



Figure 1  
Coordination or nesting of adverbial phrases

Semantics and pragmatics of  
English verbal dependent coordination

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This article investigates coordination of verbal adjuncts and complements in English, considering all three possibilities: coordinations of adjunct with adjunct, complement with complement, and adjunct with complement, for both non-wh and wh elements, considering the conjunctions or, and, and but. Previous analyses have never to my knowledge covered all these cases. It is shown that syntactic or (compositional) semantic constraints on coordination fail to cover all the facts, as do ambiguity-based explanations. In contrast, an analysis based on event semantics and neo-Gricean conversational implicature makes correct predictions about all three kinds of coordination.\*

## 1 Introduction

Coordination remains a troublesome topic in syntax, and a basic question that has still not been settled is exactly how similar coordinated words or phrases must be to each other. Since Chomsky (1957), a general assumption has been that two or more elements can be coordinated if and only if they have the same syntactic category, or the same sequence of syntactic categories if the coordinated elements contain more than one constituent. Williams (1981) names this constraint the Law of Coordination of Likes (LCL). Even so, it has been recognized that there are empirical problems with both the if and the only if part of the LCL: Likeness of conjuncts' syntactic categories is neither sufficient nor necessary for a coordination to be grammatical.

That likeness of conjuncts' syntactic categories is not sufficient has been noted in cases where two (or more) elements have like syntactic categories, but nevertheless do not seem to be coordinable, as seen in sentences such as those in (1). These sentences attempt to coordinate elements with like categories, specifically, adverbial phrases (Schachter's and Bechhofer's judgments):

- (1) a. \*John ate with his mother and with good appetite. (Schachter 1977, (10))  
b. \*I saw John yesterday and in the Coop.<sup>1</sup> (Bechhofer 1976, (70))

Coordinations of adverbial phrases will be referred to as ADJUNCT-ADJUNCT COORDINATIONS, with the understanding that VP adjuncts are the adjuncts under discussion.

Similarly, likeness of conjuncts' syntactic categories is not sufficient to license COMPLEMENT-COMPLEMENT COORDINATIONS such as the one in (2), which takes advantage of the two transitive alternants of the verb serve:

- (2) [\*]Robin served the guests and the desserts.

One alternant requires a recipient as its direct object, as in Robin served the guests. The other requires a theme as its direct object, as in Robin served the desserts. In (2), though, serve is used in both senses at once, coordinating a recipient NP the guests with a theme NP the desserts. The square brackets around the \* indicate that the sentence is

ungrammatical under this reading, although grammatical under other readings—in this case, the bizarre readings in which both the guests and the desserts are the recipients, or both the guests and the desserts are the theme.

That likeness of conjuncts' syntactic categories is not necessary for grammaticality can be seen in grammatical complement-complement coordinations known as 'coordinations of unlikes,' exemplified in (3) from Sag et al. (1985). Like the complement-complement coordination with serve above, these sentences take advantage of two senses of the relevant verb, but the two senses in these cases actually have different subcategorizations. In this sentence, an NP and an AP are coordinated, with the former requiring is to be parsed as a VP/NP (i.e. a verb taking an NP complement), and the latter requiring it to be parsed as a VP/AP (a verb taking an AP complement).

(3) Pat is a Republican and proud of it. (Sag et al. 1985, (2b))

Near the end of their paper, Sag et al. note similar cases such as (4), in which a *that*-clause is coordinated with an NP. In theories in which a *that*-clause is categorized as an NP, such coordinations pose no problem for the LCL, but in theories in which they are categorized as *S'*, distinct from NP, there is again a grammatical coordination of unlikes. Specifically, the appointment requires that remember be parsed as a VP/NP, while that it was important to be on time requires that it be parsed as a VP/*S'*:

(4) Pat remembered the appointment and that it was important to be on time.  
(Sag et al. 1985, (123a))

Therefore, sentences such as (4) might or might not ultimately turn out to be cases of coordination of unlikes.

After adjunct-with-adjunct and complement-with-complement, the third coordination possibility to consider is adjunct-with-complement, as illustrated in the ADJUNCT-COMPLEMENT COORDINATION in (5), made possible by the existence of both a transitive and an intransitive subcategorization for eat. Here, the AdvP quickly and the NP a grilled cheese sandwich are coordinated with unpleasant results (Schachter's judgment):

(5) \*John ate quickly and a grilled cheese sandwich. (Schachter 1977, (4))

Though the examples in (1)-(3) and possibly (4) point out the shortcomings of the LCL, it does seem to correctly rule out adjunct-complement coordinations such as the one above.

But turning once again to the LCL's shortcomings, there are two other facts that it fails to explain. First, it has been noted (by Bechhofer 1976, Schachter 1977, Bolinger 1978, and others) that coordination of wh-adjuncts is much more consistently grammatical than the coordination of non-wh-adjuncts, as illustrated by the contrast in (6):

- (6) a. \*I saw John yesterday and in the Coop. (Bechhofer 1976, (70))  
b. Where and when did you see John? (Bechhofer 1976, (84a))

This pattern extends to wh adjunct-complement coordinations such as the one in (7):

- (7) What and when can I eat?

Such interrogatives are widely attested and accepted; for further discussion of a corpus study and psycholinguistic experiment involving them, see Whitman (2002a). A satisfactory analysis of coordination of verbal adjuncts and complements should cover both wh and non-wh adjuncts and complements.

Second, there is the fact that coordinations that are problematic with and sometimes improve with a different conjunction, as seen in the following adjunct-adjunct coordinations:

- (8) a. \*John ate with his mother and with good appetite. (Schachter 1977, (10))  
b. John ate with his mother but with good appetite.  
c. John ate with his mother or with good appetite (but not both).

To my knowledge, this contrast has not been discussed or noted in the literature, but it should be covered in a satisfactory analysis of coordination.

To supplement the LCL, various piecemeal solutions have been proposed to account for the grammaticality patterns of verbal adjunct-adjunct, complement-complement, and adjunct-complement coordinations. These proposals and their shortcomings are discussed further in section 2. However, I argue that the patterns of

grammaticality (or rather, acceptability) for all three kinds of coordinations can be accounted for to a great extent by the compositional semantics of the coordinations themselves, and by pragmatics, specifically neo-Gricean conversational implicature. Such an analysis is developed for adjunct-adjunct coordinations in section 3, and extended to cover complement-complement and adjunct-complement coordinations in sections 4 and 5 respectively. Research questions raised by this analysis and a conclusion are presented in section 6.

