

Quantification in Existential Sentences

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Abstract This paper offers a DRT-based treatment of existential sentences in English. According to Williams[30] existential sentences contain an implicit quantifier, or scope marker that can be detected from the unusual narrow scope properties of indefinites in these sentences. In this proposal binding, or quantification, is rephrased as a dependency between the postcopular NP and a distinguished state discourse referent contributed by *[there be]*. It is shown that semantic incorporation (van Geenhoven[27]), i.e. taking *there be* to introduce the individual discourse referent of the postcopular NP, is not sufficient to keep the scope of these NPs strictly local. Instead, *[there be]* is allowed to combine with the determiner of the postcopular NP first, and to form one complex determiner with it. It is shown that this is sufficient to account for narrow scope properties of indefinites in existential sentences, and that the original quantificational properties of the determiner are preserved. That is, the results in Keenan[16] are preserved in this approach, while DRT makes it possible to handle anaphora and binding in donkey contexts, and offers the possibility to extend the analysis to non-locative codas and small clause predicates in future work.

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1 Introduction

This paper proposes a DRT-based ([14], [15],[26]) treatment of English existential sentences (Milsark[21]), shown in (1a-b).

- (1)
 - a. There is a student in the garden
 - b. There are \emptyset /some/two/several/many students in the garden
 - c. *There is every/the student in the garden

Strong quantificational NPs, seen in (1c), will not be ruled out in semantic composition. Rather, they will fail to yield the intended interpretation. In this respect, this proposal resembles the line taken in Keenan[16], while it diverges from the classical tautology/contradiction account found in Barwise–Cooper[3], or more recent accounts based on a presuppositional analysis of strong determiners (de Jong–Verkuyl[9], de Jong[8], Zucchi[32]).

The proposal in this paper can be seen as an attempt to account for the unusual scopal and binding properties of indefinites in existential sentences, by introducing an indexical component, while seeking to preserve the relevant quantificational properties of weak NPs (=denoting existential functions, Keenan[16]).

In Keenan[16] existential sentences are taken to be equivalent to their standard counterparts, but in fact there are (at least) two reasons to question this equivalence. (i) As one can see from the the examples that follow, an existential sentence embedded under a quantifier or operator is not equivalent to an ordinary sentence embedded under the same operator. (ii) As pointed out by Barbara Partee, certain weak NP-coda combinations can only occur in existential sentences:¹

- (2)
 - a. There is a hole in my pocket
 - b. *A hole is in my pocket

Weak NPs (in particular indefinites) in existential sentences have the following properties that are relevant here:

- NPs in existential sentences have narrow scope:

- (3)
 - a. Ralph believes that some lunatic is spying on him
 - b. Ralph believes that there is some lunatic spying on him

(Milsark [21], Heim [12])

¹Also, as observed in Hoeksema[13], partitives can only occur in existential sentences that have a coda. Ordinary sentences are not restricted in this manner, however:

- (i)
 - a. There are five of the cats *(in the attic)
 - b. Five of the cats are in the attic

- Postcopular NPs can only belong to the nuclear scope in a simple sentence containing an adverb of quantification (Kim[17]). That is, they cannot belong to a implicit restrictor that has to be (partly) retrieved from context:

- (4) a. Cats always land on their feet
 b. A cat always lands on its feet
 c. There is always a cat that lands on its feet

In contrast with (4a-b), (4c) can only mean that every contextually relevant event involves a (possibly different) cat that lands on its feet.

- In donkey contexts, weak NPs receive a bound reading, as shown in the contrast in (5), or in (6):

- (5) a. Every professor gets a headache whenever a student he hates
 is in class
 b. Every professor gets a headache whenever there is a student
 he hates in class

(Abusch [1])

- (6) If there is a cat in the attic, it catches mice

- The Weak Crossover test for implicit quantifiers proposed in Chierchia [6] indicates that existential sentences contain a binder for the postcopular NP:²

- (7) a. ?Its owner has reported that a cat is up the tree
 b. ???Its owner has reported that there is a cat up the tree

- NPs in there-insertion contexts are suitable antecedents for pronouns:

- (8) There is a student in the garden. He is reading a book.

