

# Existentials, predication, and modification

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**Abstract** This paper offers a new semantic theory of existentials (sentences of the form *There be NP<sub>pivot</sub> XP<sub>coda</sub>*) in which pivots are (second order) predicates and codas are modifiers. The theory retains the analysis of pivots as denoting generalized quantifiers (Barwise and Cooper 1981; Keenan 1987), but departs from previous analyses in analyzing codas as contextual modifiers on a par with temporal/locative frame adverbials. Existing analyses universally assume that pivots are arguments of some predicate, and that codas are main or secondary predicates. It is shown that these analyses cannot account for the behavior of codas with quantifiers and for the interaction of multiple codas, both of which receive a simple treatment on the proposed theory. The assimilation of codas to frame adverbials explains several semantic properties which have not been analyzed in the semantic literature, and that distinguish existentials from their copular counterparts. Furthermore, it highlights important properties of the semantics of modification and its relation to predication.

**Keywords** Semantics of existential constructions · Predication · Modification

## 1 Introduction

An English existential sentence consists of the expletive *there*, the copula *be*, a noun phrase (NP) called the PIVOT and optionally a phrase (XP) called the CODA.

(1) *There*<sub>expletive</sub> *was*<sub>copula</sub> [a flower]<sub>pivot</sub> [in her hair]<sub>coda</sub>.

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Determining what propositions existentials express involves deciding on a predicate–argument structure, and determining the semantic contributions of, at least, pivots and codas. Two features are shared by all existing analyses. They all model pivots as arguments of some predicate, and they all model codas as denoting properties (or sets) of individuals.

This paper argues against both these features. Specifically, I show that any analysis of existential propositions in which codas denote predicates cannot account for a range of semantic properties characterizing codas. First, it fails to capture the scopal properties of prepositional phrase (PP) codas containing quantifiers (2-a), and the behavior of multiple codas, including multiple codas containing quantifiers (2-b). In (2-a), the quantifier in the coda outscopes the quantifier in the pivot. (2-b) exemplifies the phenomenon of *stacking*, where each coda (except the first) is interpreted as restricting the quantification in the previous one.

- (2) a. There was exactly one mutiny on most ships.  
 b. There was exactly one mutiny on most ships in every fleet.

Second, It predicts semantic equivalence between existentials and their copular counterparts. This prediction holds in many cases, as shown in (3).

- (3) a. There is some prophet on the boat.  
 b. Some prophet is on the boat.

However, it does not hold in the general case. I point out four systematic semantic differences between existentials and their copular counterparts. These have to do with the licensing of “free choice” *any*, the presence of part-whole readings, the interpretation of free relatives, and the interpretation of certain duration PPs. Some of these differences have not been noticed in the literature. Others, like the presence of part-whole readings, are well known, but have not been treated within a formal semantic analysis. None of them are predicted to occur on an analysis in which codas are predicates.

I propose an analysis of existentials that deals with these facts. On this analysis, pivots are not arguments of any predicate in the sentence, but rather are themselves the main predicates of the construction. *Prima facie* motivation for considering the pivot the main predicate of the construction comes from the observation that pivots are the only elements that are both universally present and obligatory in the clause across languages. Expletives are not universally present. In fact, they are to be found only in a handful of the world’s languages (e.g. Freeze 1992). Codas are strictly optional in all languages I am aware of, and copulas are also optional in some, as shown by the Maori example in (4), from Bauer (1993), cited by Chung and Ladusaw (2004).

- (4) a. [he aituā]<sub>pivot</sub> [i runga i te huarahi]<sub>coda</sub> [i te ata nei]<sub>coda</sub>.  
 a accident at top at the road in the morning this  
 There was an *accident* on the road this morning.

Modulo VP-ellipsis, obligatory status in the clause is a property of predicates, not of arguments.

That pivots are the main predicates of the construction has been argued in the syntactic literature, for example by Williams (1980) and Hazout (2004). However,

this claim has not been supplemented with an explicit semantic analysis. In fact, it seems that the intuition behind analyses such as Williams' is that pivots are predicate nominals, i.e. denote properties of individuals. The analysis presented below involves a completely different understanding of what it means for the pivot to be a predicate. Pivots are viewed as second-order predicates expressing properties of sets.

Fortunately, the formal-semantic tradition makes available a denotation for NPs that is exactly fit for this role: generalized quantifiers. In an important sense then, the analysis I propose is conservative, retaining the basic semantics for existentials offered in Keenan (1987), though some new and, to my mind, stronger arguments for choosing it over related analyses, such as Barwise and Cooper (1981), are provided. Still, it differs from this and other existing analyses in the role and meaning it assigns to codas. I argue that codas are best modeled as sentential modifiers operating on BARE EXISTENTIALS, i.e. existentials with no coda, rather than as predicates taking the pivot as their subject (as in Keenan's analysis) or as secondary predicates [as in McNally (1992)]. I show that the semantic behavior of codas, both in terms of their scopal behavior and in terms of the properties contrasting them with their post-copular counterparts, is simply the behavior of contextual modifiers.

A semantic analysis of existentials is intimately linked with a syntactic analysis, in the sense that certain semantic choices are compatible with only some syntactic choices, and vice versa. The semantic theory I argue for thus has structural consequences. In particular, it poses difficulties for two prominent views about the constituent structure of existentials in the literature. One is Barwise and Cooper's 1981 NP-analysis, in which codas are internal modifiers of the pivot. The other is the "small clause" analysis of e.g. Safir (1982) and Chomsky (1981) [as well as related non-transformational analyses such as the one in Pollard and Sag (1994)], in which codas are the main semantic predicates of the construction.<sup>1</sup>

The structure of the rest of the paper is as follows. The rest of this section briefly lays out the basic terminological choices I follow throughout the paper so as to avoid some widespread terminological confusions about what is meant by the term *coda*, and presents the core views in the literature as to the constituent structure of existentials. Section 2 presents the proposed semantics for existentials and demonstrates its application to the analysis of quantified and multiple codas as well as adjectival codas. Section 3 discusses existing approaches to the semantics of existentials. It provides some arguments against adopting an analysis of existential propositions based on the property of *instantiation*, and proposes a semantic criterion for adjudicating between competing generalized quantifier analyses. Section 3.3 briefly discusses the so-called *definiteness effect*, showing that a semantic analysis of existential propositions is independent of any particular explanation of this effect. Section 4 presents five arguments against analyzing codas as predicates and in favor of analyzing them as modifiers. Section 5 concludes by summarizing the data and discussing its relation to the semantics and grammar of predication and modification in general.

<sup>1</sup> I note in passing that the problems raised for the small clause analysis also cast doubt on a related view, that existential, possessive and copular clauses share a common underlying structure and semantics. This view, which Freeze (1992) terms the "locative paradigm", is predominant in the typological literature.

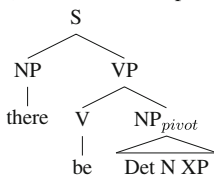
## 1.1 Terminology and constituent structure

Since much of what I and others have to say about the semantics of existentials crucially depends on the analysis of codas, it is important to clarify what exactly is intended by this term. Milsark (1974, 1977) used the term to refer to any and all material to the right of the copula. In Keenan (1987), for instance, the term is used for material to the right of the pivot. Much of the debate about the structure of existentials that is of semantic relevance is around the question whether the material to the right of the pivot, i.e. what Keenan calls the coda, is a constituent separate from the pivot or not. Henceforth, I use the term *coda* to refer only to constituents to the right of the pivot which are separate from it.

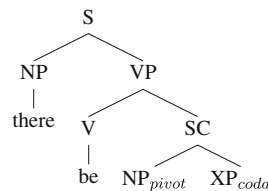
(5) **Coda:** Any constituent to the right of the pivot that is not part of it.

The question then becomes whether anything is ever a coda. Existing analyses can be categorized according to whether they posit codas, and if so, what syntactic status they assign them. The following five structures demonstrate the main existing options for assigning constituent structures to English existentials.

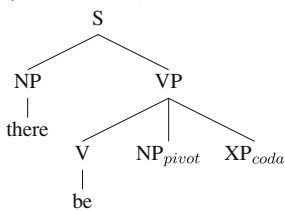
i. **NP-analysis: no codas.**  
(Barwise and Cooper 1981)



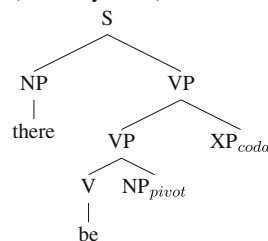
ii. **Small clause structure: pivots as subjects of codas.**  
(Stowell 1978; Chomsky 1981  
Safir 1982 inter alia)



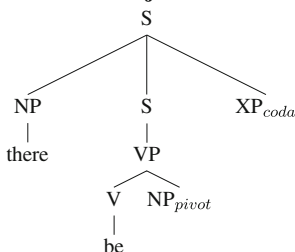
iii. **Pivot and coda co-arguments of *be*.**  
(Keenan 1987; Pollard and Sag 1994)



iv. **Codas as VP-adjuncts.**  
(McNally 1992)



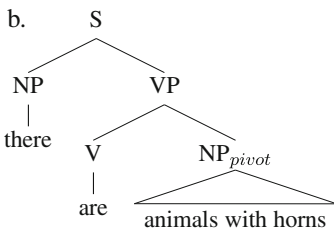
v. **Codas as S-adjuncts.**



Of these structures, (i) denies that there are codas, the rest all assume codas but differ in the status they assign them. The small clause structure (ii) predicts that pivots and codas are in a predication relation, where the coda is a predicate said to hold of the pivot.<sup>2</sup> The semantic predictions of the flat ternary structure depend on one's assumptions about what semantic relations are possible between arguments of the copula. Certainly predication would seem like a natural candidate, given that this is exactly the relation that holds between the two arguments of the copula in a copular construction, and indeed this is the relation assumed for this structure in Keenan (1987), as discussed below. A VP-adjunction analysis predicts that codas are modifiers rather than main predicates. Such an analysis must therefore assign a meaning to the existential VP<sup>3</sup> and say how it is modified by the coda. The only VP-adjunction analysis I am familiar with is McNally (1992), where codas are modeled as secondary predicates. The semantic implications of this assumption are discussed in Sect. 3.1. Finally, an S-adjunction analysis must first determine what the meaning of a bare existential is, and how codas operate on it. The semantic contribution of codas is in this case expected to be similar to that of other S-modifying frame adverbials such as *during last year* or *in Marienbad*. The analysis I argue for in this paper is of this sort.

The discussion of (i)–(v) so far rests on the supposition that all existentials have just one syntactic analysis—either they all involve no coda, all they all involve one coda in a particular position. Deciding between these options fuels much of the debate around the structure of existentials in the literature. However, there is nothing compelling about this supposition. Since pivots are NPs, and NPs can have internal modifiers, there will undoubtedly be cases in which constituents occurring to the right of the common noun will be internal modifiers. And since codas are always optional, there will undoubtedly be existentials for which (i) is the correct structure. An example which seems to me hardly controversial is given in (6).

(6) a. There are animals with horns.



There is then no reason why it should not be possible to add a modifier to the sentence in (6-a), i.e. a sentence (or VP) final constituent, that is not part of the pivot. This seems a straightforward analysis of a sentence like (7).

<sup>2</sup> There is another version of the small clause analysis that involves a different constituent structure, namely that of Moro (1997). On that analysis, codas are modifiers and *there* is the small clause predicate, which obligatorily raises to a preverbal position. I do not discuss Moro's analysis in detail here since he does not say how the structure he proposes is to be interpreted. As far as I can see, the semantic theory I propose below could conceivably be turned into an interpretation for such a structure.

<sup>3</sup> The existence of a VP in existentials is not undisputed. Williams (1980), for example, argues against it.

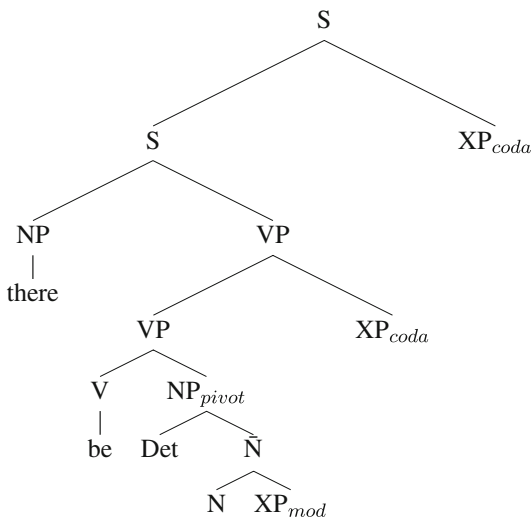
(7) There are animals with horns on the porch.

A small clause analysis of sentences like (6-a) would seem highly unlikely, and I henceforth do not consider it a live option (strong semantic arguments against a small clause analysis are the topic of Sect. 4). However, regardless of whether the PP *on the porch* is a co-argument of the NP *animals with horns* or a VP modifier, there is again no reason why the sentence so derived should not be modified by an appropriate sentence modifier. A possible case is (8).

(8) There are animals with horns on the porch whenever I look.

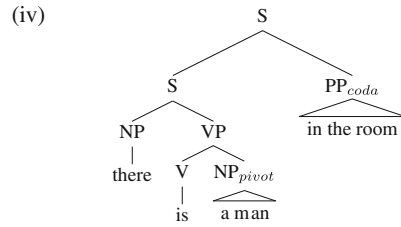
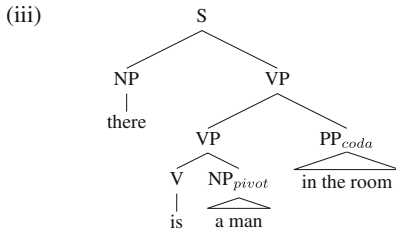
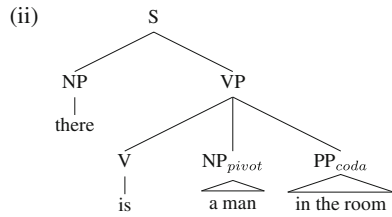
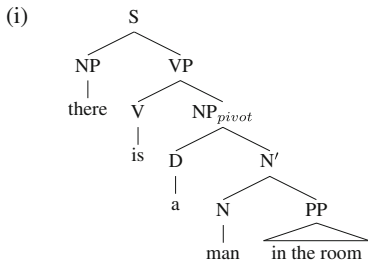
In other words, there are existentials with a full blown structure involving a pivot with internal modifiers, a modifier/co-argument/small clause predicate coda, and an S-modifier coda. For example, assuming for the sake of illustration that pivots and codas are co-arguments of *be*, an existential can have the full-blown structure in (9).

(9) **Full blown structure for existentials:**



Consequently, many existentials will be structurally ambiguous between an NP analysis and an analysis in which a coda follows the pivot. For example, (10) could in principle have any of the analyses in (i)–(iv) below.