In this paper, syntactic categories will be notated in the slash notation of type-logical (categorial) grammar (as has already been done above in giving categories for serve, is, and remember). For example, a transitive verb will have category (NP\S)/NP, indicating that it takes an NP direct object on its right and an NP subject on its left to form an S. For convenience, the category NP\S will be abbreviated as VP, so that (for instance) a transitive verb will have category VP/NP. Other information about type-logical grammar will be presented as necessary, but for the most part, this will be an empirical investigation and description of constraints on coordination of verbal dependents.

## 2 Previous analyses of grammaticality patterns

To account for the grammaticality patterns seen in section 1 while maintaining some form of the LCL, linguists have been faced with two tasks: to find a way to license the coordinations that are incorrectly predicted to be ungrammatical, and to rule out those that are incorrectly predicted to be grammatical. In the discussion that follows, it should be remembered that the judgments of ungrammaticality are either those of earlier authors, or understood to be provisional, since an overall objection to the arguments below is that most of the sample coordinations can be improved in context.

### 2.1 Licensing the coordination of unlike categories

To license the coordination of unlike categories, there are two basic approaches. One is to argue that the unlike categories are really the same category after all, or at least the same in the features that matter. The version of this analysis that Sag et al. (1985) propose for Pat is a Republican and proud of it is as follows. The copula selects for an underspecified category, specifically, anything marked as being predicative, notated as PRD: +. Therefore, if a coordinate phrase follows, then it must be marked as PRD: +, and so must each of its conjuncts. Since APs and NPs

can be so marked, they are alike enough to be coordinated, even though they differ in category. Williams (1983) goes farther, arguing that predicative NPs and APs have the same semantic type, specifically  $\langle e, t \rangle$ , or as it will be noted henceforth, **Ind**(ividual)  $\rightarrow$  **Bool**(ean). Carpenter (1997) goes farthest of all, creating the syntactic category **Pr**(edicative) for NPs, APs, and other phrases with semantic type **Ind**  $\rightarrow$  **Bool**, and categorizing the copula as **VP/Pr**.

The caveat for such an approach is that the proposed new category must be well-motivated independently. Williams (1983) offers many reasons for his categorization of predicative phrases, but there is no guarantee that such categories will be found for other verbs (such as remember) that participate in coordinations of unlikes. For instance, recalling Sag et al.'s remembered the appointment and that it was important to be on time, one could argue that complementized sentences should be categorized as NP, since they can be used as the subject of a verb, like other NPs—but on the other hand, they cannot be objects of prepositions, so calling them NPs has a whiff of circularity about it.

The second approach is to allow the copula (or other relevant verb) to have a multiple categorization, which will allow it to be parsed two ways in the same utterance, and license the coordination of unlikes. To illustrate, a derivation of is a Republican and proud of it is shown in (9).

In this derivation, the conjunction and is assigned the polymorphic category  $(X \setminus X) / X$ —that is, it takes an argument of category  $X$  on the right, and an argument of (the same) category  $X$  on the left, and results in a phrase with category  $X$ . Note that this category forces and to obey the LCL. The multiple category for is is indicated by the  $\wedge$  connecting the **VP/NP** and **VP/AP** categories.<sup>2</sup> The first step in the derivation is to type-raise both a Republican and proud of it, by way of the Type-Raising (TR) theorem, proven in Bayer (1996). Thus, the NP a Republican is derived to have category  $(VP/NP) \setminus VP$ ; informally put, it looks on its left for a verb that is looking for an NP (that is, a **VP/NP**), and combines with it to produce a **VP**. The same theorem is used with proud of it, which starts out as an **AP**, and ends up as  $(VP/AP) \setminus VP$ . The second step is to force a Republican and proud of it to have like categories. This is done with the Antecedent Strengthening (ASt) theorem, also proven in Bayer (1996). After this step, instead of seeking just an ordinary **VP/NP**, a Republican is seeking a **VP/NP** that can also be a **VP/AP**—in other words, a verb with category  $(VP/NP) \wedge (VP/AP)$ , which is just happens to have. Thus, the NP a Republican now has category  $((VP/NP) \wedge (VP/AP)) \setminus VP$ . Likewise, after ASt, proud of it is no longer seeking an just a **VP/AP**; it is seeking a **VP/AP** that can also be a **VP/NP**, and so it, too, has category  $((VP/NP) \wedge (VP/AP)) \setminus VP$ . With the same

category, a Republican and proud of it can be combined via and, with X instantiated as  $((VP/NP)\wedge(VP/AP))\backslash VP$ . This is done in two steps: First, the  $(X\backslash X)/X$  and combines with the  $((VP/NP)\wedge(VP/AP))\backslash VP$  on its right in the /E ('slash elimination') step; then the resulting  $X\backslash X$  and proud of it combines with the  $((VP/NP)\wedge(VP/AP))\backslash VP$  on its left in the \E ('backslash elimination') step. In the last step of the derivation, the whole resulting coordinate phrase a Republican and proud of it, with its category of  $((VP/NP)\wedge(VP/AP))\backslash VP$ , combines with the is on its left to produce the VP is a Republican and proud of it.

(9) Derivation of is a Republican and proud of it;  $X = ((VP/NP)\wedge(VP/AP))\backslash VP$

<u>is</u> : (VP/NP)	<u>a Republican</u> : NP	<u>and</u> : (X\X)/X	<u>proud of it</u> : AP	
$\wedge(VP/AP)$	_____ TR		_____ TR	
	$(VP/NP)\backslash VP$		$(VP/AP)\backslash VP$	
	_____ ASt		_____ ASt	
	$((VP/NP)\wedge(VP/AP))\backslash VP$		$((VP/NP)\wedge(VP/AP))\backslash VP$	
		_____ /E		
		$X\backslash X$		
				_____ \E
		_____ X = $((VP/NP)\wedge(VP/AP))\backslash VP$		
				_____ \E
	_____ VP			

So after the TR and ASt steps in the derivation, the coordination of the seemingly unlike NP and AP categories turns out to be a coordination of like categories after all—specifically, of two phrases of category  $((VP/NP)\wedge(VP/AP))\backslash VP$ .

For the coordination of unlike categories, I do not recommend either of the above strategies categorically; in some cases, the first approach may be more justified, and in others, the second. The important idea here is that REQUIRING LIKE CATEGORIES OF THE CONJUNCTS WILL NOT BY ITSELF RULE OUT ANY COORDINATIONS OF UNLIKE CATEGORIES (as far as verbal complements and adjuncts are concerned). If multiple categorizations are allowed for the verb, then the intuitively unlike categories can be logically derived to have the same category, by way of the TR and ASt theorems, as demonstrated above. To enforce the LCL, one must forbid multiple categorizations, a stance that has problems of its own, as will be seen in section 2.2.