- Milsark's Predicate Restriction: the coda cannot be an individual level predicate:

- (9) a. *There are cats astute
 b. There are cats playing with mice in the attic

I take [*there be*] to be an episodic predicate. following a suggestion made in Comorovski[7]. The discourse referent contributed by [*there be*] is related to the coda constituent anaphorically or kataphorically. At this stage of work I am committed to positing a locational element in the expletive; in sentences without a coda this is to be retrieved from context.

To sum up, Weak Crossover and scopal properties are indicative of a bound status for postcopular indefinites. Donkey contexts, pronominal anaphora on

²A proper account of Weak Crossover is well beyond the scope of this paper. (7) is merely used to test the presence of a covert binder.

the other hand are indicative of ordinary indefinite status. This contribution can be seen as an attempt to reconcile these two facets of weak NPs in existential sentences, by positing an additional dependency in *there be*. This dependency is seen as the significant binding factor, it also meshes with (Comorovski's interpretation of) Milsark's Predicate Restriction.

2 The Proposal

This part contains the formal proposal proper (in 2.2), followed by some worked-out cases in 2.3. Prior to that, a solution based on Semantic Incorporation (van Geenhoven[27]) is considered in 2.1. Semantic Incorporation presents a simple and intuitively appealing solution that nevertheless runs into some problems. This, I think, deserves some discussion.

2.1 Semantic Incorporation

If the starting point of one's analysis is the Predicate Restriction on existential sentences, then Semantic Incorporation seems to be the simplest and intuitively most appealing tool (see van Geenhoven[27], and also van Geenhoven–McNally[20]). The existential predicate (*there be*) is said to contain an existential quantifier that binds the postcopular NP (which in turn is said to contribute a property). Semantic Incorporation is motivated by lexical or syntactic incorporation in several languages (van Geenhoven[27]); its application to English existential sentences is seen as the simplest implementation of Milsark original proposal (viz *there be* contains an existential quantifier).

The main schema of semantic incorporation is the following (van Geenhoven [27]):

- (10) a. incorporating IV: $\lambda P.\exists x.[P(x) \wedge V(x)]$
 b. incorporated N': $\lambda y.[P(y)]$

(10a) is an expression in static logic, without variables over times or eventualities. It can be adopted in DRT in several ways, depending on the introduction of eventuality discourse referents, and one's translation of *be*. The following is a combination of the components of the present proposal with a semantic incorporation schema.³

- (11) There be $\mapsto \lambda P.[\tau \ s \ \chi \mid s: AT^*(\tau, \chi); P^*(\chi)]$

There is taken to introduce a location discourse referent τ . *Be* is an incorporating verb that introduces a state discourse referent. The state described by

³The notation is that of Muskens[22] and Kamp–van Eijck[26]. Here it is sufficient to note that DRS-es are enclosed in square brackets, with \mid separating the universe of a DRS from its condition set. \cdot is the asymmetric merge from Muskens[22].

there be is that of a discourse referent χ being at the location specified by τ . The discourse referent χ itself is introduced (locally) by the incorporating verbal complex.

P corresponds to a property; on the intended translation it is a predicative NP. In [20] predicative NPs are obtained from generalized quantifiers by means of Partee’s **BE** functor [23]. (Cf. Blutner [5],[4], McNally–van Geenhoven [20].)

- (12) a. **BE** : $\lambda Q.\lambda y.[Q(\lambda x.[x = y])]$
 b. **BE**(a student) : $\lambda y.\exists x.[student(x) \wedge x = y] =_{red} \lambda y.[student(y)]$

Despite its intuitive appeal, the Semantic Incorporation approach is problematic for two main reasons; one is related to the particular line taken in [20], the other is more general:

- The output of the **BE** functor does not match the set of weak NPs: there are predicative NPs that are strong (definites), and there are weak NPs that are not predicative (*at least n N*, *few N*, *at most N* a.s.o.); this could in principle be overcome if one did not use **BE** at all, making use of DRT’s \pm and not-quite quantificational distinction instead (Kamp–Reyle[15], pp. 452–461);
- (11b) allows for wide scope readings of indefinites, which should not be possible; a wide scope reading obtains if a placeholder property $\lambda x.[x = y]$ is applied to (11b), such that y is a discourse referent introduced at a superordinate level. (13b) for instance represents a reading of (4c) that this sentence should not have. (13b) says that every contextually relevant event e involves cat x such that x is in the state of having the property of landing on its feet. This sounds awkward, but it amounts to saying that the indefinite can be excorporated in the semantics and in effect introduced higher than the *there*-insertion context proper.