(10) There is a man in the room.



I leave the choice between these structures undecided here, allowing that many existentials are ambiguous between them. The important question in the current context is whether a particular choice has any semantic consequence. In Sect. 3.4 I show that, on analyses in which pivots are taken to denote GQs, the choice is in the vast majority of cases of no consequence. The cases where it does matter rule out the NP analysis (i.e. structure (i)). Furthermore, if the semantic analysis of codas I propose is correct, then whichever structure is chosen must be consistent with codas having the *semantics* of frame adverbials.

## 2 A theory of existentials

A theory of existential propositions must determine a predicate–argument structure for them. Most semantic analyses view pivots as arguments of some predicate. For example, in McNally (1992) they are arguments of an instantiation predicate, in Barwise and cooper (1981) they are arguments of a universal property, and in Keenan (1987) they are arguments of the coda. I argue here that pivots are the main predicates of existential constructions. As mentioned in the introduction, this has sometimes been suggested in the syntactic literature (e.g. by Jenkins 1975; Williams 1984; Hazout 2004), but not coupled with anything like an explicit semantic theory. Once such a theory is supplied, pivots turn out to be rather different predicates than is suggested by such syntactic accounts.

### 2.1 Bare existentials

I propose that existential propositions consist of a single second-order predicate with a single implicit argument. The main predicate of an existential construction,

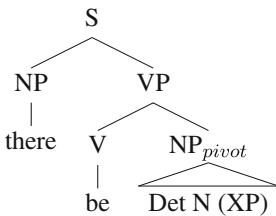
the pivot, expresses a (possibly complex) property of sets. For example, a pivot like *10 commandments* expresses the property that is true of a set iff it contains 10 commandments. All GQs express such properties of sets, and all pivots are interpreted as GQs. The second-order property expressed by a pivot predicate can be described schematically as in (11).<sup>4</sup>

(11) **GQs as predicates:**

An NP of form [Det N] denotes a property  $\mathcal{P}_{\langle\langle e,t \rangle, t \rangle}$  of sets such that for any set  $P$ ,  $P \in \mathcal{P}$  iff  $P$  contains  $d$  elements of  $\llbracket N \rrbracket$ , where  $d$  is a cardinality, an element in a set of cardinalities or a proportion determined by  $\llbracket \text{Det} \rrbracket$ .

As discussed in Sect. 1.1, I adopt the structure in (12) for *bare existentials* (BEs), i.e. existentials with no coda.

(12) **Structure for bare existentials:**



I assume that GQs can range over sets of entities of any type (at least, any simple type), including individuals, events, and time intervals. The meaning of a BE is given in ((13)), where  $\tau$  is any simple type,  $\mathbf{Q}$  is a relation between sets determined by the determiner of the pivot, and  $N$  is a set determined by the common noun in the pivot. Examples are given in (14) and (15). In these examples, the relation **no** holds between two sets  $P, Q$  iff their intersection is empty; the relation **three** holds between two sets  $P, Q$  iff the cardinality of their intersection is 3. Similar familiar definitions can be written for all natural language determiners.

$$(13) \quad \llbracket \text{there be NP} \rrbracket = \llbracket \text{NP} \rrbracket = \lambda P_{(\tau,t)} [\mathbf{Q}_{((\tau,t),((\tau,t),t))} (N_{(\tau,t)}, P)].$$

$$(14) \quad \llbracket \text{there is no bread} \rrbracket = \lambda P_{(e,t)} [\mathbf{no}_{((e,t),((e,t),t))} (\lambda x [\text{bread}(x)], P)].$$

$$(15) \quad \llbracket \text{there are three flowers} \rrbracket = \lambda P_{(e,t)} [\mathbf{three}_{((e,t),((e,t),t))} (\lambda x [\text{flower}(x)], P)].$$

In the absence of overt modification, the meaning of a BE is applied to a contextually salient set or *contextual domain*  $C$ , as exemplified for (14) in (16). I call this process *contextualization*, and distinguish *contextualized* meanings of BEs, as in (16), from their *uncontextualized* meanings, as in (15) and (14).

<sup>4</sup> An obvious exception are NPs with *only*, such as *only bakers*. The view that *only* is a determiner is problematic (see von Stechow 1997 for discussion). If it is a determiner, then the property of sets it describes cannot be named just in terms of a proportion expressed by *only* and the set denoted by its common-noun argument. Rather, a set  $P$  is a member of *only bakers* iff  $P$  contains no elements that are *not* bakers.



(16) **Contextualization**

$$\begin{aligned} \llbracket \text{there is no bread} \rrbracket_{\text{contextualized}} &= \lambda P_{(e,t)}[\mathbf{no}(\lambda x[\text{bread}(x)], P)](C) \\ &= \mathbf{no}(\lambda x[\text{bread}(x)], C). \end{aligned}$$

Two general features of this analysis should be noted. First, the single argument of the pivot—its scope set—is an implicit argument, similar to the implicit argument of lexical predicates such as *local* in (17). An implicit argument is one whose presence is required semantically, but which is not contributed by anything in the surface structure.

(17) They gathered in a local bar.

Pivots are thus **context-sensitive** predicates. In order for a BE to express a determined proposition, the value of the implicit argument of the pivot must be determined contextually, either by an inferential process or by means of explicit contextual modifiers. In Francez (2007a), I provide extensive evidence for the presence of an implicit argument in existentials, based on the range of interpretations available to such arguments and on contrasts between their interpretation and the interpretation of overt pronouns discussed in Condoravdi and Gawron (1996). I cannot take space here to review all this evidence, but take it that the presence of some contextual element in the interpretation of e.g. (14) above is fairly clear. In the current context, the crucial evidence comes from the interaction of BEs with quantified codas, discussed below. Second, and relatedly, codas on this analysis play no role in the main predication in an existential. In particular, they are not predicates that select for pivots as their subjects. Rather, they are contextual modifiers. Their semantic contribution, and their role in the sentence, is that of frame adverbials such as the temporal PPs in (18).

- (18) a. Mary wept [during my funeral].  
 b. Mary wept [during every funeral].

In summary, three features, listed below, distinguish this theory of existentials from existing semantic theories I am aware of. The rest of this paper is dedicated to demonstrating the semantic advantages of this theory.

1. Pivots are the main predicates of existentials.
2. Existentials express context-dependent propositions.
3. Codas are contextual modifiers.

## 2.2 Codas and contextual modifiers

Contextual modifiers with quantifiers generally scope over the existential quantification over events in the sentence they modify (Pratt and Francez 2001; von Stechow 2002; Artstein 2005). They cannot be analyzed as intersective predicates of events in a Davidsonian event-semantics. Thus, while (18-a) above can be analyzed informally along the lines of (19), (18-b) cannot be assigned a similar intersective

meaning, since it does not describe a weeping event occurring throughout every funeral.

$$(19) \quad \exists e[\text{weep}(m, e) \ \& \ \text{during}(e, \text{my funeral})]$$

Furthermore, like multiple codas, multiple temporal PP modifiers are not interpreted intersectively but rather form what Pratt and Francez (2001) call *cascades*. This is exemplified in (20-a), the meaning of which can be represented informally as in (20-b). Here, as in (90-a) above, each modifier binds a restriction within the previous one(s).

- (20) a. Madonna said a prayer before each meal during most holidays.  
 b. For most holidays  $h$ , for each meal  $m$  during  $h$ , there is an event of Madonna saying a prayer before (the onset of)  $m$ .

These facts indicate that a single semantic mechanism is involved in the interpretation of both codas and sentential modifiers.

The parallelism I posit between temporal modifiers and codas can be made most transparent by modeling sentence meanings as GQs over intervals. Assume that the type of intervals, written  $\iota$ , is the type of sets of times, where times are points. Throughout, lowercase  $i, j$  are used for variables over intervals. *Sentence radicals* are then properties of intervals, i.e. of sets of times. For example, the sentence radical *mary-weep* has the denotation in (21).

$$(21) \quad \llbracket \text{mary-weep} \rrbracket = \lambda i_i[\text{weep}(m)(i)]$$

The formula  $\text{weep}(m)(i)$  is to be read as saying that  $i$  is the running interval of an event of Mary weeping.<sup>5</sup> An interval  $i$  is the running interval of an event if for every part  $e$  of the event, the time at which  $e$  occurs is a member of the power set of  $i$ . Under the standard assumption that events are associated with unique running times, the predicate in (21) is true of an interval  $i$  iff  $i$  is the running interval of an event of Mary weeping.

The sentence meanings on which sentential modifiers operate however cannot be identified with such properties of times. For example, saying that Mary wept on Monday does not entail that Monday is the running time of an event of Mary weeping, but rather that Monday *contains* such a running time. This is naturally captured if sentence meanings are existential GQs over intervals. For example, ignoring tense, the meaning of *Mary wept* can be written as (22). The quantifier **a** in (22) corresponds to the existential quantification over events familiar from Davidsonian semantics.

$$(22) \quad \llbracket \text{Mary wept} \rrbracket = \lambda P_{(\iota, \iota)}[\mathbf{a}(\lambda i[\text{weep}(m)(i)], P)]$$

This formula describes a function that maps any set of intervals to true iff that set of intervals has a non-empty intersection with the set of intervals that are the running-interval of an event of Mary weeping. The property in (22) will hold of many sets of

<sup>5</sup> Such predicates of intervals can be divisive or non-divisive. Aspect is ignored here.

intervals (including such that contain many intervals completely disjoint from the time of Mary’s weeping). What is more important is that the set of subintervals of any superinterval of the running-interval of Mary’s weeping necessarily has this property. In other words, for any interval  $i$  that *contains* Mary’s weeping, (22) will be true of the set of  $i$ ’s subintervals. The property in (22) is therefore closely related to the kinds of properties of times in (23), more familiar from work in the Davidsonian tradition, where  $\tau(e)$  is the running time of the event  $e$ . Specifically, (23) is true of an interval  $i$  iff (22) is true of the set of its subintervals.

$$(23) \quad \lambda i[\exists e[\text{mary-weep}(e) \ \& \ \tau(e) \subseteq i]]$$

Modifiers can now be modeled as functions from GQs over intervals to GQs over intervals, i.e. from sentence meanings to sentence meanings. Intuitively, the role of a temporal modifier, or a frame adverbial, is to impose restrictions on the contextual interval within which the event expressed by the sentence is said to be realized.<sup>6</sup> In terms of the semantics of sentence meanings just outlined, a modifier determines or restricts the value of the variable representing the scope for the GQ denoted by the sentence. For example, the derivation of the meaning of the modifier *during every funeral* is as in (25). I use the notation  $\mathcal{P}^C$  to indicate that a GQ involves a contextually restricted determiner, following Westerståhl (1984), as defined in (24).

- (24) a. For any quantifier  $\mathbf{Q}_{((\tau,t),((\tau,t),t))}$ ,  $\mathbf{Q}^C(A, B) =_{\text{def}} \mathbf{Q}(A \cap C, B)$   
 (Westerstahl 1984).  
 b. If  $\mathcal{P}$  is a GQ of the form  $\mathbf{Q}(X)$ , then  $\mathcal{P}^C =_{\text{def}} \mathbf{Q}^C(X)$ .

$$(25) \quad \begin{aligned} \llbracket \text{during} \rrbracket &= \lambda \mathcal{P}_{((t,t),t)} \lambda \mathcal{Q}_{((t,t),t)} \lambda C_{(t,t)} [\mathcal{P}^C(\lambda i[\mathcal{Q}(\lambda j[j \subseteq i])])] \\ \llbracket \text{every funeral} \rrbracket &= \lambda \mathcal{P}_{(t,t)} [\mathbf{every}(\lambda i[\text{funeral}(i)], \mathbf{P})] \\ \llbracket \text{during every funeral} \rrbracket &= \llbracket \text{during} \rrbracket(\llbracket \text{every funeral} \rrbracket) = \\ &\lambda \mathcal{Q}_{((t,t),t)} \lambda C_{(t,t)} [\mathbf{every}^C(\lambda i[\text{funeral}(i)], \lambda i'[\mathcal{Q}(\lambda j[j \subseteq i'])])] \end{aligned}$$

(25) maps a sentence meaning, such as the meaning of *Mary wept* in (22), to a set of intervals such that every funeral interval in that set is such that the sentence meaning applies to it. In (25), the variable  $C$  representing the context set is abstracted over. Having such a variable available for binding after the application of each coda is crucial for capturing the semantics of stacking, as will become apparent below. There are other ways of introducing context sets, and more generally implicit arguments, into the logical form. For example, Pratt and Francez (2001) (also Francez and Steedman 2006) introduce temporal contextual variables into the logical form by making the meanings of nouns relational. On the current analysis, the recursive availability of a context set variable, and hence the availability of stacking, is linked not to the semantics of nouns, but to the semantics of modifying prepositions. Except for simplifying compositional buildup (Pratt and Francez must

<sup>6</sup> I abstract away from the interaction of temporal modifiers with tense and aspect, an issue which is far beyond the scope of this paper. See Stechow (2002) for discussion.

make use of a non-standard operation which they call *pseudoapplication*), this analysis arguably has two conceptual advantages. First, it avoids the somewhat unintuitive assumption that all nouns are relational. Second, it links the possibility of recursive modification to the semantics of modifying prepositions.