## 2.2 Ruling out ungrammatical coordinations of like categories

To rule out adjunct-adjunct coordinations such as those in (1), repeated below as (10), Schachter (1977) proposes that conjuncts in a coordinate structure must carry the same kind of semantic information. Specifically, he argues that coordinations such as (10) are ungrammatical because there are ‘functional differences’ between the two adverbial phrases (i.e., an adverb of accompaniment vs. an adverb of manner). A similar explanation is offered independently by Bechhofer (1976).

(10) \*John ate with his mother and with good appetite. (Schachter 1977, (10))

The problem now is the vagueness of the phrase ‘same semantic function, as Schachter admits: ‘Just what is meant by “same semantic function”? This is not a question to which I can pretend to give a definitive answer’ (90). Likewise, Bechhofer is vague about how to define semantic similarity of adverbial phrases. Simply declaring that the conjuncts must have the same semantic type is not enough, since semantically, all adverb phrases (excluding sentential adverbs) are functions from VPs to VPs, with no logical type distinction between temporal, locative, manner or other varieties.

Moreover, aside from being poorly defined, such a constraint says only when coordination is possible, not when it is necessary. For example, the acceptability of quickly and carefully is expected (since it is a coordination of two manner adverbs), but the questionability of ?quickly carefully is not. And finally, such a constraint does not explain why coordination of some semantically similar adverbs is NOT completely acceptable—for example, ?yesterday and at 4:00.

To rule out complement-complement coordinations such as that in (2), repeated below as (11), two explanations have been offered. One is the same requirement of semantic similarity as proposed for the adjunct-adjunct coordinations. Thus, (11) would be ruled out because the guests fulfils one semantic role (recipient), while the desserts fulfils another (theme). Bechhofer (1976) proposes essentially this explanation (although she has in mind a different complement-complement coordination).

(11) [\*]Robin served the guests and the desserts.

Since there are objective measures of the semantic differences between thematic roles (see Dowty 1989, 1991), an appeal to semantic similarity works better here than for the adjunct-adjunct coordinations. Nevertheless, such an explanation should be discarded in favor of one that can cover all three kinds of coordination under discussion instead of just complement-complement coordinations.

A more recent explanation for the ungrammaticality of coordinations such as (11) is that serve (or whatever the relevant verb is) is ambiguous between its two senses—that is, it exists in the lexicon as two entries, only one of which can be chosen in parsing a single token (see for example, Bayer 1996; Heylen 1996). However, as noted at the beginning of the section, these coordinations improve in the right context, which casts doubt on an ambiguity-based explanation. Furthermore, the two meanings of serve are similar enough that to resort to ambiguity in order to rule out (11) risks turning the term ‘ambiguous’ into nothing more than a diacritic with the meaning, ‘cannot be used in both senses at once.’ In other words, one is reasoning that serve must be ambiguous, because the coordination in (11) fails, and the coordination fails because serve is ambiguous. Similarly, is and remember are not ambiguous because the coordinations in (3) and (4) succeed, and these coordinations succeed because is and remember are not ambiguous.

For adjunct-complement coordinations such as that in (5), repeated below as (12), it would seem at first glance that no special means are necessary in order to rule it out, since quickly and a grilled cheese sandwich have different categories.

(12) \*John ate quickly and a grilled cheese sandwich. (Schachter 1977, (4))

Recall, however, that if multiple categorizations are allowed in order to license desired coordinations of unlikes, then coordinations such as this one will be licensed by way of the same kind of TR+AS<sub>t</sub> derivation as was done in section 2.1 for is a Republican and proud of it. To illustrate, a derivation of ate quickly and a grilled cheese sandwich is shown in (13). Here, X is instantiated as ((VP/NP)∧VP)\VP, and ate has the multiple category (VP/NP)∧VP. The derivation proceeds precisely in the same way as the one in (9), except that the adverb quickly proceeds directly to the AS<sub>t</sub> step, without first undergoing TR.

(13) Derivation of ate quickly and a grilled cheese sandwich;  $X = ((VP/NP)\wedge VP)\backslash VP$

<u>ate</u> :	<u>quickly</u> :	<u>and</u> :	<u>a grilled cheese sandwich</u> :
$(VP/NP)\wedge VP$	$VP\backslash VP$	$(X\backslash X)/X$	$NP$
			$\frac{\quad}{\quad} TR$
			$(VP/NP)\backslash VP$
	$\frac{\quad}{\quad} ASt$		$\frac{\quad}{\quad} ASt$
	$((VP/NP)\wedge VP)\backslash VP$		$((VP/NP)\wedge VP)\backslash V$
			$\frac{\quad}{\quad} /E$
		$X\backslash X$	
			$\frac{\quad}{\quad} \backslash E$
		$X = ((VP/NP)\wedge VP)\backslash VP$	
			$\frac{\quad}{\quad} \backslash E$
		$VP$	

So if one allows multiple categorizations in the grammar, then some other explanation must be found for the ungrammaticality of (12). Two have been proposed. There is first the appeal to semantic differences that has been used for adjunct-adjunct and complement-complement coordinations as well: quickly and a grilled cheese sandwich are intuitively very different semantically. And as stated earlier, the problem is in pinning down what is meant by semantic difference. It cannot be a difference in semantic type, since in the derivation above, both conjuncts are derived to have the same syntactic type, and therefore the same semantic type. All we are left with is Schachter’s intuitive notion of functional (dis)similarity to rule out the coordination.