- (13) a. There is always a cat that lands on its feet
 b. $[\forall e[e\ x \mid e:\varphi ; cat(x)][s\ e' \ \tau\ y \mid s\mathcal{R}e; s: AT^*(\tau\ y); s\mathcal{R}'e'; e': y\ lands-on-y's-feet ; y = x]]$

The possibility of excorporating the indefinite and generating the unwanted reading (13b) hinges on a corollary of the Definiteness Effect formulated in Heim [12]:

- (14) * There be x , where x is an individual variable

(14) serves to exclude pronouns and traces from *there*-insertion contexts. It is by no means straightforward, however, to adopt this constraint. In my opinion, it has to be stipulated separately, which in turn requires very sound motivation.

2.2 Function Composition

This part contains the formal proposal proper, which involves two main ingredients: (i) type assignment that enables to [*there be*] to combine with the determiner of the postcopular NP (in fact, this is the only way to obtain a well-formed DRS-formula), and (ii) a state discourse referent introduced by *there be*.

At this stage I have little to say about the syntactic structure of existential sentences, except that I follow Keenan[16], Zucchi[32], and others, by taking the copula, the NP and the coda (if present) to form one syntactic constituent. As regards the syntax–semantics interface, I assume that existential sentences involve a mismatch between syntactic and semantic constituents. Presumably, there are in fact two main types of mismatches, which correspond to existential and presentational readings of existential sentences (Comorovski[7]).

The framework adopted is DRT with λ -abstraction (Muskens[22], van Eijck–Kamp[26]). For reasons of space I use Muskens’ linear notation: A DRS is enclosed in square brackets []; its universe is separated from its conditions by |. ; is the asymmetric merge from Muskens[22]. In fact, the framework assumed here is a mix of Muskens’ compositional DRT and DRT proper: eventualities are introduced as a distinct sort of individual discourse referents, and event descriptions are in the usual DRT format ($e: \dots$). Universal quantification is also rendered in a manner that resembles DRT.⁴

[*There be*] is defined as a property modifier that introduces its own discourse referents:

$$(15) \quad \text{There be} \mapsto \lambda P. \lambda \eta. [s \ \tau \mid s: AT^*(\tau, \eta); P^*(\eta)]$$

The expletive and the copula are said to introduce a state discourse referent s and a location discourse referent τ . (15) then says that some discourse referent η , with property P , is in the state of being at τ . The relation AT goes back to Dowty[10].

NPs are defined as generalized quantifiers of type edd (where d is the type of DRS-s). The determiner *three* is for instance defined as follows:

$$(16) \quad \text{Three} \mapsto \lambda P. \lambda Q. [X \mid |X| = 3; P^*(X); Q^*(X)]$$

Function composition of (15) and (16) yields the following:

$$(17) \text{There be three} \mapsto \lambda P. \lambda Q. [s \ \tau \ X \mid s: AT^*(\tau, X); |X| = 3; P^*(X); Q^*(X)]$$

In (17) the original properties of the determiner are preserved; in addition, it contains the information that the discourse referent in question is in the state of being AT τ .

⁴Collective discourse referents are marked with capitals, so-called neutral discourse referents are written in small Greek letters. * is the collectivity operator from Link[18]. See also Kamp–Reyle[15].

2.3 Coverage

According to the generalization in Keenan[16], NPs in existential sentences are appropriate iff their determiner is existential:

$$(18) \quad f(A)(B) \Leftrightarrow f(A \cap B)(1)$$

It can be checked that the complex determiner [*there be Det*] is existential just in case *Det* is existential:

$$(19) \quad \text{There be } n(A)(B) \Leftrightarrow \text{There be } n(A \cap B)(1) \\ [s \ \tau \ X \mid |X| = 3; s: AT^*(\tau, X); A^*(X); B^*(X)] \Leftrightarrow \\ [s \ \tau \ X \mid |X| = 3; s: AT^*(\tau, X); A^*(X); B^*(X); X = X]$$

In this toy system, proper names and pronouns are excluded from existential sentences simply because they lack a determiner that could be composed with the expletive and be. That is, this proposal is consonant with McNally[19], according to whom strong quantificational NPs and strong non-quantificational NPs are to be ruled out by different methods.