The derivation of (18-b) above is then as in (26).

$$\begin{aligned}
 (26) \quad & \llbracket \text{Mary wept during every funeral} \rrbracket = \\
 & \llbracket \text{during every funeral} \rrbracket (\llbracket \text{Mary wept} \rrbracket) = \\
 & \lambda \mathcal{Q}_{((i,t),t)} \lambda C [\mathbf{every}^C (\lambda i [\text{funeral}(i)], \lambda i' [\mathcal{Q}(\lambda j [j \subseteq i'])])] \\
 & \quad (\lambda P_{(i,t)} [\mathbf{a} (\lambda i [\text{weep}(m)(i)], P)]) = \\
 & \lambda C_{(i,t)} [\mathbf{every} (\lambda i [\text{funeral}(i)] \cap C, \lambda i' [\mathbf{a} (\lambda i [\text{weep}(m)(i)], \lambda j [j \subseteq i'])])]
 \end{aligned}$$

Codas can now be assigned essentially the same semantics as contextual modifiers taking BEs as their arguments. The fact that quantified codas outscope the quantification introduced by the pivot falls out immediately from this semantics. The interaction of codas with bare existentials is best seen through an example. Consider the derivation of the existential in (27).

$$(27) \quad \text{There is a drummer in every punk band.}$$

The uncontextualized meaning of *There is a drummer* is given in (28).

$$(28) \quad \llbracket \text{there is a drummer} \rrbracket = \llbracket \text{a drummer} \rrbracket = \lambda P_{(e,t)} [\mathbf{a} (\lambda x [\text{drummer}(x)], P)].$$

Codas, like contextual modifiers, are modeled as functions from GQs (over entities of any simple type) to GQs. Thus, the meaning of *in every punk band* is derived as in (29). Here I make the further assumption that punk bands are individuals of type  $e$ , which are related by a mereological membership relation to individuals of type  $e$ . However, note that nothing hangs on this assumption. Regardless of what the type of nouns like *punk band* is, on the rather uncontroversial assumption that the things *in* a punk band are individuals of type  $e$ , the argument of the coda modifier will in this case be a standard GQ, of type  $((e, t), t)$ . Generally, however, I assume that a preposition like *in* as occurs in a modifier is polymorphic and semantically underspecified.

$$\begin{aligned}
 (29) \quad & \llbracket \text{every punk band} \rrbracket = \lambda P_{(e,t)} [\mathbf{every} (\lambda x_e [\text{PB}(x)], P)] \\
 & \llbracket \text{in} \rrbracket = \lambda P_{((\tau,t),t)} \lambda \mathcal{Q}_{((\tau,t),t)} \lambda C [\mathcal{P}^c (\lambda y_\tau [\mathcal{Q}(\lambda x_\tau [\text{in}(x, y)])])] \\
 & \llbracket \text{in every punk band} \rrbracket = \llbracket \text{in} \rrbracket (\llbracket \text{every punk band} \rrbracket) = \\
 & \lambda P_{((\tau,t),t)} \lambda \mathcal{Q}_{((\tau,t),t)} \lambda C [\mathcal{P}^c (\lambda y [\mathcal{Q}(\lambda x [\text{in}(x, y)])])] \\
 & \quad (\lambda P_{(e,t)} [\mathbf{every} (\lambda x [\text{PB}(x)], P)]) = \\
 & \lambda \mathcal{Q}_{((e,t),t)} [\lambda P_{(e,t)} [\mathbf{every} (\lambda x [\text{PB}(x)], P)] (\lambda y [\mathcal{Q}(\lambda x [\text{in}(x, y)])])] = \\
 & \boxed{\lambda \mathcal{Q}_{((e,t),t)} \lambda C [\mathbf{every}^c (\lambda x [\text{PB}(x)], \lambda y [\mathcal{Q}(\lambda x [\text{in}(x, y)])])]}
 \end{aligned}$$

This meaning combines by function application with the uncontextualized meaning of the BE in (28) to derive the meaning of (27), as in (30).

(30)

$$\begin{aligned} & \llbracket \text{There is a drummer in every punk band} \rrbracket = \\ & \llbracket \text{in every punk band} \rrbracket (\llbracket \text{there is a drummer} \rrbracket) = \\ & \lambda \mathcal{Q}_{((e,t),t)} \lambda C [\text{every}^c (\lambda x [\text{PB}(x)], \lambda y [\mathcal{Q}(\lambda u_e [\text{in}(u, y)])]) (\lambda P_{(e,t)} [\mathbf{a}(\lambda z_e [\text{drummer}(z)], P)]) = \\ & \boxed{\lambda C [\text{every}^C (\lambda x [\text{PB}(x)], \lambda y [\mathbf{a}(\lambda z [\text{drummer}(z)], \lambda u [\text{in}(u, y)])])}] \end{aligned}$$

This is still an uncontextualized meaning. By contextualization, this meaning is applied to a contextually given set  $C^*$ , yielding the result in (31).

$$(31) \quad \text{every}(\lambda x [\text{PB}(x) \ \& \ C^*(x)], \lambda y [\mathbf{a}(\lambda z [\text{drummer}(z)], \lambda u [\text{in}(u, y)])])$$

(31) gives the correct truth conditions for (27). It says that the sentence is true iff every punk band in the contextually relevant domain is such that it has a drummer.

In a similar manner, it is now possible to derive the meaning of a sentence like (32-a) in a way that captures the intuition that the PP *in 1967* has the same meaning there as is does in (32-b). The derivation is given in (33). Since a modifier like *in 1967* cannot be further modified (cf. # *There was a war in 1967 in the 20th century*),<sup>7</sup> the context-set variable in the meaning of the modifier can be ignored.

- (32) a. There was a war in 1967.  
b. Mary wept in 1967.

$$\begin{aligned} (33) \quad & \llbracket \text{There was a war in 1967} \rrbracket = \llbracket \text{in 1967} \rrbracket (\llbracket \text{There was a war} \rrbracket) = \\ & \lambda \mathcal{Q}_{((i,t),t)} [\mathcal{Q}(\lambda i [i \subseteq 1967])] (\lambda P_{(i,t)} [\mathbf{a}(\lambda j [\text{war}(j)], P)]) = \\ & \mathbf{a}(\lambda i [\text{war}(i)], \lambda j [j \subseteq 1967]) \end{aligned}$$

An immediate alternative to this analysis is one in which codas and temporal modifiers are analyzed as involving quantifying-into the NP position, e.g. by a rule of quantifier raising (QR). This option is discussed in Sect. 4.1 below. See von Stechow (2002) for such an analysis of temporal modifiers. Note that such an analysis of codas must follow the current one in making quantifiers in codas bind into the *scope*, rather than the restriction, of the quantification introduced by the pivot.

### 2.3 Stacking

As noted in the introduction, an existential can have multiple, or “stacked”, codas. The effect of each stacked coda is to restrict the context within which the previous

<sup>7</sup> The problem here is that since 1967 is a proper name referring to a unique time, the restriction to the 20th century is vacuous and does not eliminate any possibilities. In a context where such vacuous modification has a discursive role, it is possible. This is the case in (i).

(i) In the 20th century, there was a war in 1967.

coda is interpreted. As discussed, the same effect arises when contextual modifiers are stacked. The relevant examples, with informal representations of the required logical form, are repeated in (34) and (35).

- (34) a. Madonna said a prayer before each meal during most holidays.  
 b. For most holidays  $h$ , for each meal  $m$  during  $h$ , there is an event of Madonna saying a prayer before (the onset of)  $m$ .
- (35) a. There is a drummer in every punk band in most festivals.  
 b. Most festivals  $f$ , every punk band  $b$  in  $f$ , the set of things in  $b$  contains a drummer.

In the current semantics, the effect of stacking, together with the correct scoping for the quantifiers in each coda/modifier, is derived in the same way in both types of examples, by simple function application of each coda/modifier in turn. For example, the derivation of (35-a) is given in (36) (assuming again that the expressions *punk band* and *festival* denote in  $D_{(e,t)}$ ).

- (36) a.  $\llbracket \text{There is a drummer in every punk band} \rrbracket = (30) =$   
 $\lambda C[\mathbf{every}^C(\lambda x[\mathbf{PB}(x)], \lambda y[\mathbf{a}(\lambda z[\mathbf{drummer}(z)], \lambda u[\mathbf{in}(u, y)])])]$   
 b.  $\llbracket \text{in most festivals} \rrbracket = \lambda \mathcal{P}_{((e,t),t)} \lambda C'_{(e,t)} [\mathbf{most}^C(\lambda v[\mathbf{festival}(v)],$   
 $\lambda v'[\mathcal{P}(\lambda d_e[\mathbf{in}(d, v')])])]$   
 c.  $\llbracket \text{There is a drummer in every punk band in most festivals} \rrbracket$   
 $= \llbracket \text{in most festivals} \rrbracket (\llbracket \text{in every punk band} \rrbracket (\llbracket \text{there is a drummer} \rrbracket))$   
 $= \lambda \mathcal{P}_{((e,t),t)} \lambda C'_{(e,t)} [\mathbf{most}^C(\lambda v[\mathbf{festival}(v)], \lambda v'[\mathcal{P}(\lambda d_e[\mathbf{in}(d, v')])])]$   
 $(\lambda C[\mathbf{every}^C(\lambda x[\mathbf{PB}(x)], \lambda y[\mathbf{a}(\lambda z[\mathbf{drummer}(z)], \lambda u[\mathbf{in}(u, y)])])])$   
 $\equiv \lambda \mathcal{P}_{((e,t),t)} \lambda C'_{(e,t)} [\mathbf{most}^C(\lambda v[\mathbf{festival}(v)], \lambda v'[\mathcal{P}(\lambda d_e[\mathbf{in}(d, v')])])]$   
 $(\lambda C[\mathbf{every}^C(\lambda x[\mathbf{PB}(x)] \cap C, \lambda y[\mathbf{a}(\lambda z[\mathbf{drummer}(z)], \lambda u[\mathbf{in}(u, y)])])])$   
 $= \lambda C'_{(e,t)} [\mathbf{most}^C(\lambda v[\mathbf{festival}(v)], \lambda v'[\mathbf{every}(\lambda x[\mathbf{PB}(x)] \cap \lambda d_e[\mathbf{in}(d, v')],$   
 $\lambda y[\mathbf{a}(\lambda z[\mathbf{drummer}(z)], \lambda u[\mathbf{in}(u, y)])])])$   
 $\equiv \lambda C'_{(e,t)} [\mathbf{most}^C(\lambda v[\mathbf{festival}(v)], \lambda v'[\mathbf{every}(\lambda x[\mathbf{PB}(x)] \ \& \ \mathbf{in}(d, v'),$   
 $\lambda y[\mathbf{a}(\lambda z[\mathbf{drummer}(z)], \lambda u[\mathbf{in}(u, y)])])])]$

The last line in (36-c) is the desired meaning for the sentence. The addition of more codas is straightforward. A crucial aspect of the semantics of codas is that the first coda in the existential determines the *scope* of the pivot quantifier, rather than its restriction. Section 3.4 shows that it can be used to decide between competing semantic theories of existentials. Any additional coda however binds a restriction in the quantification introduced by the first coda (and in so doing, further restricts the possible scope sets for the pivot quantifier). Thus, a semantics that assimilates codas to contextual modifiers captures both their scopal behavior in relation to pivots and the fact that they form cascades when stacked.

The semantics of multiple codas points to a more general fact about context sets, namely that such sets must be made available for binding by explicit quantifiers in modifiers. That implicit context sets can be bound by quantifiers has been argued already by Heim (1991), based on examples like (37).

(37) Most classes were so bad that no student passed the final exam.

The proposed semantics shows how such bound readings are brought about by modifiers in general, and codas in particular.

#### 2.4 Adjectival codas

So far I have only discussed PP-codas. However, English allows also other categories to act as codas, as shown in (38).

- (38) a. There are two people [present]<sub>adjective</sub>.  
b. There are two people [waiting]<sub>gerund</sub>.  
c. There were two people [killed]<sub>participle</sub>.

The status of the bracketed phrases in (38) is not obvious, but can be easily verified by testing whether they map to the restriction or the scope of the quantification expressed by the pivot. The relevant test involves existentials in which the pivot contains a strong determiner, such as (39).

(39) There was every kind of diplomat present.

In this sentence, the pivot clearly quantifies over kinds of diplomats, not over kinds of diplomats present. The sentence is true iff every kind of diplomat was present. Thus, the adjectival phrase *present* here contributes the scope of quantification, which was shown in the previous section to be a general characteristic of codas. This test, and its relevance for choosing between competing semantic theories of existentials, is discussed in more detail in Sect. 3.4 below.

There are several reasons why I have privileged PP codas over non-PP codas. One is that only PP-codas unambiguously contain quantifiers, making them a particularly important window into the semantics of the construction. Another is that all languages seem to allow PP codas, whereas not all languages allow other kinds of codas. For example, German does not in general allow adjectival codas, as shown in (40).

- (40) a. Es gibt viele Elefanten in Africa.  
It gives many elephants in Africa  
There are many elephants in Africa.  
b. \*Es gibt viele Elefanten krank.  
It gives many elephants sick  
Intended: There are many elephants sick.

Nevertheless, a semantic theory of existentials should account for non-PP codas in English.

In this section I show that the analysis proposed above naturally extends to adjectival codas. I do not explore gerundive and participial codas in any detail, but the analysis of adjectival codas should extend unproblematically to these cases as

well. The analysis is an implementation, within the current framework, of McNally's (1992) intuition that adjectival codas restrict the spatiotemporal parameters within which the main predication in an existential is evaluated. On the analysis I propose, there is a crucial difference between adjectival codas and modifying adjectives. Adjectival codas are linked to a contextual variable, whereas modifying adjectives are not. This accounts for a contrast, first noted by Kuno (1971), between the behavior of adjectival codas and adjectival predicates when in the presence of another modifier containing a quantifier.

Consider an existential with an adjectival coda, such as (41).

(41) There were many sailors drunk.

The meaning of the coda *drunk* can be thought of as a similar to that of a PP coda involving a preposition *drunk-in* or *drunk during*. The parallelism between the meaning of adjectival codas and PP-codas becomes apparent in the paraphrases in (42).

- (42) a. There were many sailors drunk.  
 The context time  $I$  is such that *there were many sailors* is true of the set of people *drunk during I*.
- b. There was a drummer in the punk band.  
 The punk band  $p$  is such that *there was a drummer* is true of the set of people *in p*.

I propose that adjectives can denote, beyond their standard  $(e, t)$  denotations, also relations between individuals and intervals. For example, the adjective *drunk* is assigned the denotation in (43). I write  $\llbracket A^{rel} \rrbracket$  for this kind of relational denotation of an adjective. Any pair  $\langle a, I \rangle$  where  $a$  is an individual and  $I$  an interval stand in the relation denoted by  $drunk^{rel}$  iff  $I$  is an interval throughout which  $a$  is drunk.

$$(43) \quad \llbracket drunk^{rel} \rrbracket = \lambda_i \lambda_x \lambda_e [drunk(x)(i)]$$

Adjectival codas, like PP-codas, denote functions from sentence meanings to sentence meanings, i.e. from GQs to GQs. Such codas take a bare existential and say that it is true of a set of individuals that have the property expressed by the adjective at a restricted set of intervals. For example, the meaning I assign to the coda *drunk* is given in (44). I write  $\llbracket AP \rrbracket^{coda}$  for the denotation of an adjectival phrase acting as coda.

$$(44) \quad \llbracket drunk \rrbracket^{coda} = \lambda \mathcal{P}_{((e,t),t)} \lambda I_{((t,t),t)} [\mathbf{a}(\lambda i [i \subseteq I], \lambda j [\mathcal{P}(\lambda x [drunk^{rel}(x)(j)])])]$$

The meaning of (41) is then derived in exactly the same way as the meanings of existentials with PP-codas, namely by applying the coda to the bare existential. This is shown in (45).

$$(45) \quad \llbracket \text{There were many sailors drunk} \rrbracket = \llbracket drunk \rrbracket^{coda} (\llbracket \text{There were many sailors} \rrbracket) = \lambda I [\mathbf{a}(\lambda i [i \subseteq I], \lambda j [\mathbf{many}(\lambda x [\text{sailor}(x)], \lambda y [\text{drunk}^{rel}(y)(j)])])]$$



As before, the result of combining a coda with a bare existential yields a GQ which can combine with more codas. In the absence of further modification by codas, the process of contextualization discussed above applies, and the meaning in (45) is applied to the context interval. But an attractive consequence of this analysis is that it can also capture the behavior of adjectival codas when they co-occur with other codas, including quantified codas. This behavior is interesting because it reveals a contrast between adjectival codas and predicative adjectives.