In moving to the second explanation for the ungrammaticality of (12), it should be reiterated that the whole derivation above crucially depends on ate having a multiple categorization. Therefore, an easy way to rule out the coordination would be to forbid multiple categorizations in one’s grammar, decreeing that words (such as ate) that require more than one category will have to be listed more than one time in the lexicon—that is, that they are ambiguous between the two (or more) categorizations. In the case of ate, the adverb quickly requires that ate be parsed as a VP, while the complement a grilled cheese sandwich requires that it be parsed as a VP/NP. Since only one of these subcategorizations could be chosen for the sentence, the sentence would not be generated. Still, this appeal to ambiguity suffers from the same circularity here as it did earlier in connection with the complement-complement coordination with serve: There is little independent motivation for calling eat ambiguous, and to do so only to rule out coordinations like the one in (12) is circular argumentation, as argued in the discussion of (11)

### 2.3 Summary

In summary, in an analysis of the coordination of verbal dependents in English, the main problem is not how to license the coordination of complements with unlike categories (as in is a Republican and proud of it), since there are means in formal grammars that will easily accomplish this aim. The main problem is in ruling out the coordinations of like categories (and now, even unlike categories) that are incorrectly predicted to be grammatical. One approach talks in vague terms of semantic ‘functional similarity’ required of conjuncts. Such an explanation addresses adjunct-adjunct coordinations, complement-complement coordinations, and adjunct-complement coordinations, but has never been satisfactorily formalized, and fails to state which coordinations are merely possible, which are necessary, and which are (close to) impossible. The other approach is to declare that the relevant verb is ambiguous between its different categorizations, and therefore cannot be parsed with both categories at once. This explanation, however, covers only the cases of complement-complement and adjunct-complement coordination, since for the adjunct-adjunct coordinations, only one category for the verb is needed. Furthermore, it is circular reasoning to say a verb is ambiguous simply because a coordination requiring it to have more than one category is ungrammatical. And finally, as stated at the beginning of section 2, **the sample coordinations can be improved in context**, suggesting that an approach based strictly on syntax or semantics is off the mark.

### 3 Adjunct-adjunct coordination

In this section, an analysis is developed for verbal adjunct-adjunct coordinations; it will be extended to complement-complement and adjunct-complement coordinations in sections 4 and 5. In discussing when coordination is and is not allowed, it will be necessary to talk about the alternative to coordinating adverbial phrases—that is, simply putting them adjacent to each other, which will be referred to as NESTING. The two options are illustrated in Figure 1. Of course, a third option in English is to put one or more adverbial phrases in front of the VP, and the other(s) after it. For simplicity’s sake, this option will not be considered, since (i) not every adverb in English can appear in this position; (ii) those that do sometimes have subtle meaning differences from those appearing after the VP; and (iii) those that do not can be treated as another variety of nesting as far as the analysis below is concerned.

INSERT FIGURE 1 ABOUT HERE

Below is a list of questions that a theory of adverbial coordination should be able to answer, in the approximate order in which they will be addressed:

1. Why coordination sometimes seems OBLIGATORY for semantically ‘similar’ adjuncts, or at least much more acceptable than nesting: quickly and carefully vs. ?quickly carefully, or yesterday and today vs. ?yesterday today.
2. Why coordination of wh adjuncts is much easier to do than coordination of non-wh adjuncts: When and where did it happen? vs. ?It happened yesterday and at noon.
3. Why coordination sometimes seems FORBIDDEN for semantically ‘different’ adjuncts, or at least much less acceptable than nesting: ?in the shower and at night vs. in the shower at night, or ?with his mother and with good appetite vs. with his mother with good appetite.
4. Why coordination sometimes seems FORBIDDEN even for semantically ‘similar’ adjuncts, or at least much less acceptable than nesting:: ?yesterday and at noon vs. yesterday at noon.
5. Why coordinations with or or but sometimes differ from similar coordinations with and in level of acceptability.

The overall argument in this section is that in some cases, coordination is obligatory because of the semantics of the adverbial phrases and the conjunctions. In other cases, the semantics is such that either coordination or nesting can be employed based on the intended meaning. And in cases where there is minimal difference between the semantics of a coordinated or nested adverbial phrase, the neo-Gricean Q and R Principles affect the acceptability of the different options. In section 3.1, the semantic part of the analysis is developed, which addresses Question 1, lays the groundwork for the pragmatic part to come. Section 3.2 discusses the semantics of multiple wh interrogatives in English, and shows why the easier coordinability of wh adjuncts should not be surprising (Question 2). The pragmatic part of the analysis, which addresses Questions 3, 4, and 5, is developed in section 3.3.

### 3.1 Semantics of coordination and nesting

The different semantics of coordinated vs. nested adverbial phrases can explain some of the grammaticality patterns discussed in sections 1 and 2, in particular, the apparent obligatoriness or optionality of coordinating certain adverbial phrases (Questions 1 and 2 above). For convenience, I adopt Schachter’s terminology of ‘functionally similar’ or ‘functionally different’ adverbial phrases, but in no way does the analysis rely on such a taxonomy of adverbial phrases.

We begin with and, following the presentation in Carpenter (1997:178-180). Carpenter first defines a function  $\mathbf{Coor}_{\sigma}$  for coordination of any elements with a boolean semantic type—that is, either the type  $\mathbf{Bool}$ , or any type  $\sigma \rightarrow \tau$ , where  $\tau$  is a boolean type. His definition for  $\mathbf{Coor}_{\sigma}$  is shown in (14):

- (14) Preliminary definition for  $\mathbf{Coor}_{\sigma}$  (adapted from Carpenter 1997:180)
- a.  $\mathbf{Coor}_{\mathbf{Bool}}(\alpha)(\beta_1)(\beta_2) = \alpha(\beta_1)(\beta_2)$  (base case)
  - b.  $\mathbf{Coor}_{\sigma \rightarrow \tau}(\alpha)(\beta_1)(\beta_2) = \lambda x^{\sigma} . \mathbf{Coor}_{\tau}(\alpha)(\beta_1(x))(\beta_2(x))$  (recursive case)

With this definition in place, Carpenter defines and as shown in (15a), with or implied to be as in (15b):

- (15) a. and:  $(X \setminus X) / X$ :  $\mathbf{Coor}_{\sigma}(\mathbf{and})$ , where **and** abbreviates  $\lambda \phi \lambda \psi . (\phi \wedge \psi)$
- b. or:  $(X \setminus X) / X$ :  $\mathbf{Coor}_{\sigma}(\mathbf{or})$ , where **or** abbreviates  $\lambda \phi \lambda \psi . (\phi \vee \psi)$

However, for the discussion to follow, it is necessary to introduce events into the semantic system. In order to take event semantics into account, every formula  $\phi$  is now decreed to have type  $\mathbf{Event} \rightarrow \mathbf{Bool}$ , rather than  $\mathbf{Bool}$ . Thus,  $\phi$  is now equivalent to  $\lambda \underline{e} . \phi(\underline{e})$ . Existential closure is assumed to occur when a proposition is interpreted, so that  $\lambda \underline{e} . \phi(\underline{e})$  is interpreted as  $\exists \underline{e} . \phi(\underline{e})$ . (This approach is taken from Hinrichs 1985.) With this redefinition of the semantic type for formulas, Carpenter’s definition of  $\mathbf{Coor}_{\sigma}$  will need to be revised, so that the base case is now  $\mathbf{Coor}_{\mathbf{Event} \rightarrow \mathbf{Bool}}$  instead of  $\mathbf{Coor}_{\mathbf{Bool}}$ . This revision is shown in (16):