It has been apparent from the uniform type assignment to determiners and NPs that composing strong determiners with [*there be*] is not ruled out: if *Det* is strong, [*there be Det*] will not yield the intended interpretation.

$$(20) \quad a. \quad \text{There is every student in the garden} \\ b. \quad [y \mid \textit{garden}(y); \forall x. [s \ \tau \ x \mid s: AT^*(\tau, x); \textit{student}(x)], \\ [\tau' \mid IN^*(y, \tau'); \tau = \tau']]$$

Although [*there be Det*] has the determiner type (*ed(edd)*), its second argument serves more like a placeholder for anaphoric/kataphoric information from the coda. This is harmless with weak determiners that do not involve a restrictor/nuclear scope division. With a strong determiner like *every*, this redundancy is more conspicuous: (20b) says that for every student in some state *s* and at some location τ , that τ is in the garden. One could now argue that this is so because the coda in (20) has wide scope because it is a definite. Yet cases with indefinite NPs in the coda are just as strange, or inappropriate:

$$(21) \quad \text{There is every student in a pub}$$

Another feature of (20) is that the contribution of the coda PP has been factored into several components: the NP is introduced at one DRS-level, with the contribution of the preposition at two other levels. The motivation for this is given by examples like (22):

$$(22) \quad a. \quad \text{There is a gnome in every garden} \\ b. \quad \text{There is a hen cooking in every pot}$$

I take (22a) to mean that every garden is such that there is a gnome in it.

The remainder of this section contains a discussion of some cases from the checklist in Part 1:

- Narrow scope and bound status (strong readings of donkey sentences): (6), repeated here as (23b), shows two properties of indefinites in existential sentences: they can only have narrow scope, and in donkey contexts they get a bound reading.

- (23) a. If a cat is in the attic, it catches mice
 b. If there is a cat in the attic, it catches mice

In contrast with (23a), (23b) can only mean that all instances of there being a cat in the attic are instances of that cat catching mice. This is represented in (24). The discourse referent y is bound by the universal quantifier implicit in the conditional (Kamp[14]), thus yielding the strong donkey reading in the usual way.

- (24) $[x \mid \textit{attic}(x) \llbracket [y \ s \ \tau \mid s: AT^*(\tau, y) ; IN(x, \tau) ; \textit{cat}(y)] \rightarrow [e \ z \mid e: [\mid z \textit{ catches mice}] ; z = y]]]$

In constructing a representation for (23b), the postcopular NP cannot be introduced in a higher DRS, because its determiner **has to** combine locally with [*there be*]. Thus, forming a complex determiner *there be Det* shares the advantages of the semantic incorporation approach, without its drawbacks.

It can be checked that for reasons of type assignment, the representation of *There is a cat in the attic* can only be put together if a is first composed with *there be*:⁵

- (25) a. There is a cat in the attic
 b. (ed,(edd)) ed
 c. edd - ed
 d. (ed,ed) d
 e. ?????

Another property of indefinites is that in simple sentences they cannot form part of the restrictor of an adverb of quantification (Kim[17]) is also seen to follow from this strictly local composition procedure. (27) below is the representation of (4c) from Part1, repeated here as (26c).

- (26) a. Cats always land on their feet
 b. A cat always lands on its feet
 c. There is always a cat that lands on its feet

⁵Given this, it is not possible to introduce the indefinite higher, and leave a placeholder quantifier-type variable in its place. Nor can [*there be*] be composed with a variable of type e left behind by Quantifier Raising.

(27) $[\forall \varepsilon. [\varepsilon : \Phi], [s \ e \ x \ \tau \mid s : AT^*(\tau, x); \text{cat}(x); e: x \text{ lands } \dots; \mathcal{R}(e, \tau)]]$

Again, (27) is the only possibility to render (26c), as the indefinite determiner has to be composed with [*there be*] first.