As observed by Kuno (1971), (46-a) is truth conditionally distinct from (46-b).

- (46) a. There are many sailors drunk every day.
- b. Many sailors are drunk every day.

The difference is that in (46-a) the adjective is necessarily interpreted as involving a variable bound by the higher coda, yielding the logical form in (47). In other words, an adjectival coda, like a PP-coda, can stack with another coda of a different type.

- (47) Every day  $d$  is such that the set of people drunk *during*  $d$  contains many sailors.

(47-b) on the other hand has another reading, in which the property of being constantly drunk is predicated of many sailors.

- (48) Many sailors  $x$  are such that  $x$  is drunk during every day  $d$ .

On an analysis in which codas denote  $(e, t)$  predicates, there is no obvious explanation why this property is not available as a coda-denotation.<sup>8</sup> The current analysis on the other hand predicts that adjectival codas should give rise to stacked readings in the presence of other codas. The interpretation of (46) is given in (49). The derivation of the formula in (49-c) from (49-a) and (49-b) is straightforward and hence omitted.

- (49) a.  $[\text{every day}]^{coda} = \lambda\mathcal{P}_{((e,t),t)}\lambda I_{((i,t),t)}[\mathbf{every}(\lambda i[\text{day}(i) \ \& \ i \subseteq I], \lambda j[\mathcal{P}(\lambda i_1[i_1 \subseteq j])])]$
- b.  $[\text{drunk}] = \lambda\mathcal{P}_{((e,t),t)}\lambda I_{((i,t),t)}[\mathbf{a}(\lambda i[i \subseteq I], \lambda j[\mathcal{P}(\lambda x[\text{drunk}^{rel}(x)(j)])])]$
- c.  $[\text{There are many sailors drunk every day}] =$   
 $[\text{every day}]([\text{drunk}]([\text{There are many sailors}])) =$   
 $\lambda I[\mathbf{every}(\lambda i[\text{day}(i) \ \& \ i \subseteq I],$   
 $\lambda j[\mathbf{a}(\lambda i_1[i_1 \subseteq j],$   
 $\lambda j_1[\mathbf{many}(\lambda x[\text{sailor}(x)], \lambda y[\text{drunk}(y)(j_1)])])])]$

Finally, I note here, without detailed explication, that this analysis of adjectival codas can also derive the contrast in (50), discussed in Bolinger (1967) and more recently in Larson (2000).

<sup>8</sup> Thinking in terms of theories of quantifier raising, an analysis of codas as predicates must explain why the quantifier *every day* must take widest scope in an existential, but can scope inside the predicate in a copular sentence.

- (50) a. There are no visible stars.  
 b. There are no stars visible.

While (50-a) can mean that the world does not contain stars that are in principle visible, (50-b) means that no stars are such that they are visible at the time of context. For this reason, (51) is not a contradiction.

- (51) There are no visible stars visible.

Similarly, suppose that there is an organization where people who have been declared missing (e.g. teenage renegades) can enlist to get various types of support. Suppose this association has weekly meetings which missing people are free to attend without the risk of police or parental intervention. The truth of (52-a) depends on how many missing people show up. (52-b) on the other hand is contradictory.

- (52) a. The meeting was fully attended and there were many missing people.  
 b. #The meeting was fully attended and there were many people missing.

On the analysis of adjectival codas proposed here, this data is anticipated. The adjectival coda *missing* in (52-b) [but not the adjectival modifier in (52-a)] necessarily involves a variable that is bound either contextually or by a higher modifier. On the most salient reading of (52-b), this variable is understood to be the location of the meeting. The current analysis thus predicts that (52-b) is true, roughly, if the meeting location simultaneously contains all the expected attendees and does not contain some of them.

## 2.5 Summary

This section described the semantic theory of existential propositions I propose. On this theory, bare existentials consist of a single second-order predicate with an implicit argument. Codas are contextual modifiers that operate on bare existentials. The theory was shown to correctly model the behavior of codas with quantifiers and of stacked codas, and to capture the semantic affinity of codas and sentence-level frame adverbials. An analysis of adjectival codas was also proposed, on which they share the essential semantic features of PP-codas. This was argued to explain the fact that adjectival codas, unlike adjectival predicates, necessarily give rise to a stacking effect in the presence of quantified codas. The next section moves on to survey existing analyses of existential propositions and contrast them with the one proposed.

## 3 Previous analyses: codas as predicates

Existing analyses of existentials fall broadly into two classes: McNally's instantiation analysis and generalized quantifier (GQ) analyses. In this section I briefly describe the main analyses within each class.

### 3.1 The instantiation analysis

McNally (1992, 1998) constructs a semantic theory of existentials in terms of instantiation. The main intuition driving her approach is that the main predicate in an existential, denoted by *there be*, is an intransitive predicate meaning *is instantiated*. This predicate imposes a sortal restriction on its single argument, which must denote a property. The pivot, which functions as the argument of the instantiation predicate, is thus restricted to denote a property. An existential sentence is true iff the property expressed by the pivot is instantiated by some entity at some index. The truth conditions for existentials are given in (53).

- (53) **McNally's (1998) truth conditions for existentials** (McNally, 1998, p. 376):  
 For all models  $M$  and variable assignments  $g$ ,  $\llbracket \text{NP} \rrbracket^{M,g} \in \llbracket \textit{there be} \rrbracket^{M,g}$  iff  $\llbracket \text{NP} \rrbracket^{M,g}$  is non-empty.

The status of codas in an instantiation analysis is discussed in McNally (1992), where they are assimilated to depictive adjuncts such as *alive* in (54).

- (54) The fish swallowed Jonah alive.

Semantically, the role of a coda is to provide spatiotemporal parameters within which the entity or entities instantiating the property denoted by the pivot instantiate it. For example, an existential such as (55-a) is interpreted as in (55-b).<sup>9</sup> Thus, even though codas are modifiers, i.e. adjuncts, their semantic contribution is an  $(e, t)$  predicate that holds of the entities denoted by the pivot.

- (55) a. There is a dog barking.  
 b. The property *dog* is instantiated by an individual at a spatiotemporal index at which that individual also instantiates *barking*.

While McNally's analysis is intuitively appealing, several objections might render it untenable.

#### 3.1.1 Arguments against an instantiation analysis

The most immediate objections to the instantiation analysis are that it requires decomposition of all non-monotone-increasing NPs. For example, an NP such as *no man* cannot be assigned a property denotation, and must instead be decomposed into sentential negation and an indefinite. Furthermore, the instantiation analysis entails abandoning the attractive possibility of assigning a uniform semantics to all NPs as denoting GQs.

<sup>9</sup> A formal discussion of McNally's analysis of codas would require exposition of her dynamic version of the property theoretic framework in Chierchia and Turner (1988). Since such an exposition would take up much space, and since none of the arguments I present below against the instantiation analysis require it, I restrict myself to an informal description of her semantic analysis.

These objections are familiar, and responses to them can be found in McNally (1998). Below I discuss three other objections to the instantiation analysis. The first has to do with the analysis of pivots as property-denoting. The other two have to do with the semantics of the instantiation predicate.

*Scope* One consequence of modeling pivots as denoting properties is that pivots have no quantificational force. This readily explains the observation in the literature that pivots generally take scope below operators such as modals (see e.g. Heim 1987). This is exemplified by (56), which lacks a *de re* reading.

(56) There must/may be someone following me.

However, there are contexts in which pivots do show scopal behavior. Consider for example sentence (57).<sup>10</sup>

(57) There can be three winners in this race.

(57) does not mean (at least on its most salient reading) that this race, unlike normal races, could end up having three winners rather than one. Nor does it mean that three winners are such that they could end up winning the race. Rather it means that three *people* are such for each one of them, it is possible that that person will win the race. This shows clearly that the pivot interacts scopally with the modal. Intuitively, the quantification over contestants outscopes the quantification over worlds introduced by the modal. If pivots denoted properties, they could not possibly show scope interactions. Another example exemplifying the same point is given in (58).

(58) There could be three fathers of this baby.

Not all modals give rise to this kind of scopal interaction. For example, necessity modals such as epistemic *must* cannot, as shown in (59), which can only mean that it must be the case that this equation has three solutions.

(59) There must be three solutions to this equation.

Examples such as (57) or (58) have to my knowledge not been discussed in the literature. In fact, they pose a problem for any existing analysis of existentials, including mine, since it is not clear how their meanings are to be derived. Consider how one might informally represent the logical form of (57). (60) gives the correct truth conditions.

(60)  $\exists x[\diamond(x \text{ is a winner in the race})]$

This logical form involves construing the determiner *three* as an unrestricted quantifier, leaving the common noun within that quantifier's scope. It is not clear

<sup>10</sup> These examples are inspired by an example discussed (in a different context) by Gendler Szabó (2006). Szabó's original example is *This election could have three outcomes*. The existential variant of this sentence, *There could be three outcomes to this election*, also exemplifies the relevant scoping phenomenon.

how to derive this meaning in a semantics in which pivots denote GQs. Nevertheless, it is clear that the example involves scopal interaction between the modal and a quantifier in the pivot, so an analysis of pivots as quantifiers over individuals involves the right components.

The situation is worse for an analysis in which pivots denote properties, since on such an analysis, no quantification over individuals is possible. McNally's analysis does feature cases in which the determiner in the pivot is raised and construed as an unselective binder, and this might seem at first to be exactly what is needed to achieve the logical form in (60). In fact, however, this is not the case. Determiner raising occurs in her analysis only in contexts where the quantification is over kinds. Since the instantiation predicate requires a property denoting argument, any quantification involved in existentials must be over properties, of which kinds are a special case. However, the quantification in (57) and (58) is not over kinds, but over individuals. This is evidenced by the possibilities for continuation shown in (61-a) and (61-b), as well as by the contrast between (61-a) and (61-c), which are clearly truth-conditionally distinct.

- (61) a. There can be three winners in this game: Peter, Paul and Mary.  
 b. There can be three solutions to this equation: 2, 3 and 9.  
 c. There can be three kinds of winner in this game: a genius, a hard-worker and a trickster. But no one will win by sheer luck.

Note that (61-c), the case of actual quantification over kinds, does not give rise to the relevant reading, i.e. the one requiring construing the determiner as an unrestricted quantifier with the common noun in its scope. The sentence does not mean that three things are such that there is a possibility that they are kinds of winners in this game. Rather, it means that for three kinds of winner, there is a possibility of that kind of winner winning the game. This example is readily handled within a GQ theory of pivots, by simply assigning the pivot wide scope. Thus, the sentences that necessarily involve scoping of the determiner above a modal do not involve quantification over kinds, and conversely, the sentences that necessarily involve quantification over kinds do not require determiner raising. I conclude that the sentences in (57) and (58) provide strong evidence against the theory of pivots as property denoting.

*Missing gerunds* One of the original motivations for adopting a property theoretic semantics for natural language comes from cases where properties seem to be arguments of predication, as in (62) (see e.g. Chierchia 1985; Chierchia and Turner 1988).

- (62) Being honest is a virtue.

Since gerunds like *being honest* are taken in property theoretic approaches to be prime examples of expressions with nominalized function denotation, they should be grammatical as pivots, modulo syntactic restrictions. However as shown in (63), they are not, even though there is no syntactic restriction against gerunds in pivot position (cf. *There is dancing in the hallway*).

- (63) a. \*There is being a dog in the room.  
 b. \*There is being stupid in the room.

The unavailability of such prototypical property denoting nominals in pivot function is mysterious on an instantiation analysis of existentials.

*Existentials out of space and time* While existentials often convey information about instantiation in space and time, it is easy to find examples whose truth does not depend on such instantiation. Some examples are given in (64).

- (64) a. There is a philosopher-king in the ideal state.  
 b. There is a three personed God in Christianity.  
 c. There is mutual aid in an anarchy.

The truth of (64-a) and (64-b) does not depend on whether the properties of being a philosopher-king or a three personed god are instantiated or not. It is true that there is a three personed God in Christianity regardless of whether the property of being a three personed God (whatever that property is) is instantiated at some index or not. (64-c) is a generic sentence about anarchic systems. Its truth does not even require the instantiation of such a system, let alone the instantiation of mutual aid.

Furthermore, the truth of examples such as (65) not only does not require instantiation, but precludes it.

- (65) a. There was a disaster prevented.  
 b. There were two people absent in today's meeting.

(65-a) is true only if the property presumably denoted by *a disaster* is not in fact instantiated at some particular index. In (65-b), if *two people* denotes the property of being a plural individual made of two people, then the sentence is true if a plural entity instantiating that property is *not* instantiated at the index determined by the coda (or codas, if that is the right analysis) *absent in the meeting*.

These three objections seem to me to pose serious problems for any instantiation analysis. The problems may or may not be insurmountable. In the current context, however, this is not a crucial question. The feature of the instantiation analysis that is the focus of this paper is the assignment of property (i.e.  $(e, t)$ ) denotations to codas. This feature is shared by the alternatives to the instantiation analysis, to which I now turn.

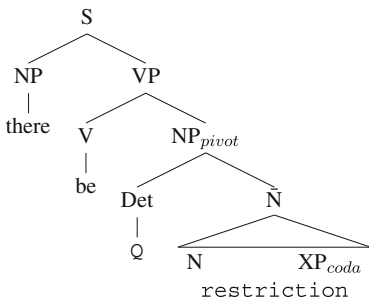
### 3.2 Generalized quantifier analyses

The second major approach to the semantics of existentials does not involve an instantiation predicate, and assigns to pivots a generalized quantifier (GQ) interpretation instead of a property one. GQ analyses fall into two kinds with respect to the interaction of pivot and coda. The first kind views codas as semantically effecting the restriction of the quantifier in the pivot. The second kind views them as contributing the scope of quantification.

3.2.1 GQ analyses I: codas in the restriction

Barwise and Cooper (1981) suggest that it is a universal of natural language that there is a syntactic category NP which denotes a GQ. Since pivots are NPs, they receive GQ denotations (type  $((e, t), t)$ ). The meaning of an existential sentence is derived by applying the meaning of the pivot to the domain of the model of interpretation. The only semantically active element in an existential is therefore the pivot (since the domain of the model is invariable), and hence all material to the right of the copula on this analysis must be part of the pivot NP. Codas are then interpreted as internal modifiers modifying the common noun in the pivot. Their semantic contribution is thus a restriction to the quantification introduced by the pivot.