(16) Revised definition for  $\mathbf{Coor}_\sigma$

- a.  $\mathbf{Coor}_{\text{Event} \rightarrow \text{Bool}}(\alpha)(\beta_1)(\beta_2) = \alpha(\beta_1)(\beta_2)$  (base case)
- b.  $\mathbf{Coor}_{\sigma \rightarrow \tau}(\alpha)(\beta_1)(\beta_2) = \lambda x^\sigma. \mathbf{Coor}_\tau(\alpha)(\beta_1(x))(\beta_2(x))$  (recursive case)

The definitions of and and or will still be as given in (17), but **and** and **or** are now taken to abbreviate the semantic terms in (17):

- (17) a.  $\mathbf{and} =_{\text{def}} \lambda\phi\lambda\psi\lambda e. (\exists e_1[(e_1 \subseteq e) \wedge \phi(e_1)] \wedge \exists e_2[(e_2 \subseteq e) \wedge \psi(e_2)])$
- b.  $\mathbf{or} =_{\text{def}} \lambda\phi\lambda\psi\lambda e. (\exists e_1[(e_1 \subseteq e) \wedge \phi(e_1)] \vee \exists e_2[(e_2 \subseteq e) \wedge \psi(e_2)])$

This definition for **and** takes two formulas  $\phi$  and  $\psi$ , declares an event variable for each of them, and declares that each of these events  $e_1$  and  $e_2$  is contained in the larger event  $e$  that is abstracted for the entire compound formula. The distinct event variables are necessary, since two different events may be referred to in a conjoined proposition—for example, Kim was born in Texas, and Robin was born in Ohio. It is also necessary to have a single event that subsumes these separate events, since two separate events may be lumped together as a single event and subjected to further adverbial modification, as in In 1980, Kim was born in Texas and Robin was born in Ohio. Similarly, the definition for **or** allows for two event variables  $e_1$  and  $e_2$ . The different variables are necessary in this case in order to allow for the non-exclusive or reading, as in Kim went dancing or saw a movie (maybe both). And since the entire VP may be further modified, as in Last night, Kim went dancing or saw a movie, the single event subsuming  $e_1$  and  $e_2$  is necessary.

To illustrate how these definitions work together, a derivation of Kim walked and talked is given in (18), with X standing for NP\S (i.e., VP). The semantic type for NP\S is  $\mathbf{Ind} \rightarrow (\mathbf{Event} \rightarrow \mathbf{Bool})$ , so  $\mathbf{Coor}_{\sigma \rightarrow \tau}$  will be instantiated as  $\mathbf{Coor}_{\mathbf{Ind} \rightarrow (\mathbf{Event} \rightarrow \mathbf{Bool})}$ .

(18) VPs coordinated by and: Kim walked and talked, X = NP\S

$$\begin{array}{c}
\begin{array}{ccc}
\text{Kim:} & \text{walked:} & \text{and:} \\
\text{NP: kim'} & \text{NP\S: walk'} & (X\backslash X)/X: \mathbf{Coor}_{\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})}(\mathbf{and})
\end{array} & & \begin{array}{c}
\text{talked:} \\
\text{NP\S: talk'}
\end{array} \\
& & \hline
& & \text{XX: } \mathbf{Coor}_{\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})}(\mathbf{and})(\mathbf{talk}') \\
& & \hline
& & \text{NP\S: } \mathbf{Coor}_{\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})}(\mathbf{and})(\mathbf{talk}')(\mathbf{walk}') \equiv \\
& & \lambda x. \mathbf{Coor}_{\text{Evt} \rightarrow \text{Bool}}(\mathbf{and})(\mathbf{talk}'(x))(\mathbf{walk}'(x)) \equiv \\
& & \lambda x. (\mathbf{and})(\mathbf{talk}'(x))(\mathbf{walk}'(x)) \equiv \\
& & \lambda x \lambda e. (\exists e_1[(e_1 \subseteq e) \wedge \mathbf{talk}'(x)(e_1)] \wedge \exists e_2[(e_2 \subseteq e) \wedge \mathbf{walk}'(x)(e_2)]) \\
& & \hline
& & \text{S: } \lambda e. (\exists e_1[(e_1 \subseteq e) \wedge \mathbf{talk}'(\mathbf{kim}')(e_1)] \wedge \exists e_2[(e_2 \subseteq e) \wedge \mathbf{walk}'(\mathbf{kim}')(e_2)])
\end{array}$$

Notice that the existence of these separate event variables  $e_1$  and  $e_2$  allows for two readings of Kim walked and talked: one in which the walking and the talking are distinct events (i.e.,  $e_1 \neq e_2$ , as made explicit in a sentence such as Kim walked in the morning and talked in the afternoon), and one in which the walking and the talking are the same event (i.e.,  $e_1 = e_2$ , as made explicit in a sentence such as Kim walked and talked at the same time).

A derivation of Kim walked or talked (not shown) proceeds in exactly the same way as (18), with final category and term as in (19).

(19) VPs coordinated by or: Kim walked or talked:

$$\lambda e. (\exists e_1[(e_1 \subseteq e) \wedge \mathbf{talk}'(\mathbf{kim}')(e_1)] \vee \exists e_2[(e_2 \subseteq e) \wedge \mathbf{walk}'(\mathbf{kim}')(e_2)])$$

In this case, the existence of these separate event variables  $e_1$  and  $e_2$  allows for three readings of Kim walked or talked: the ‘exclusive-or’ reading, in which Kim walked or talked, but not both; plus the two readings obtained for Kim walked and talked – Kim walked and talked on separate occasions (i.e.,  $\exists e_1 \wedge \exists e_2 \wedge e_1 \neq e_2$ , one of the ‘inclusive-or’ possibilities), and Kim walked and talked on the same occasion (i.e.,  $e_1 = e_2$ ).

At this point, the semantics of a VP modified by coordinated adverbial phrases can be calculated. The derivation of a VP modified by two adverbial phrases coordinated by and is shown in (20). In this derivation, there is a VP with meaning  $\underline{P}$ , and two adverbial phrases with meanings  $\alpha$  and  $\beta$ . These adverbial phrases have category VP\VP, and therefore type  $(\mathbf{Ind} \rightarrow (\mathbf{Event} \rightarrow \mathbf{Bool})) \rightarrow (\mathbf{Ind} \rightarrow (\mathbf{Event} \rightarrow \mathbf{Bool}))$ . Accordingly, X in this derivation stands for VP\VP, and  $\mathbf{Coor}_{\sigma \rightarrow \tau}$  is instantiated as  $\mathbf{Coor}_{(\mathbf{Ind} \rightarrow (\mathbf{Event} \rightarrow \mathbf{Bool})) \rightarrow (\mathbf{Ind} \rightarrow (\mathbf{Event} \rightarrow \mathbf{Bool}))}$ .

