right\}$$

See the works cited here for discussion on the maximality, as well as on further topics on plurality such as collective predication and dependency with other pluralities.

## 5. Conclusion

In the first half of this paper, we established the empirical lay of the land, claiming that a quantifier in an ellipsis antecedent may license an E-type reading in the ellipsis site. This was shown to be the case for both sluicing, and VP ellipsis, suggesting that this is not a construction-specific phenomenon (contra Romero 2003 and Chung et al. 2011), but rather a consequence of the identity condition on ellipsis.

In the second half, we critically examined Merchant's (2001) analysis of E-type readings, and found it wanting. Our criticisms being that: (i) it under-generates E-type readings in contexts where the quantifier in the antecedent is embedded inside of a scope island, (ii) it is not clear how to constrain  $\exists$ -type shifting, giving rise to unattested Q-readings licensed by a *wh*-expression in the antecedent, and (iii) it fails to directly capture the requirement that the definite in the ellipsis site be anaphoric on the quantifier in the antecedent clause.

Nevertheless, we agreed with Merchant's account in spirit. Our proposed solution is to reformulate Merchant's focus condition in terms of dynamic semantics. For concreteness, we use Heim's (1982) File Change Semantics for our revised focus condition, which we dub d-GIVENNESS. Modulo discourse factors, we argued that this accurately predicts the pervasiveness of E-type readings licensed by quantifiers in elliptical contexts. This work opens up the question of whether there are other phenomena motivating a specifically *dynamic* approach to the identity condition on ellipsis.

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