(66) Barwise and Cooper’s analysis of existentials:



$$\llbracket \text{There be NP} \rrbracket_M = \llbracket NP \rrbracket_M(E), \text{ where } E \text{ is the domain of } M.$$

Zucchi (1995) presents a truth conditionally equivalent variant of this analysis. Like Barwise and Cooper, Zucchi assumes that the meaning of an existential is derived by applying the meaning of the pivot to the domain of quantification of the model of evaluation. However, unlike them, he does not assume that the coda is an internal constituent of the pivot NP, but rather that it is a separate constituent which operates on the context relative to which the existential in which it appears is interpreted.

Intuitively, the role of the coda is to restrict the domain of interpretation for the common noun in the pivot. For example, a sentence like (67) is interpreted to mean that there is a prophet on the boat, where the extension of *prophet* is determined relative to a domain consisting of all and only things that are on the boat. Formally, Zucchi’s truth conditions for existentials with a coda are given in (68). In this formula,  $c$  and  $c'$  are what Zucchi calls contexts. A context for Zucchi is an  $n$ -tuple consisting of various elements, the relevant one for current purposes being a domain  $D(c)$ . For any context  $c$ ,  $D(c) \subseteq E$ , where  $E$  is the domain of the model of interpretation. All expressions thus receive interpretations relative to a model, an assignment function, and a context. For current purposes, the only relevant aspect of a context is the fact that it determines a relevant subdomain of  $E$  for the interpretation of expressions.

(67) There is a prophet on the boat.

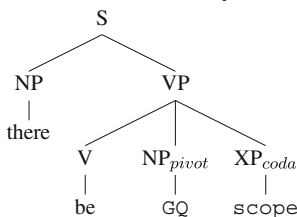
(68)  $\llbracket \text{there be NP XP} \rrbracket_{M,c}^g = 1$  just in case  $E \in \llbracket \text{NP} \rrbracket_{M,c'}^g$   
 where  $c'$  is identical to  $c$  except for the fact that  $D(c') = \llbracket \text{XP} \rrbracket_{M,c}^g$

Truth conditionally, (68) yields the same results as Barwise and Cooper's analysis. However, it makes different claims about the effect of uttering an existential sentence in a context, and hence about the felicity conditions associated with such sentences. While these claims are crucial for his account of the definiteness effect (for which the analysis is tailored), they are not important in the current context, where only the semantic contribution of codas is at issue. This semantic contribution, though couched in a mechanism of domain restriction, is nevertheless a predicate of type  $(e, t)$  which adds a restriction to the quantification in the pivot.

### 3.2.2 GQ analysis II: codas in the scope

Keenan (1987) argues for yet another type of GQ analysis (see also Keenan 2003), which is not truth conditionally equivalent to the Barwise and Cooper analysis. Like Zucchi, Keenan assumes that codas are separate constituents rather than modifiers internal to the pivot. Unlike Zucchi, codas are not viewed as domain restrictors, but rather as predicates which contribute the scope of the quantification introduced by the pivot. Codas thus contribute  $(e, t)$  properties of individuals. Codas and pivots combine by standard function application, and the relation between them is standard predication, the same semantic relation as would be found in a standard copular construction.

(69) **Keenan's (1987) analysis of existentials:**



$$\llbracket \text{There be NP XP} \rrbracket = \llbracket \text{NP} \rrbracket(\llbracket \text{XP} \rrbracket) = 1 \text{ iff } p_{XP} \in Q_{NP}$$

For bare existentials, i.e. in the absence of a coda, Keenan adopts the Barwise and Cooper analysis. Since no predicate is explicitly provided, and hence no particular subset of the domain of quantification  $E$  is signaled as the scope of the quantification for the pivot to compose with, the interpretation defaults to the domain of quantification  $E$ . This is not an unnatural default since  $E$  is always available from the model independently of an interpretation function assigning meanings to predicate symbols.



### 3.3 A note on the definiteness effect

Perhaps the best known and most widely studied topic in the analysis of existentials is a contrast in the degree to which certain types of NPs occur naturally in the construction. This contrast, which has come to be known as the *definiteness effect* (DE), is exemplified in (70).

- (70) a. There is *a/some/one/no* book in the library.  
 b. ??There is the/*this/that/my* book in the library.  
 c. ??There is Jacob/*him* in the library.  
 d. ??There's every/*most/both* books in the library.

Two issues are raised by the DE. The first is what is the correct descriptive generalization involved, and the second is what explains that generalization. Neither of these issues is discussed in this paper,<sup>11</sup> and the semantics proposed in Sect. 2 makes no predictions about such an effect. In this section I want to point out that, contrary to a common perception, most semantic analyses of existentials in the literature draw no direct connection between the propositions they assign to existentials and the explanation they offer for the DE. In other words, the DE does not follow from any existing semantics.

Four analyses of existentials were discussed in this section. These provide three theories of the truth-conditional content of existentials, summarized in (71) in terms of the schematic function-argument structure assigned to existential propositions.

- (71) a. *be instantiated*(*p*), where *p* is a property.  
 b. GQ(E), where E is the domain of quantification.  
 c. GQ(P), where P is the meaning of the coda.

Clearly, neither (71-b) nor (71-c) in any way anticipates or necessitates there being a DE. Consider first (71-b). Any GQ can be applied to E yielding a semantically well formed proposition. The semantic question is whether this is indeed the proposition expressed by an existential. Once this is determined, it is possible to ask what gives rise to the DE, but this can then have no bearing on whether (71-b) provides the correct truth conditional content or not (I show in Sect. 3.4 that it does not). Barwise and Cooper's explanation of the DE, as is well known, is simply that for certain GQs, GQ(E) is trivially true. But whatever principle of grammar, communication or epistemology is supposed to rule out trivially true propositions has nothing in particular to do with their semantics for existentials, which only requires that E be a member of some GQ. The same is true of Zucchi's version of (71-b). Zucchi imposes felicity conditions on existentials in the form of constraints on contexts in which they can be felicitously uttered. But such felicity conditions are imposed on top of an already determined truth-conditional content, the same content as in

<sup>11</sup> see Beaver et al. (2006) for a re-evaluation of the first and a markedness-based approach to the second, and Francez (2007a) for a discussion within a theory of existentials similar to the one proposed in this paper.

Barwise and Cooper's analysis. Whether or not this is the correct truth-conditional content is independent of what the felicity conditions are.

(71-c) similarly imposes no restrictions on the type of GQ that can occur in an existential proposition, and so in itself (as Keenan himself notes) makes no predictions about the existence of a DE or about its explanation. Keenan does provide a characterization of the GQs that are admissible in existentials, but this characterization is independent of his semantics for existentials, which will admit any GQ. In fact, what Keenan characterizes is, as he proves, the class of intersective GQs, namely those GQs constructed from intersective determiners. An intersective determiner is defined in (72).

(72)  $D$  is an intersective determiner iff for any  $A, B \subseteq E$ ,  $D(A, B) \equiv D(A \cap B, E)$ .

That this is a natural class of determiners, and hence of GQs, is independent of the semantics of, and even the existence of, existentials. For example, it is the class that characterizes the set of NPs such that the equivalence in (73) holds (where  $D$  is a determiner,  $N$  a noun and  $V$  a verb), as exemplified in (74).

(73)  $D N V \equiv D N$  who  $V$  exist.

(74) a. Three insects bite  $\leftrightarrow$  Three insects that bite exist.  
 b. Most insects bite  $\not\leftrightarrow$  Most insects that bite exist.

The only semantic analysis that links the DE to the truth-conditional content of existentials directly is McNally's. On her analysis, pivots must denote properties, and at least some quantificational NPs cannot be construed as properties, and are thus ruled out as a pure consequence of the structure of existential propositions. However, as discussed in Sect. 3.1.1, this explanation crucially depends on the assumption that many NPs traditionally taken to denote quantifiers do not in fact denote quantifiers, and furthermore that all downward monotone and non-monotone determiners are lexically decomposed, both of which are problematic. Even if these assumptions are correct, however, they only account for a part of the DE, as McNally notes. To rule out definites, proper names and demonstratives, appeal must be made to pragmatic principles, which are again independent of the semantics of existentials.

Thus, the question of the nature and explanation of the DE is orthogonal to the question of the truth-conditional content and the compositional makeup of existential propositions. The latter is the topic of this paper. I show in the coming sections that this topic is anything but exhausted, and that it is rewarding to approach it on its own terms rather than as a window into the DE.

### 3.4 Deciding between GQ analyses

The two types of GQ analysis just discussed, with codas contributing either the scope or a restriction for the quantifier denoted by the (determiner in the) pivot, can be distinguished by their prediction about, and explanation for, the definiteness

effect. But do they make different predictions about the truth conditional content of existentials? The semantics determined by the two types of analysis can be represented schematically as in (75), where D is the determiner of the pivot, N the common noun of the pivot, C is the coda and E the domain of quantification.

- (75) a. **coda as restriction:**  $D(N \cap C, E)$   
 b. **coda as scope:**  $D(N, C)$

Clearly, for intersective determiners these two representations cannot be distinguished, since, as discussed in the previous section, for such determiners (72) holds (Barwise and Cooper 1981), and hence (75-a) is true iff (75-b) is.

One way to decide between these two theories is therefore to use a proportional or co-intersective determiner. For such quantifiers, the *coda-as-restriction* analysis in (75-a) predicts trivial truth-conditions. For example, EVERY(A, E) is always true for any set A, since E by definition includes all its subsets. The *coda-as-scope* analysis predicts non-trivial truth-conditions which depend on the relation between the sets denoted by the pivot and the coda. But of course the empirical observation behind the DE is that such determiners are not easily acceptable in existentials. Fortunately, there is at least one systematic case, first pointed out by Lumsden (1988) and analyzed in McNally (1992), where they do occur naturally in existentials, namely when the common noun in the pivot is headed by a noun like *kind*, *type*, *variety* etc., as in (76).

- (76) a. There is every kind of fish in that market.  
 b. In addition, there are most types of airspace within an hour's flying, including Class C, D, E and G airspace, MBZs, CTAFs, military airspace and 3 ILS approaches at Brisbane, Amberley and Oakey.<sup>12</sup>

Such cases are complicated by the fact that it is not clear how expressions like *kind of fish* should be interpreted, a question that goes beyond the scope of this paper. Nevertheless, given fairly intuitive assumptions, the two types of analysis can be shown to make different predictions in these cases. To illustrate this, assume that kinds are special individuals of type  $\kappa$ , a subtype of  $e$ , and that they are associated with instantiations by a function  $\cup$  (this notation is borrowed from Chierchia 1998):

- (77) For any  $k_\kappa, \cup k \subseteq E$

Assume further that the meaning of a phrase like *kind of A*, where A is a set term, is represented as the set  $k^A$  of kinds whose extension is comprised of A's. (78) exemplifies this for *kind of fish*.

- (78)  $\llbracket \text{Kind of fish} \rrbracket = k^{\text{fish}} = \lambda k. \cup k \subseteq \lambda y. \text{fish}(y)$

<sup>12</sup> <http://www.fogartys.com.au/frequently-asked-questions.php>.

Determiners like *every* can then have meanings of type  $((\kappa, t), ((e, t), t))$ . For example, the meaning of *every*, given in (79), says that the relation *every* holds between a set of kinds  $k^A$  and a set of individuals  $P$  iff every kind in  $k^A$  is a kind such that at least one of its instantiations is in the extension of  $P$ .

$$(79) \quad \llbracket \text{every}_{((\kappa, t), ((e, t), t))} \rrbracket = \lambda K_{(\kappa, t)} \lambda P_{(e, t)} \cdot \{k : k \in K\} \subset \{k : \cup k \cap P \neq \emptyset\}$$

Determiners combine with expressions such as *kind of fish* to form GQs. The meaning of *every kind of fish* is in (80). The GQ *every kind of fish* applies to a set of individuals if that set contains at least one instance of every kind of fish.

$$(80) \quad \llbracket \text{every kind of fish}_{((e, t), t)} \rrbracket = \lambda P_{(e, t)} \cdot \{k : k \in k^{\text{fish}}\} \subset \{k : \cup k \cap P \neq \emptyset\}$$

With these meanings at hand, it is now possible to assign meanings to (76-a) in terms of the two GQ analyses under consideration and compare the results. On the *coda-as-restriction* analysis in (75-a), codas are intersective internal modifiers combining with the common noun in the pivot. The quantificational structure this analysis assigns to (76-a) is therefore the one in (81).

$$(81) \quad \text{EVERY(KIND-OF-FISH-IN-THE-MARKET, E)}$$

What (81) means depends on what interpretation is assigned to the complex NP *kind of fish (that is) in the market*. If the phrase *kind of fish* is taken to denote a set of sets, as assumed in (76-a), and if *in the market* is taken to denote the set of things in the market, the two cannot intersect, and something else needs to be said about how their combination is interpreted. I see two intuitive possibilities. The first, given in (82-a), is that *in the market* is interpreted as a property that kinds have in virtue of some of their instantiation. The second, shown in (82-b), is that *in the market* is intersected with the set term which names the essential property that all instantiations of the kind share.

$$(82) \quad \begin{array}{l} \text{a. } \llbracket \text{kind of fish in the market} \rrbracket = \lambda k. k \in k^{\text{fish}} \ \& \ \cup k \cap \lambda x. \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \text{in-the-market}(x) \neq \emptyset \\ \text{b. } \llbracket \text{kind of fish in the market} \rrbracket = \lambda k. k \in k^{\text{fish} \cap \text{in-the-market}} \end{array}$$

If one of these representations (or any other in which the NP *every kind of fish* contributes universal quantification) is correct, the semantics in (75-a) clearly yields the wrong meaning for (76-a), since it assigns it a trivial meaning. For example, the proposition it assigns to (76-a) given (82-a) is the one in (83-a), paraphrasable as (83-b). Regardless of how many, if any, kinds of fish have instances in the market, the sentence is true, since there are never any kinds of fish whose instances are not elements of the domain. The same holds if (82-b) is instead the right analysis.

$$(83) \quad \begin{array}{l} \text{a. } \text{every}(\lambda k. k \in k^{\text{fish}} \ \& \ \cup k \cap \lambda x. \text{in-the-market}(x) \neq \emptyset, \lambda k. \cup k \cap E \neq \emptyset) \\ \text{b. } \text{Every kind of fish that has instances in the market has instances in} \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \text{the domain of quantification.} \end{array}$$

The *coda-as-scope* analysis on the other hand makes intuitive predictions when (82-a) is considered. In that case, it assigns to (76-a) the meaning in (84).