(20) Semantics of a VP modified by and-coordinated adverbial phrases,  $X = VP \setminus VP$

$$\begin{array}{c}
 \text{VP: } \underline{P} \quad \text{VP} \setminus \text{VP: } \alpha \quad (X \setminus X) / X: \mathbf{Coor}_{(\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})) \rightarrow (\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool}))}(\mathbf{and}) \quad \text{VP} \setminus \text{VP: } \beta \\
 \hline
 X \setminus X: \mathbf{Coor}_{(\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})) \rightarrow (\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool}))}(\mathbf{and})(\beta) \\
 \hline
 \text{VE} \\
 X = \text{VP} \setminus \text{VP: } \mathbf{Coor}_{(\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})) \rightarrow (\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool}))}(\mathbf{and})(\beta)(\alpha) \equiv \\
 \lambda Q. \mathbf{Coor}_{(\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool}))}(\mathbf{and})(\beta(Q))(\alpha(Q)) \equiv \\
 \lambda Q \lambda \underline{x}. \mathbf{Coor}_{\text{Evt} \rightarrow \text{Bool}}(\mathbf{and})(\beta(Q)(\underline{x}))(\alpha(Q)(\underline{x})) \equiv \\
 \lambda Q \lambda \underline{x}. (\mathbf{and})(\beta(Q)(\underline{x}))(\alpha(Q)(\underline{x})) \equiv \\
 \lambda Q \lambda \underline{x} \lambda \underline{e}. (\exists \underline{e}_1[(\underline{e}_1 \subseteq \underline{e}) \wedge \beta(Q)(\underline{x})(\underline{e}_1)] \wedge \exists \underline{e}_2[(\underline{e}_2 \subseteq \underline{e}) \wedge \alpha(Q)(\underline{x})(\underline{e}_2)]) \\
 \hline
 \text{VE} \\
 \text{VP: } \lambda \underline{x} \lambda \underline{e}. (\exists \underline{e}_1[(\underline{e}_1 \subseteq \underline{e}) \wedge \beta(\underline{P})(\underline{x})(\underline{e}_1)] \wedge \exists \underline{e}_2[(\underline{e}_2 \subseteq \underline{e}) \wedge \alpha(\underline{P})(\underline{x})(\underline{e}_2)])
 \end{array}$$

Notice that after existential closure for  $\underline{e}$ , the formula will refer to two subevents,  $\underline{e}_1$  and  $\underline{e}_2$ . Thus, in a sentence such as I saw a movie yesterday and today, the desired meaning that there were two movie-watching events is obtained.

Of course, multiple events are not necessary: As a special case,  $\underline{e}_1$  and  $\underline{e}_2$  could be identical, just as in the Kim walked and talked example. So in a sentence such as Kim worked quickly and efficiently, the more plausible interpretation is possible, in which there is only one event of working.

A similar derivation for a VP modified by adverbial phrases coordinated by or (not shown) has the following final category and semantic term:

(21) Semantics of a VP modified by or-coordinated adverbial phrases

$$\text{VP: } \lambda \underline{x} \lambda \underline{e}. (\exists \underline{e}_1[(\underline{e}_1 \subseteq \underline{e}) \wedge \beta(\underline{P})(\underline{x})(\underline{e}_1)] \vee \exists \underline{e}_2[(\underline{e}_2 \subseteq \underline{e}) \wedge \alpha(\underline{P})(\underline{x})(\underline{e}_2)])$$

With the semantics of adverbial phrases coordinated by and and or established, we can move on to the semantics of nested adverbial phrases. A derivation of one is shown in (22). In this derivation, a VP with meaning  $\underline{P}$  is modified by two adverbial phrases with meanings  $\alpha$  and  $\beta$ . The first adverbial phrase combines with the VP in the first  $\setminus E$  step; the second adverb combines with the resulting VP in the second  $\setminus E$  step.

(22) Semantics of a VP modified by nested adverbial phrases

$$\begin{array}{c}
 \text{VP: } \underline{P} \qquad \text{VP}\backslash\text{VP: } \alpha \qquad \text{VP}\backslash\text{VP: } \beta \\
 \hline
 \text{VP: } \alpha(\underline{P}) \\
 \hline
 \text{VP: } \beta(\alpha(\underline{P})) \equiv \lambda_{\underline{x}}.(\beta(\alpha(\underline{P})))(\underline{x}) \equiv \\
 \lambda_{\underline{x}}\lambda_{\underline{e}}.(\beta(\alpha(\underline{P})))(\underline{x})(\underline{e})
 \end{array}$$

The nested adverbial phrases give rise to a nested-scope reading, in which  $\alpha$  is within the scope of  $\beta$ . In contrast, with the coordinated adverbial phrases given in (20) and (21), each adverbial phrase scopes separately over the VP. Also, the final term has just one event variable abstracted, indicating that when existential closure occurs at the sentence level, the proposition will refer to a single event  $e$ .

It has been shown that the semantics of nested adverbial phrases lead to a single-event readings, while the semantics of adverbial phrases coordinated by and and or lead to multiple-event readings (with single-event readings as a special case). An immediate prediction that can be made is that when a single event reading is impossible, the adverbial phrases will have to be coordinated rather than nested. An easy (and perhaps the only) way to make a single-event reading impossible is to have the different adverbial phrases contribute information that is contradictory when associated with a single event. Furthermore, adverbial phrases that are ‘functionally similar’ are more likely to contribute this kind of contradictory information, since they are not contributing complementary information, as functionally different adverbial phrases would. In this way, the contrast between (23a) and (23b) falls immediately into line, and matches the intuitive explanation behind its unacceptability: that to do something ‘yesterday today’ is impossible. In fact, the event semantics of adverbial phrases also predicts that (23b) should improve if a context can be imagined in which it is possible for a single event occur during two disjoint intervals of time, and this is indeed the case: If I have a time machine, and used it this morning to go back in time to yesterday afternoon and see Kim, then I saw Kim yesterday today begins to make more sense.

- (23) a. I saw Kim yesterday {and, or} today  
 b. ?I saw Kim yesterday today

Similar remarks about inconsistent information can be made about the following, locative example:

- (24) a. I saw Kim here {and, or} there.  
 b. ?I saw Kim here there.