A final remark on (27): it draws attention to something in the main proposal that requires further work. The point is, the location discourse referent τ remains unbound in (27). Its antecedent can either be retrieved from context (but in this type-driven mini-system the second argument of the determiner should be supplied by the combinator *I*), or, it can be bound to the event discourse referent supplied by the relative clause.

The felicity of the Present Simple in (27) is due, I think, to the adverb *always*. Without the adverb, the relative clause is to be in the progressive, and this suggests that state descriptions in small clauses or relative clauses are to be related in some manner to the discourse referents introduced by *there be*.⁶

- (28) a. ?There is a cat that lands on its feet
 b. There is a cat (that is) landing on its feet

In this case, τ , or the state discourse referent s could be bound to the state discourse referent contributed by the relative clause (or by the small clause, respectively). Alternatively, τ can be linked to the time of the event described by the relative clause.

If the postcopular NP is monotone increasing (or non-monotone), its anaphoric potential is left intact. This can easily be checked by constructing a representation for (8), repeated here as (29):

- (29) There is a student in the garden. He is reading a book.

3 Conclusions, Questions for Further Research

This paper has shown a method of capturing narrow scope properties of weak NPs in existential sentences in a way that does not affect their anaphoric potential. Strong NPs have been excluded for two reasons: (i) strong quantificational NPs do enter semantic composition, but they yield the wrong kind of interpretation. (ii) Nonquantificational strong NPs, such as proper names or pronouns, are excluded from the semantic composition process itself.

In addition, two indexical elements have been introduced, a state discourse referent s and a locational discourse referent τ . It is assumed that information from a locative coda serves to specify this locational discourse referent. This is consonant with the view in the syntactic or descriptive literature (see for instance Freeze [11]), viz *be* is par excellence locative. It is not clear however how existential sentences without any coda, or with a nonlocative coda could

⁶A similar observation has been made in Comorovski[7].

be analysed under this approach. A possible way of preserving the main components of this analysis is to deprive the locational discourse referent τ of any content (e.g. sortal information), and to leave it merely as an indexical anchor (say, for state descriptions in small clauses).

A problem relevant for further work is that of the novelty of the postcopular NP. There is growing consensus in the literature that the discourse referent introduced by a postcopular indefinite is to be strictly new⁷. According to the formal proposal in this paper, indefinites are introduced strictly locally, in tandem with the expletive and the copula. This however does not preclude an anaphoric interpretation for them. In fact, as in DRT proper, a definite is like an indefinite, with an additional anaphoric condition of the form $x = y$ (when necessary or appropriate). What I mean is the main problem is not caused by indefinites and definites being nearly identical: after all, non-anaphoric definites are in fact allowed in some types of existential sentences, as seen in (30).

- (30) Suddenly there ran out of the woods the man we had seen
at the picnic

(Ward[29], J. Aissen's ex.)

The problem is, I think, is caused by anaphoric conditions, of the form $\alpha = \beta$ for definites, or $\eta \subseteq X$ for partitive-specific indefinites. *Anaphoric* definites are disallowed from existential sentences, and partitive indefinites are more restricted than non-partitive, ordinary indefinites:

- (31) a. John saw a cat on the roof
b. *There is the cat John saw on the roof
c. There are ten of those cats *(on the roof)

This framework (and any framework I am familiar with, with the possible exception of Kim[17]) has no readily available solution to the novelty problem. A possibly viable solution would be to strenghten the dependency between the episodic predicate [*there be*] and the postcopular NP, in such a way that the novelty of the postcopular NP should follow from the novelty of the state discourse referent in [*there be*]. That is, it is not sufficient for the NP to be new relative to the local context of [*there be*] only: this can be seen from (31a-b). Rather, as [*there be*] is new relative to preceding context, the novelty of the NP is also to be understood as relative to preceding context.

⁷This goes back to the work of Ellen Prince and her associates; in formal semantics it has been taken up in Blutner[4] and McNally[19]. It is not entirely clear to me how this line of research relates to accounts that derive the Definiteness Effect from the \pm presuppositional properties of determiners, such as de Jong-Verkuyf[9] or Zucchi[32]

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