- (84) a. **every**( $\lambda k.k \in k^{fish}, \lambda k.\cup k \cap \lambda x.in\text{-the-market}(x) \neq \emptyset$ )  
 b. Every kind of fish has instances in the market.

The same point can be made using a language in which strong quantifiers (in the sense of Barwise and Cooper) are more readily available. As shown in (85), Hebrew allows NPs headed by strong determiners (as well as proper names, definites and pronouns) to occur rather freely in existentials.<sup>13</sup>

- (85) yeS et kol ha-sfarim Sel gerSom Salom ba-sifriya.  
 EX acc all the-books of Gershom Shalom in.def-library  
 They have all of Gerschom Scholem's books in the library.  
 (Lit.: There are all of GS's books in the library.)

This sentence is ambiguous. It can either mean that the library has copies of every book written by Gerschom Scholem, the founder of the scholarly study of Jewish mysticism, or it can mean that the library has all of the books he owned at the time of his death. Both are true about the Jewish National and University Library in Jerusalem. The *coda-as-restriction* analysis wrongly assigns this sentence the trivially true proposition that all of Gerschom Scholem's books that are in the library are in the domain of quantification. Keenan's *coda-as-scope* analysis on the other hand rightly assigns it the contingent proposition that the set of things in the library contains the set of Gerschom Scholem's books. Existentials with non-intersective quantifiers thus provide a clear criterion for judging between the two kinds of GQ analysis, which shows that the contribution of codas must be in the scope, rather than the restriction, of the quantifier in the pivot.

The test described in this section also shows that e.g. adjectival codas are real codas. For example, the sentence in (86) does not quantify over kinds of vegetables that are available but over kinds of vegetables in general. The sentence is true if in some markets one could find a token of most kinds of vegetables.<sup>14</sup> Thus adjectival codas are real codas and must be treated by any analysis of existentials.

- (86) There were most kinds of vegetables available in some markets.

### 3.5 Summary

In this section four analyses of existentials were discussed: the instantiation analysis and three GQ analyses, two in which codas contribute a restriction to the

<sup>13</sup> The Hebrew existential lexeme *yeS* is glossed as EX, avoiding the issue of its categorial status, which is not relevant here (but see Doron 1983; Falk 2004 for discussion). In the glosses, 'S' is used for the palato-alveolar voiceless fricative.

<sup>14</sup> This of course entails that most kinds of vegetables are also kinds of available vegetables, but the reverse entailment does not hold.

quantification introduced by the pivot, and one in which they contribute the scope. I argued against the instantiation analysis, and showed that if a GQ analysis is adopted, it has to follow the analysis in Keenan (1987) in making the semantic contribution of codas determine the scope rather than the restriction of the quantifier in the pivot. Nevertheless, I claim that Keenan's analysis of codas is still inadequate. Like the other analyses, that analysis views codas as contributing  $(e, t)$  predicates. The next section presents several arguments against this view.

#### 4 Against codas as predicates

An important difference between the analysis of existential propositions I proposed in Sect. 2 and the four analyses described above is that the latter, but not the former, analyze codas as denoting predicates. An analysis in which pivots and codas stand in a predication relation is furthermore presupposed in much of the syntactic and typological literature on existentials, where pivots and codas are often seen as constituents in a *small clause* (Chomsky 1981; Safir 1982; Freeze 1992; Moro 1997, to name a few).

This section presents five arguments against analyzing codas as predicates. All five arguments have a common form. Each of them points out a phenomenon in relation to which codas pattern with frame adverbials rather than with predicates, leading to truth conditional differences between existentials and their copular counterparts. If codas are predicates that combine with pivots in a predication relation, then existentials and their copular counterparts are expected, modulo possible syntactic constraints on interpretation, to be truth conditionally equivalent. Some meaning differences between existentials and their corresponding copular constructions are well known, and are at least arguably relatable to the different syntactic position occupied by the NP in the two constructions (the pivot in existentials, the subject in copular clauses). For example, bare plurals are interpreted generically in a copular clause, but must be interpreted existentially in pivot position, as shown in (87).

- (87) a. There are zebras in Africa.  
b. Zebras are in Africa.

None of the contrasts discussed in this section are plausibly relatable to the different interpretations available for existential pivot and copular subject NPs. Some of them have not to my knowledge been noted in the literature. Others have, but have not been properly analyzed. I argue that they are a direct consequence of codas being modifiers rather than predicates.

##### 4.1 Codas with quantifiers

The first piece of evidence that codas are not predicates comes from the main motivation for the analysis in Sect. 2, namely codas with quantifiers. As discussed

there, when the coda is a PP, it can contain a quantifier. Furthermore, an existential can contain more than one such coda. The relevant data is repeated in (88).

- (88) a. There is a drummer in every punk band.  
b. There was a drummer in every punk band in most festivals.

Existentials with quantifiers in the coda have not been explicitly analyzed in the literature.<sup>15</sup> Clearly, they cannot be modeled simply as contributing a property or set, since they show scopal interaction. If codas in general contributed predicates, then the coda in (88-a) should be able to contribute the property of *being in every punk band* (or, equivalently, the set of individuals who are in every punk band). But there is clearly no reading of (88-a) involving this property. Rather, the sentence means that every punk band *has* a drummer. In other words, the logical form required for a sentence like (88-a) is the one in (89). The coda clearly contributes a quantification over punk bands, and hence does not contribute a predicate.

- (89) Every punk band *b*, *b* contains a drummer.

Furthermore, if codas contribute sets, whether to the restriction or to the scope of the pivot, then multiple codas as in (88-b) should be interpreted as multiple conjuncts, giving rise to familiar kinds of conjunct-elimination entailments. However, multiple quantified codas do not give rise to such entailments: (90-a) entails neither (90-b) nor (90-c).

- (90) a. There are two phones in every home in most countries.  $\nrightarrow$   
b. There are two phones in most countries.  
c. There are two phones in every home.

The logical form of (90-a) is represented informally in (91), where the second coda binds a variable in the restriction of the quantification in the first.

- (91) For most countries *c*, every home *h* in *c*, the set of things in *h* contains two phones.

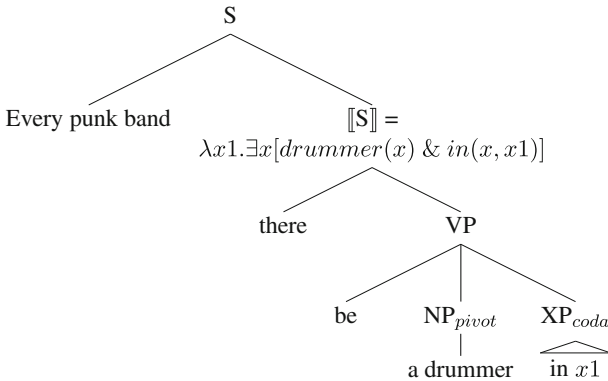
The behavior of quantified codas thus requires some mechanism for handling their scopal behavior, both in relation to the pivot and in relation to each other. None of the analyses discussed so far provide such a mechanism, and providing one entails abandoning the view that codas contribute predicates.

An immediate objection to the last claim is that the data from quantification can be captured within a Keenan-style analysis. Specifically, assuming (69) above, the data simply requires quantifying into the PP coda. Thus, a natural analysis of (88-a) within e.g. a framework like Montague Grammar would be roughly as in (92). The

<sup>15</sup> But see Kuno (1971) for some insightful informal discussion. Francez (2007a,b) present previous versions of the formal analysis presented in Sect. 2.

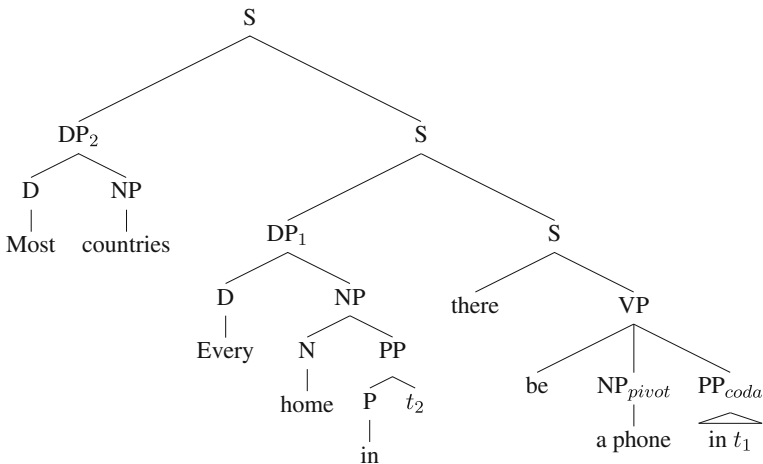
same result could be achieved using a rule of quantifier raising at some syntactic level of representation such as LF.

(92) **Quantifying into codas**



For existentials with multiple codas, the further assumption must be made that all codas are part of a single PP with multiple embedded internal PPs. All such internal PPs must furthermore be inversely linked [in the sense of May (1985)], as must the first coda. (93) shows the logical form that a QR analysis would have to assign to (90-a).

(93) **QR analysis of multiple codas**



I do not pursue this kind of analysis here, for the following reasons. First, I find the assumption that multiple codas form a single PP with multiple, inversely linked NP-internal modifiers, highly unattractive considering the somewhat variable word order of codas demonstrated in (94) and (95).



- (94) a. There are two books on some shelf in every apartment.  
b. There are two books in every apartment on some shelf.
- (95) a. There is a fool in every village in the local tavern.  
b. There is a fool in the local tavern in every village.

Second, it seems to me that an analysis in terms of quantifier raising/quantifying in predicts that codas can show scope ambiguities relative to the pivot. In fact they generally cannot. As noted above and exemplified in (96), existentials with quantified codas systematically lack readings in which the quantifier in the coda receives low scope. Such readings are however completely natural for corresponding copular sentence.

- (96) a. There was some drummer I know in every punk band.  
b. Some drummer I know was in every punk band.

Finally, regardless of the strength of these two objections, an analysis in terms of quantifying in or QR in any case cannot be rightfully claimed to assign a predicate meaning to codas. This is because on this analysis codas as such do not receive *any* interpretation as constituents. Instead, codas make two separate contributions to the semantics: one is a GQ, the other a syncategorematic  $\lambda$ -abstract with a free variable. Neither of these constituents actually *denotes* a set. The analysis I argue for maintains the principle, argued for by proponents of direct compositionality, that any expression which is a syntactic constituent must receive a semantic interpretation (see for example the introductory chapter of Barker and Jacobson 2007).

Thus, whether or not an analysis in terms of quantifying in/quantifier raising is empirically adequate, adopting such an analysis does not alter the fact that codas cannot be characterized as semantically set-denoting. The question remains what kind of semantic entities codas are and how they should be treated in an overall theory of existentials.

Another objection to my claim that quantified codas provide an argument against analyzing codas as predicates was pointed out by a reviewer. The objection is that the fact that PP codas can be analyzed as frame adverbials might be taken to indicate that such PPs have a different status from non-PP codas. Since these PPs are modifiers of the kind that can occur with any sentence, they should perhaps not be viewed as part of the core existential construction. Adjectival and other non-PP codas on the other hand cannot in general function as frame adverbials, and should therefore be analyzed as codas, showing that “real” codas are predicates.

There are several reasons not to accept this objection. First, Sect. 2.4 shows that adjectival codas are in fact amenable to an analysis assimilating them to frame adverbials, and that such an analysis captures various aspects of their behavior that have received no explicit analysis in the literature. Thus, while it is true that adjectives do not generally occur as frame adverbials in non-existential sentences,

adjectival codas do in fact pattern semantically with frame adverbials in important ways.<sup>16</sup>

Second, even if non-PP codas were not amenable to an analysis assimilating them to frame adverbials, this in no way shows that they are part of the core existential construction. What counts as part of the core existential construction is determined by one's theory of existentials, not by pre-theoretical facts. It is perfectly possible to analyze non-PP codas as something other than frame adverbials and still not part of the core existential construction. McNally's (1992) analysis is an example. On that analysis, as discussed, the core existential construction consists of an instantiation predicate and a property. Codas are external modifiers (though adjectival codas are depictives, not frame adverbials).

Third, it seems unlikely that in a simple existential like (97), the PP is anything but a very prototypical coda, no different in status from a non-PP coda. At least, no analysis I am aware of assumes otherwise.

(97) There is a man in the room.

If this is so, then there seems to be no reason why the PP in (98) should be any different; adding a quantifier should not change the status of the PP.

(98) There is a man in every room.

Thus, a theory in which (97) involves a coda would be hard pressed to argue that (98) does not, and there is therefore no obvious reason to deny the PPs discussed in Sect. 2 the same status as non-PP codas.

Finally, if one maintains that the PP in (98) [or (97)] are not codas, one is committed to one of the following:

- (i) There is a silent or missing coda in the sentence.
- (ii) Some existentials have frame adverbials but no coda.

Choosing (i), one would have to explain, among other things, how the missing coda is interpreted. In particular, one would have to explain how it is interpreted in the presence of quantified modifiers, since Sect. 2 clearly established that such modifiers bind into the scope set for the pivot quantifier. It seems to me that any such specification of the semantics of missing codas would simply emulate the analysis

<sup>16</sup> I conjecture that the inability of adjectives to act as frame adverbials in verbal sentences has to do with the simple semantic fact that such sentences, unlike bare existentials, cannot express properties of sets of individuals, but only of sets of intervals. For example, if *drunk* were a frame adverbial in (i-a), the sentence would have to mean something like (i-b), which is nonsense.

- (i) a. Brutus killed Caesar drunk.
- b. The topic interval *I* is such that the set of people who are drunk during *I* is *Brutus Killed Caesar*.

Instead, (96-a) means either that Brutus or else that Caesar was drunk during the killing. An analysis of the so-called depictive reading of adjectives is well beyond my scope here.

of quantified PPs in Sect. 2 with some other machinery. Similarly, choosing (ii) entails explaining how bare existentials are interpreted and how they are modified by quantified modifiers. Again such an explanation would must in the end emulate the analysis proposed in Sect. 2. I thus do not see any gain in assuming that PP codas have a different status from any other coda, whereas the loss in generality is obvious.

#### 4.2 Part-whole/constitution readings

Existentials, but not their copular counterparts, allow part-whole and what I call *constitution* readings. The relevant contrast is exemplified in (99).

- (99) a. There is *a*/no prime minister in the U.S.  
 b. *A*/no prime minister is in the U.S.

(99-a) has a reading according to which the country called the U.S. does not have a prime minister, i.e. the set of things that constitute the U.S. as a state apparatus does not include a prime minister. (99-b) lacks this reading, and can only mean that no prime minister (of any country) is visiting the U.S. at the reference time.