The nested adverbial phrase here there results in a contradiction when associated with a single event, since here is defined to exclude there. But when the semantics allows for a multiple-events reading, as in (24a), the coordination is fine.

The preceding discussion answers to some extent Question 1 (why coordination is sometimes obligatory for functionally similar adjuncts), using temporal and locative adverbial phrases to illustrate. However, manner adverbial phrases do not yield to the above explanation, and the contrast in (25) is still unexplained. Specifically, if Kim did it quickly and carefully at the same time, there is no apparent reason so far why nesting the adverbs in (25b).should sound as strange as it does. (Issues pertaining to or-coordinations such as quickly or carefully are deferred to section 3.2)

- (25) a. Kim did it quickly and carefully.  
 b. ?Kim did it quickly carefully.

A possible explanation for this contrast is based not on the different event structures of nested vs. and-coordinated adverb phrases, but on the difference between the separate scopings and nested scoping of adverb phrases. Recall that in the nested adverbial phrase, one adverb is within the scope of another, whereas in a coordinated adverbial phrase, each adverb scopes individually over the VP. For temporal and locative adverbial phrases, the only difference this made was the difference in event structure discussed above. For example, I saw Kim yesterday today means the same thing as ‘I saw Kim yesterday and I saw Kim today,’ with the stipulation that there is (impossibly) only one event of me seeing Kim. To see how, let us translate this sentence initially as  $\lambda e.(yesterday'(today'(saw'(kim'))))(i'))(e)$ . The terms **yesterday'** and **today'** are taken to be defined as follows:

- (26) a. **yesterday'** =<sub>def</sub>  $\lambda P \lambda x \lambda e. (P(x)(e) \wedge (e \subseteq \text{YESTERDAY}))$   
 b. **today'** =<sub>def</sub>  $\lambda P \lambda x \lambda e. (P(x)(e) \wedge (e \subseteq \text{TODAY}))$

With these definitions for yesterday and today substituted into the above translation, the more fully written out translation for I saw Kim yesterday today is  $\lambda e. ((\text{saw}'(\mathbf{kim}')(\mathbf{i}'))(e) \wedge (e \subseteq \text{YESTERDAY}) \wedge (e \subseteq \text{TODAY}))$ , which is a special case of the separate-scope reading  $\lambda e. (\exists e_1 [(e_1 \subseteq e) \wedge (\text{saw}'(\mathbf{kim}')(\mathbf{i}'))(e_1) \wedge (e_1 \subseteq \text{YESTERDAY})] \wedge \exists e_2 [(e_2 \subseteq e) \wedge (\text{saw}'(\mathbf{kim}')(\mathbf{i}'))(e_2) \wedge (e_2 \subseteq \text{TODAY})])$ ; specifically, it is the case in which  $e_1 = e_2 = e$ . The only difference between the readings is that the nested-scope reading requires (impossibly, given the laws of physics) that there be a single event, while the separate-scope reading allows for multiple events.

To put it another way, even though yesterday is technically within the scope of today, today essentially looks right through the semantically transparent yesterday to modify only saw Kim. However, this is not in general the case: Very often, wider-scoping adverbial phrases do have a nontrivial effect on the adverbial phrases within their scope, and when this is the case, nesting or and-coordination is used depending on the desired scoping. For example, consider the pair of sentences in (27), where coordination and nesting are both viable. Sentence (27a) means that neither plagiarism nor being hated by Dr. Jones would ordinarily be enough to cause me to fail, but that in conjunction, they are. On the other hand, (27b) means that either plagiarism or being hated by Dr. Jones can cause me to fail, though (in the and case) it just so happens that both were in effect.

- (27) a. Dr. Jones flunked me because I plagiarized my essay because he hates me.  
 b. Dr. Jones flunked me because I plagiarized my essay {and, or} because he hates me.

Similar effects can be seen in the coordinations of adverbial phrases shown in (28). In both cases, the nesting is somewhat strange out of context, but can be sensibly interpreted in the proper context. To illustrate, I could say (28a) if I did a job happily, but was at the same time sad that I was doing it happily—for example, if I were ‘burying an evil or hated family member’ (a scenario suggested by Brian Joseph). It does not mean that I did the job sadly, as it would if sadly scoped individually over did the job. Likewise, (28b) means that I fixed the bicycle with a wrench, and that in some way I used a hammer to do this, perhaps banging the hammer on the wrench to turn it—not the same reading as would obtain if with a hammer scoped individually over fixed the bicycle. If this

action, unusual as it is, is truly what I want to convey, then (28b) is not only acceptable, but in fact the only suitable choice between nesting and coordination.

- (28) a. ?I did the job happily sadly.  
b. ?I fixed the bicycle with a wrench with a hammer.

Returning to the case of ?quickly carefully, I submit that there are similar, but more subtle, scoping differences at work, such that doing something quickly and carefully is not the same as doing it quickly carefully or carefully quickly. That is, if I did a job quickly and carefully, then I did it quickly, and I did with some degree of care—say between 7 and 10 on a scale of 1 to 10. However, if I did a job quickly carefully, it is true that I did it quickly, but (depending on the job) one can be only so careful if quickness is a given. So if carefully includes quickly in its scope, then my degree of care might be between, say, 5 and 8, not between 7 and 10. Similarly, if I did a job carefully quickly, it is true that I did it carefully, but the meaning of quickly could vary in the same way as that of carefully depending on whether carefully is in its scope.

Before such an explanation can be fully accepted, the formal semantics of manner adverbials must be worked out more thoroughly, a task that is not taken up here. In its favor, however, this explanation is based on the undeniable fact of the scoping differences between nested and and-coordinated adverbial phrases, and the fact that only in special cases (i.e., temporal and locative) are these scoping differences truth-conditionally trivial. In light of these facts, it would be surprising if these differences did NOT have an effect on the choice between nesting and and-coordination in general.

So far, then, the analysis is that sometimes, semantic differences between nesting adverbial phrases and coordinating them results in seeming obligatoriness of coordination.

### 3.2 Coordination of wh-adjuncts

Many have noted that wh adverbial coordinations are often better than analogous non-wh adverbial coordinations (for example, Schachter 1977, Bechhofer 1977, Bolinger 1978), the basis of Question 2 above. The following pair from Bechhofer (1977) (judgments hers) illustrates the point well:

- (29) a. \*I saw John yesterday and in the Coop. (Bechhofer 1977, (70))  
b. When and where did you see John?