This contrast is related to the observation, to my knowledge first commented on by Kimball (1973), that certain existentials lack a corresponding copular construction altogether.

- (100) a. There is room in the car.  
 b. \*Room is in the car.

- (101) a. There are penalty kicks in soccer.<sup>17</sup>  
 b. \*Penalty kicks are in soccer.

Perhaps the contrast in (100) can again be traced to constraints on the interpretation of certain nominals in subject position. However, for examples such as (99) and (101) this is unlikely.

Since the existential and copular examples consist of exactly the same material, any difference in meaning must come either from the configuration in which the relevant parts occur, i.e. from their mode of combination, or from a lexical ambiguity. It cannot be purely lexical, since whichever lexical item introduces the ambiguity should in principle introduce it in both the existential and copular construction. Yet on a Keenan-style analysis, no difference in the mode of composition is possible. I suggest that the contrast results from a confluence of both factors.

The descriptive generalization behind the contrast seems to be simply that as part of a modifier, the preposition *in* has a superset of the meanings available to it as a predicate. Specifically, in a modifier it can have a whole range of meanings, whereas as a predicate it is generally (though not absolutely) restricted to location. This is

<sup>17</sup> I note, without further comment, that this example is a putative counterexample to the generalization that bare plurals cannot have kind-readings in existentials.

shown in (102), where changing a post-nominal modifier to a predicative relative clause eliminates the constitution reading. The fact that this kind of ambiguity is present with codas but not with predicates is thus not surprising on the view of codas as modifiers.

- (102) a. Prime ministers in the U.S. are elected by Congress.  
 b. Prime ministers who are in the U.S. are elected by Congress.  
 (Only locative reading)  
 c. Knights in chess can move over other pieces.  
 d. ??Knights who are in chess can move over other pieces.  
 (Only locative reading)

The question is why should the constitution reading of *in* be unavailable in a predicative contexts? My conjecture is that in a post-copular context, where the prepositional phrase acts as the main predicate of the construction, it semantically selects the subject argument. Prototypically, constitutive parts are *existentially dependent* on the wholes of which they are parts. For example, the role of prime minister is not defined outside of a state apparatus, and penalty kicks are only defined within the rules of soccer. A state apparatus on the other hand exists independently of the role of prime minister, as soccer rules are not dependent on the existence of penalty kicks. Since independent existence is a proto-agent property in the sense of Dowty (1991), the part-whole relation is not readily expressed by a predication in which the subject is existentially-dependent.

When *in* occurs in a PP modifier on the other hand, it is not part of the core predication at all, and the problem does not arise. Specifically, in an existential expressing a constitution relation, the expression expressing the integral part is, on the current semantics, the main predicate, not the subject, and hence no problem arises with existential-dependence. The closest thing to a semantic “subject” in an existential is the (implicit) argument corresponding to the scope of the pivot quantifier, the value of which the coda determines. This argument corresponds to the whole, and is existentially independent.

This is perhaps clearest in the case of quantified codas, where the quantification is intuitively over entities that comprise wholes, and the scope of quantification is the property of (not) containing some quantity or proportion of parts of some sort. Consider, for example, the meaning assigned by the current analysis to (103-a), paraphrased informally in (103-b).

- (103) a. There is a 12 year old kid in every class.  
 b. Every class *c* is such that the set of its constitutive parts ( $\lambda x.x < c$ ) contains a 12 year old kid.

The sentence expresses a quantification over classes, conceived as wholes, and the scope set is the set of wholes which have a 12 year old as an integral part.

Note that since the *part-of* relation  $<$  is not transitive, cases of multiple constitutive codas do not yield conjunctive inferences, as shown in (104).

- (104) a. There are two doors in some car in some race.  
 b.  $\rightarrow$  There are two doors in some race.

Like other codas, codas expressing part-whole relations can also be stacked, in which case the interaction of quantifiers in them is the same as with temporal and locative codas. Again, as with other quantified codas, the codas in (105-a) do not license conjunctive inferences.

- (105) a. There are two doors in every car in most races.  
 b.  $\rightarrow$  There are two doors in every car.  
 c.  $\rightarrow$  There are two doors in most races.

The intuitive meaning of (105-a) is that every race is such that every car that is part of it is such that its set of parts contains two doors. In terms of the current semantics, the meaning of the sentence can be represented as in (106), where  $<_x$  is used for the set of things standing in the (constitutive) part-of relation to  $x$ . I call this set the *mereological domain* of  $x$ .

- (106) **most**( $\lambda r$ [race( $r$ )],  
 $\lambda r'$ [**every**( $\lambda c$ [car( $c$ ) &  $c \in <_{r'}$  ],  
 $\lambda c'$ [**two**( $\lambda x$ [door( $x$ )],  $<_{c'}$ )])]])

Here, the first coda restricts the possible values of the implicit argument of the pivot *two doors* to those mereological domain  $<_{c'}$  that are the mereological domains of a car. The second coda further restricts the relevant cars to cars that are in the mereological domain of a race.

#### 4.3 Licensing of free choice any

Codas, but not post-copular predicates, license free choice (FC) *any*, as the contrast in (107) shows. (107-c) shows that codas in this respect pattern with contextual modifiers, as expected on the current analysis.

- (107) a. There's a drummer in any punk band.  
 b. ??A drummer is in any punk band.  
 c. The drummer smokes in any punk band.

I suggest that the key to understanding this contrast is the availability of a generic reading for *any*. It is well known that FC *any* has readings in which it is interpreted as an indefinite [(108-a)] and others in which it is interpreted as a wide scope universal [(108-b)] (see e.g. Horn 1972, 2000; Dayal 1998; Giannakidou 2001)

- (108) a. Press any key to continue. (Giannakidou 2001)  
 (= *Press a key*)  
 b. Any fool can think of words that rhyme. (Morrissey, *Sing your life*, 1991)  
 (= *Every fool can . . .*)

Here I assume what Horn (2000) calls the *indefinitist* analysis of FC *any*, according to which it is interpreted as a generic indefinite, i.e. an indefinite in the scope of a silent generic operator. In both (107-a) and (107-b), *any* is interpreted as involving a quasi-universal force similar to the force associated with generics. In fact, both (107-a) and (107-c) are paraphrasable with a generically interpreted indefinite replacing *any*, as in (109).

- (109) a. There's a drummer in a punk band.  
b. The drummer smokes in a punk band.

Thus, a coda with free choice *any* is interpreted as a quantificational coda, where the quantification is generic. The analysis of (107-a) can be represented as in (110). Deriving this meaning compositionally in the same manner as was employed for quantified codas above is straightforward.

- (110)  $\text{GEN}_x [\text{PB}(x)] [\mathbf{a}(\lambda y[\text{drummer}(y)], <_x)]$

Generic NPs in general are not felicitous in post-copular predicates, as shown in (111). Presumably, the reason is that predicates denote properties of individuals, and generics conceptually cannot form such properties. The generic jail is not something capable of hosting Mary.

- (111) ??Mary is in a jail. (strange on generic reading of *a jail*)

This analysis of codas with FC *any* entails that codas can in general contribute a restriction to a quantification not explicitly contributed by the NP in the coda. This is a desirable feature, since codas are also in general mapped to the restriction of an adverb of quantification when one is present in an existential. For example, a sentence like (112-a) means that most zoos have a zoo-keeper, and can be informally represented as in (112-b).<sup>18</sup>

- (112) a. There is usually a zoo-keeper in a zoo.  
b.  $\text{USUALLY}_x [\text{zoo}(x)] [\mathbf{a}(\lambda y[\text{zoo-keeper}(y)], <_x)]$

The analysis of codas as modifiers, and of pivots as context-sensitive predicates thus provides a natural way of capturing the interaction of existentials with adverbs of quantification. As noted by various authors (e.g. Heim 1987; Kim 1997), this is another way in which existentials contrast with corresponding copular clauses. Compare the copular (113) with the existential in (112-a).

- (113) A zoo-keeper is usually in a zoo.

<sup>18</sup> This raises the interesting question of how exactly the logical form in (112-b) is to be compositionally derived. I cannot elucidate this question here and leave it for future research.

The subject NP *a zoo-keeper* in (113) forms the restriction of the quantificational adverb. In the existential in (112-a) on the other hand, the NP in the coda forms the restriction, and the NP *a zoo-keeper* is part of the scope.

Kim (1997) explains this contrast in terms of information structure.<sup>19</sup> According to her, the NP subject of a copular clause is the topic of the sentence, whereas in an existential the pivot is part of the assertion. Since topic and focus generally map onto the restriction and scope of quantificational adverbs respectively (e.g. Chierchia 1992; Rooth 1995), the relevant NP is mapped to the scope in an existential, to the restriction in a copular clause. The intuition that existentials differ from copular clauses in information structure, and particularly that existential pivots are focus elements is common in the literature (Babby 1980; Kuroda 1972; Sasse 1995; Lambrecht 1994; Erteschik Shir 1997, Borschev and Partee 2001; Lambrecht 2000, *inter alia*).

On the current analysis this contrast between existentials and copulars follows from their different predicational structures. In existentials, pivots are the main predicates, and like other main predicates tend to form the assertion or focus and are mapped to the nuclear scope of quantificational adverbs. Codas are sentential modifiers, and like other sentential modifiers tend to map to the restriction of a quantificational adverb. For example, the natural interpretation of (114) is that most situations in which Miriam is on a ship are situations in which she falls asleep.

(114) Miriam usually falls asleep on ships.

The generalization that emerges from this discussion is that codas can contribute the restriction of a quantificational operator, whether it comes from within the coda itself or from an external operator such as an adverb of quantification. The theory of existential propositions proposed here anticipates this behavior of codas since (a) it models them as modifiers rather than predicates and (b) it makes available an implicit argument in the pivot for the quantificational operator to bind.

#### 4.4 Free relative codas

Free relatives receive different interpretations when they function as codas, as in (115-a), and when they function as post-copular predicates, as in (115-b). While the former means that my place of origin features a zoo, the latter can only mean that I come from a zoo.

- (115) a. There is a zoo where I come from.  
b. A zoo is where I come from.

The coda *where I come from* in (115-a) is interpreted as if it were the PP *in the place from which I come*. Thus, if the place where I come from is San Diego, the sentence means that there is a zoo in San Diego. In contrast, the predicate *where I come from*

<sup>19</sup> Kim's analysis is the only one I am aware of that attempts a formalization (within situation semantics) of the information structural difference between existential and copular sentences.

in (115-b) is interpreted as the NP *the place I come from*. This NP is predicated of (or equated with, depending on one's analysis of such definite descriptions) the subject, *a zoo*, and the sentence is true iff some zoo is the place I come from. The phenomenon is quite general. More examples are given in (116) and (117).

- (116) a. There is a toilet where we went camping.  $\neq$   
 b. A toilet is where we went camping.
- (117) a. There was a war the last time someone killed a prince.  $\neq$   
 b. A war was the last time someone killed a prince.

It might be objected that the free relative in examples like (115-a) is not a coda at all, but rather an adjunct. However, this objection presupposes that codas are not adjuncts, but something else. But if codas are not adjuncts, then they are either NP-internal modifiers, or else predicates. The former option would lead to a codas-as-restriction analysis, and can be ruled out for the reasons specified in Sect. 3.4. The latter option is exactly what this section has been arguing against. Adopting it begs the question why such codas systematically receive a different interpretation from corresponding post-copular predicates. Furthermore, the relevant free relatives are semantically indistinguishable from standard PP codas. For example, if I come from Israel, (118-a) is truth-conditionally equivalent to (118-b).

- (118) a. There is a war [where I come from].  
 b. There is a war [in Israel].

Similarly, if I was born in Chicago, then (119-a) and (119-b) have the same meaning.

- (119) a. There is a zoo where I was born.  
 b. There is a zoo in Chicago.

Hence, as far as the semantic contribution of codas and their semantic relation to pivots is concerned, free relatives following a pivot are indistinguishable from paradigmatic PP codas.

The explanation for this contrast between free relatives (FRs) in codas and in post-copular position comes from very general observations about their nature. Various authors [e.g. Emonds 1976; Larson 1985; McCawley 1988 and most recently Caponigro and Pearl (2008)] point out that some FRs are ambiguous between NP and PP readings. Thus, in (120-a) the FR can be replaced by an NP *salva veritate*, and the one in (120-b) can be replaced with a PP.

- (120) a. I like where you're going. (NP interpretation)  
 b. You'll need this where you're going. (PP interpretation)

For example, if I am on my way to Hell, (120-a) and (120-b) can be paraphrased as in (121-a) and (121-b), respectively.



- (121) a. I like Hell.  
 b. You'll need this in Hell.

Another fairly uncontroversial observation about the two FRs, and the NP and PP that replace them in (121-a) and (121-b), respectively, is their role in the predicational structure of the sentence. The FR/NP in (120-a) and (121-a) is an argument, whereas the FR/PP in (120-b) and (121-b) is a (verbal or sentential) modifier.

The different roles played by the FRs in the predication and their paraphrasability with either an NP or a PP correlate, of course, with their interpretation. In (120-a) and (121-a), where the FR is an argument and corresponds to an NP, it clearly refers to a place: Hell. The role of the FR in (120-b) [and the PP in (121-b)] is to locate the event expressed in the rest of the clause within some spatiotemporal parameters.

Now PPs such as *in Hell* have another function beyond the two mentioned above (argument and modifier). They can also act as main semantic predicates in copular clauses such as (122).

- (122) Orpheus is in Hell.

However, in this kind of predicative context, the PP is not interchangeable with a FR. If I am going to hell, the PP *in hell* cannot be replaced with the FR *where I'm going*, as shown in (123).<sup>20</sup>

- (123) Orpheus is in Hell  $\neq$  ??Orpheus is where I'm going.

That FRs in predicative positions have only NP meanings and no PP meanings is also evidenced by the inference patterns. If the FR in (124-a) had PP readings, then the inference in (124-a) would be as seamless as the one in (124-b). However, this inference is not valid.

- (124) a. I grew up in New York  
 Penn Station is in New York  
 $\rightarrow$  Penn Station is where I grew up.  
 b. I grew up in New York  
 Penn Station is in New York  
 $\rightarrow$  Penn Station is in the city I grew up in.

Thus, FRs in predicative positions have NP meanings whereas as modifiers they have PP meanings.<sup>21</sup> The interpretation of FRs in existentials as exemplified in the contrast in (115), (116) and (117) is as PPs, not NPs, and in this sense codas pattern

<sup>20</sup> There do seem to be cases where a FR in predicative position is replaceable by a PP, e.g. in such set expressions as *Love is where you find it* and also with more productive expressions like *Home is where you want it to be* or, more strikingly, in a sentence such as *Make sure everything is where you left it*. I do not know what distinguishes these examples from (123).

<sup>21</sup> I do not enter here the interesting question of whether this systematic interpretational difference entails two distinct structures for FRs, one involving an NP and the other a PP with an empty preposition (see Caponigro and Pearl (2008) for a suggestion along these lines).

with modifiers, not with predicates. The truth conditional difference between existentials and copulars with FRs stems therefore from the difference between the general semantics of FR-modifiers vs. that of FR-predicates. This is summarized in (125).

(125) The interpretation and function of free relatives in existential and copulars

Construction	Interpretation	Function
Existentials	PP/*NP	modifier
Copulars	*PP/NP	predicate

An anonymous reviewer proposes the possibility that what is responsible for the pattern in (125) is not the properties of FRs per se, but rather a confluence of two more general factors. The argument, as I understand it, runs as follows:

- (i) The observation that subjects of copular locatives do not have PP interpretations is an illusion arising from the use of bare singular indefinites. The latter lack partitive interpretations. When an NP which allows partitive interpretation is used, the relevant PP interpretation is readily available. Thus, this interpretation is available in (126) when *two toilets* is read partitively.

(126) Two toilets are where we went camping. (Read as: two of the toilets are where we went camping)

On the partitive reading, there is therefore no difference between the existential and its copular counterpart, beyond the fact that pivots cannot be interpreted partitively, due to the definiteness effect.

- (ii) What I call the NP interpretation involves an identity statement. That existentials with FR codas do not show this reading reduces to the fact that existentials cannot express identity statements, which no theory predicts them to.

I find this alternative explanation for the facts unsatisfactory. First, the contrast in availability of a PP interpretation between existentials and copular sentences is in no way dependent on the presence of an indefinite singular NP, and can be recreated with many other NP types. This is shown in (127) and (128).

- (127) a. No zoos are where I come from.  
b. There are no zoo where I come from.

- (128) a. Exactly two beds are where my mother gave birth.  
b. There are exactly two beds where my mother gave birth.

I agree with the reviewer that the example in (126) has the relevant PP interpretation (two toilets are located in the place where we camped) on a partitive reading of the NP. But the fact at stake here is that a PP interpretation is unavailable for the copular sentence on the non-partitive reading, whereas it is the only interpretation available for the existential counterpart in (129). The observation that partitive readings license the PP interpretation does nothing to explain this.

(129) There are two toilets where we went camping.

On the contrary, this interesting observation is itself in need of explanation. I see no obvious reason why partitivity should affect the interpretation of post-copular FRs in this way. In fact, fn 20 mentions yet other contexts in which PP interpretations seem natural in copular clauses. Thus, there are certainly interesting exceptions to the pattern in (125), and the exceptions might be systematic, but a pattern is not explained by the existence of systematic exceptions.

The alternative explanation for the lack of NP interpretations for FR-codas presupposes that the former involve identity statements, i.e. that examples like (130) involve an identity predicate and a referential reading for the free relative.

(130) Amsterdam is where I lost my wallet.

However, this is a controversial assumption, and certainly an analysis where no identity predicate is present is readily available. On such an analysis, the phrase *where I lost my wallet* could denote the set  $\{x : \text{I lost my wallet in } x\}$ .

Furthermore, while it is true that none of the analyses discussed earlier predicts identity readings for existentials, it is also true that none of them formally precludes such readings, since all identity statements can be modeled as involving predication. For example, (130) could involve predicating of Amsterdam membership in the set  $\{x : \exists!y[\text{I lost my wallet in } y] \& x = y\}$ .

In order to preclude such predicates in a theory of existentials in which codas denote sets, the theory must make further assumptions about what *kinds* of predicates are allowed in the coda. For example, McNally (1992) adds a requirement on codas that they express temporally and/or spatially bound properties in order to model the claim, often made in the literature following Milsark, that codas are restricted to stage level predicates. However, NP interpretations for FRs can involve temporally bound properties, and when they do they are still unavailable for codas. Thus, (131-a) has a reading that (131-b) lacks when the FR *where I used to live* is read as a coda (i.e. as providing the *scope* for the pivot, see Sect. 3.4). On this reading, there is some bus station that, until last year, had the property of being my habitual residence.

(131) a. Until last year, a downtown bus station was where I used to live.  
b. Until last year, there was a downtown bus station where I used to live.

Thus, it is far from clear that the NP interpretation involves identity, and if it does, this does not immediately explain its absence for FR-codas.

#### 4.5 Durational vs. punctual interpretations of duration-PPs

A final contrast between the interpretation of codas and that of post-copular predicates involves PPs relating duration, such as *until noon* or *for 10 h*. Specifically, such PPs receive a durational interpretation as post-copular predicates, but as codas they are ambiguous between this reading and one in which they locate a situation within some temporal coordinates.<sup>22</sup>

- (132) a. There was exactly one strike until December.  
 b. ? Exactly one strike was until December.
- (133) a. There were no contracts for more than a year.  
 b. No contracts were for more than a year.
- (134) a. There were many TV programs until midnight.  
 b. ? Many TV programs were until midnight.

Consider (132) as an example. (132-a) is ambiguous. It can mean either that exactly one strike started before December (regardless of when they ended), or that exactly one strike is such that its duration was until December. (132-b) only means that exactly one strike lasted until December. In other words, the scenario in (135), in which there is just one strike which ends before December 1st, makes (132-a) true and (132-b) false.

- (135) - - - <—strike—> - - - Dec.1<sup>st</sup>

Exactly the same contrast with exactly the same meanings can be found in Hebrew, where again the copular variants strike speakers as somewhat odd.

- (136) a. yeS harbe tisot ad xacot.  
 EX many flights until midnight  
 There are many flights until midnight. (But few later.)  
 b. ?harbe tisot hen ad xacot.  
 many flights cop[3.f.pl] until midnight  
 Many flights are/run until midnight.

It seems clear that the contrast here, as in the part-whole examples, has to do with the different interpretations available for the preposition *until*. That *until*-PPs give rise to two readings, a punctual one and a durative one, is well known (Karttunen 1974; Declerck 1995; de Swart 1996; Giannakidou 2002; Condoravdi 2008). The standard generalization in the literature is that punctual *until* is used with telic

<sup>22</sup> English copular sentences with such PPs are often odd to native speakers and are difficult to find in corpora. Nevertheless, speakers I have consulted with converge in their intuitions about the meaning of such examples, to the extent that they are acceptable. Note also that fronting of the coda significantly improves the existential examples.

predicates and is a negative polarity item, whereas durative *until* is not polarity sensitive and occurs with atelic predicates.

- (137) a. He was sick until last night. (durative)  
 b. He didn't arrive until last night. (punctual) (compare: \*He arrived until last night.)

However, the examples in (132), (134) and (136) do not involve negation or any other downward entailing environment. In fact, the contrast in interpretation I am concerned with here does not depend on the presence or absence of negation, also in non-existential contexts. The same contrast arises with telic and atelic predicates in standard verbal constructions, as shown by the contrast between the naturally occurring (138-a) and its constructed counterpart (138-b).

- (138) a. Hundreds of people died until the epidemic ran its course.<sup>23</sup>  
 (telic, punctual).  
 b. Hundreds of people hid until the epidemic ran its course.  
 (atelic, durative).

I suggest that the contrast between existentials and their copular variants in this context is again due to the difference between predicates and modifiers. Specifically, my suggestion is that in a copular clause, a duration-PP contributes a property of events, the property of having a certain duration (for example, having a duration with a specific right boundary). In existentials, according to the proposed analysis, codas are modifiers. Thus, the contribution of a duration-PP coda is, as with all temporal modifiers, to locate an eventuality or a time within some temporal coordinates. For example, (132-a) will be true just in case the interval running from some contextually determined left boundary to December 1st is such that it overlaps with exactly one strike interval.<sup>24</sup>

Returning to the example in (132), the meaning of *until December* when it functions as a predicate can be modeled along the lines of (139), where  $rb(i)$  and  $lb(i)$  stand for the right and left boundaries of an interval  $i$ , respectively. (Here I assume that points, such as right and left boundaries, are a special case of intervals.)

- (139) a.  $[[\text{until}]] = \lambda j \lambda i [rb(i) \subset j]$   
 b.  $[[\text{until December}]] = \lambda i [rb(i) \subset Dec.]$

Assuming that a noun like *strike* can denote both an event (cf. *The strike was violent*) and an interval (cf. *The strike was long*), this predicate combines in the standard way with a subject like *exactly one strike*.

<sup>23</sup> Harris (1994, p. 97).

<sup>24</sup> Here the required relation is overlap rather than the subinterval relation, since the strike interval need not be strictly contained in the relevant interval—the sentence is consistent with the strike continuing after December 1st, as long as after this time it is not the only strike. Probably, overlap should also replace the subinterval relation in the treatment of all temporal modifiers.

The punctual reading of the PP in the existential (132-a) can be modeled in a way parallel to other temporal modifiers and codas discussed earlier. I make the fairly standard assumption that the modifier PP *until December* is interpreted with an *in* (or *at*) relation which is not expressed in the syntax. Also, the meaning of *until* in this example is the punctual meaning rather than the durative one used in (139). For current purposes, I take this meaning to be a function from an interval  $t$  to the interval  $[lb_*, t)$ , i.e. the interval starting at some contextual left boundary  $lb_*$  and ending immediately before the left boundary of  $t$ . The derivation of (132-a) is shown in (140), where  $\circ$  is the overlap relation.

- (140) a.  $\llbracket \text{until} \rrbracket = \lambda j [ [lb_*, j) ]$   
 b.  $\llbracket \text{until December} \rrbracket = \lambda P_{i,t} [ P( [lb_*, Dec.) ) ]$   
 c.  $\llbracket \text{in} \rrbracket = \lambda \mathcal{P}_{((t,t),t)} \lambda \mathcal{Q}_{((t,t),t)} [ \mathcal{P}(\lambda i [ \mathcal{Q}(\lambda j [ j \circ i ] ) ] ) ]$   
 d.  $\llbracket \text{until December}_{mod} \rrbracket = \lambda \mathcal{Q}_{((t,t),t)} [ \mathcal{Q}(\lambda j [ j \circ [lb_*, Dec.) ] ) ]$   
 e.  $\llbracket \text{There was exactly one strike until December} \rrbracket =$   
 $\llbracket \text{until December}_{mod} \rrbracket ( \llbracket \text{There was exactly one strike} \rrbracket ) =$   
 $\lambda \mathcal{Q}_{((t,t),t)} [ \mathcal{Q}(\lambda j [ j \circ [lb_*, Dec.) ] ) ] ( \lambda P_{i,t} [ | P \cap \lambda i [ \text{strike}(i) ] | = 1 ] ) =$   
 $| \lambda j [ j \circ [lb_*, Dec.) ] \cap \lambda i [ \text{strike}(i) ] | = 1$

The durative reading of the existential can be derived by replacing the subinterval relation with the identity relation. This analysis of the contrast captures the intuition that in the existential example (132-a), something is said about the set of times until December, whereas in the copular example something is said about the interval of the strike.

## 5 Summary: codas, predicates and modifiers

This paper started out with the basic question of what propositions are expressed by existentials, and how such propositions are compositionally derived from a predicate and its arguments. I claimed that codas are not predicates but rather modifiers. Two arguments were brought in support of this claim.

The first is the behavior of codas with quantifiers and multiple codas, which was shown to parallel the behavior of quantified and multiple modifiers. A theory in which codas are predicates cannot model such codas without losing important generalizations about the scopal behavior of quantifiers in predicational contexts.

The second argument is a range of systematic semantic differences between the interpretation of codas and the interpretation of corresponding predicates. Four such differences were pointed out and discussed:

1. Presence of part-whole readings.
2. Licensing of free-choice *any*.
3. Punctual vs. durative interpretation of duration PPs.
4. The interpretation of free-relatives.

In all four cases, codas pattern in terms of their interpretations with sentential modifiers rather than with predicates. The case of part-whole readings and punctual

interpretations of temporal PPs both involve readings of *in*. In both cases, the reading available in codas but not in predicative PPs is a reading characteristic of adverbial modifiers. Temporal adverbial modifiers and temporal PPs function to locate the meanings they modify within a spatiotemporal region. Their interpretation involves a relation, often called AT in the literature (following Dowty 1979), which is a part-whole relation on intervals, the subinterval relation  $\subseteq$ . For example, the interpretation of a simple adverbial like *yesterday* in (141) is as if a silent preposition equivalent in meaning to *on*, *in* or *during* were present, and the sentence is true iff the interval of John's leaving is a subinterval of yesterday.

(141) John left yesterday.

If codas are modifiers, it is not surprising that they should allow an interpretation of this kind for *in*, and my claim is that the subinterval relation and the part-whole relation are two of a kind.

The fact that existentials but not copular constructions allow “PP interpretations” of free-relatives follows from exactly the same feature of the semantics of modification. A free-relative coda is a free-relative modifier, and as such its interpretation involves a part-whole relation (which may or may not correspond to a silent preposition). The fact that existential codas but not post-copular predicates license free-choice *any* was argued to follow from the general incoherence of a generically interpreted NP forming part of a locative predicate. In a modifying PP, on the other hand, the generically interpreted *any*-NP unproblematically binds the implicit argument of the pivot. Intuitively, codas with free-choice *any* simply express generalizations about the sets to which the predicate denoted by the pivot applies.

These arguments, taken together with the simple observation that codas are optional, show conclusively that codas are not predicates, and hence that a theory of existentials should not model the pivot-coda relation as one of predication. I presented a theory of existential propositions in which they consist of a second-order predicate (a generalized quantifier) with an implicit scope-set argument. Informally, the main intuition behind this theory is that existentials serve to assert about a certain contextual domain, such as a spatiotemporal location or a contextually distinguished “region” of the universe of quantification, that it contains or does not contain a quantity or proportion of elements of some sort. Codas are modeled as contextual modifiers on a par with sentential temporal and locative modifiers. Thus, tracing the semantics of existentials and particularly of codas has served to bring to the fore several general properties that distinguish the grammar of modification from that of predication. It seems plausible to expect these properties to extend to post-nominal modification as well, though I leave this issue for further research.

Finally, tracing the semantics of codas has revealed some interesting features of the mechanism of contextual domain restriction. It is well known that quantification in natural language is generally contextually restricted, and that such restriction must be allowed to affect truth-conditional content. The nature of the relevant mechanism however has been the topic of much recent debate (see e.g. Stanley and Gendler Szabó 2000). If the semantics I proposed is on the right track, then codas provide further evidence that context-sets must also be made available for binding,

and hence that quantifier domain restriction is, at least in some cases, semantic. Furthermore, if I am right about the presence of an implicit set-argument in the logical form of existentials, this shows that context-sets can be present in the scope, and not only the restriction, of quantifiers.

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