This difference in grammaticality is usually explained by declaring that wh phrases count in some way as being similar enough (in some relevant aspect) to be coordinated. Schachter notes their semantic similarity: 'Evidently, the function that [two adverbial wh words] share, that of requesting information, takes priority over the function that distinguishes them....' (91). Bechhofer and Bolinger simply appeal to the words' similarity in being 'wh words' without stating whether they have in mind semantic similarity, or (less likely) phonetic or even orthographic similarity. Bechhofer ventures: 'Perhaps the very fact that the conjoined constituents [in a conjoined-wh interrogative] are wh words makes them more similar, and thus more easily conjoined' (119). Bolinger is more confident: 'If the rule for coordinating with and is some form of equal status on the part of the elements coordinated, then we must conclude that it is their equal status as wh words that entitles how-why, when-how, etc. to this treatment...' (139).

However, it is not necessary to stipulate that wh words are inherently semantically parallel in order to explain the improved grammaticality of adverbial wh coordinations. When the different means of incorporating more than one wh adverb into an English interrogative are considered, coordination ties with one other method as the most natural one to use. The two other means of deploying more than one wh adverb are multiple-wh interrogatives, and sluiced interrogatives. All three methods are illustrated in (30).

- (30) Three ways of having more than one wh-adverb in an interrogative
- a. Wh coordination  
When and where did you see John? / Where and when did you see John?
  - b. Multiple-wh  
When did you see John where? / Where did you see John when?
  - c. Sluicing  
When did you see John, and where? / Where did you see John, and when?

Instead, the relevant semantic difference seems to be that multiple-wh interrogatives in English expect a pair-list answer, while coordinated and sluiced *wh* interrogatives do not. Thus, a natural answer to (30b) would be a list of time-place pairs: yesterday at school, today in the mall, etc., whereas a single time-place pair would usually be an unexpected answer. Although a multiple-wh interrogative does not always expect a pair-list answer, there must be a special context for this to be the case. The main example of such a context is what Ginzburg and Sag (2000) call DISJUNCTIVE RESOLUTION CONTEXTS, as exemplified in (31):

- (31) [Context: It is known that Robin phoned Dale or Dale phoned Robin.]  
Who phoned whom? (Ginzburg and Sag 2000:141)

However, as far as adjunct-adjunct coordinations are concerned, disjunctive resolution contexts are irrelevant, since they exist only for wh NPs, as in Ginzburg and Sag's example.

Consequently, incorporating more than one wh adverb into a multiple-wh interrogative is not the optimal choice for a speaker if s/he is not expecting a pair-list answer. The remaining choices are sluicing and coordination of the wh adverbs. In a sluicing sentence, although a pair-list answer is possible, it is not expected. Thus, a natural answer to (30c) could be yesterday at school. Likewise, an interrogative with coordinated wh adverbs does not expect a pair-list answer, so yesterday at school would also be a natural answer to (30a). Therefore, if a speaker is not expecting a pair-list answer to a question about the time and location of some seeing-John event, sluicing and coordination are equally natural courses to take.

The analysis of coordinated and nested wh adjuncts and non-wh adjuncts may seem to be heterogeneous, but they have a common core: When one of the choices makes the desired reading unattainable, then the other

option is taken, even if it results in ambiguity. Where there is a significant semantic difference between nesting and coordination—whether in event structure, scope, or expectation of a pair-list answer—one or the other is chosen based on the desired meaning.

### 3.3 Q- and R-based implicature

The previous two subsections dealt with Questions 1 and 2: Why are some adjunct-adjunct coordinations are (seemingly) obligatory, and why are wh adjunct-adjunct coordinations generally much more acceptable than their non-wh counterparts? This section takes up first Question 3 (why some coordinations of functionally different adverbials are forbidden), and then Question 4 (the same question for functionally similar adverbials). Question 5 (why the same coordination can have different levels of acceptability depending on choice of conjunction) is addressed simultaneously with Questions 3 and 4.

Horn (1984, 1989) refines the Gricean conversation maxims of Quantity, Relation, and Manner into what he names the Q and R Principles. Q is mnemonic for Quantity (in particular Grice's first Quantity maxim), and R for Relation; the two are summed up in (32):

- (32) The Q and R Principles (from Horn 1984:13)
- a. The Q Principle (Hearer-based):  
MAKE YOUR CONTRIBUTION SUFFICIENT; SAY AS MUCH AS YOU CAN (given R)
  - b. The R Principle (Speaker-based):  
MAKE YOUR CONTRIBUTION NECESSARY; SAY NO MORE THAN YOU MUST (given Q)

The interaction these principles explains some of the facts about adjunct-adjunct coordinations with or and and. We begin with the coordination of functionally different adverbial phrases, with the following amended version of the earlier sentence from Schachter:

- (33) ?John ate with his mother or with good appetite.

Here, there is an accompaniment adverbial and a manner adverbial. On the one hand, the coordination of these two different adverbials seems to be a non-sequitur, a violation of the R Principle. However, assuming that the speaker truly is following the cooperative principle, it may be that the R Principle is being flouted rather than violated. That is, by seeming to violate the R Principle, the speaker Q-implicates that there is some message to be conveyed by the or-coordination that could not be conveyed otherwise.

What might that message be? A well-known type of Q-based inference is the ‘exclusive or’ reading; as an example, Horn (1984:2d) gives the sentence Maggie is patriotic or quixotic. Though it is possible that Maggie could be both, the implication is that she is not, or else the speaker would have made the more informative statement Maggie is patriotic and quixotic. This ‘exclusive or’ effect holds true when one considers the event structure of coordinated adverbial phrases, discussed in section 3.1. In this case, the use of or Q-implicates that the pieces of information apply to mutually exclusive events—in other words, that there was either an event  $e_1$  of John eating with his mother, or an event  $e_2$  of John eating with good appetite, but not both an  $e_1$  and an  $e_2$  (not to mention an  $e_1$  and an  $e_2$  that name the very same event). Put another way, the speaker is implying that John never has a good appetite when he eats with his mother.<sup>3</sup> If the context allows for the hearer to make such an accommodation, this sentence improves greatly. And it is virtually impeccable if the speaker emphasizes this point by saying John ate with his mother or with good appetite—not both. It is also impeccable if the speaker acknowledges the implicature by explicitly canceling it, adding or maybe both.

A similar interaction of the Q and R Principles can be traced in the original sentence from Schachter, with and instead of or:

(34) \*John ate with his mother and with good appetite. (Schachter 1977, (10))

The complementarity of the information contributed (accompaniment, manner) seems to invite the listener to snap the two pieces together like parts of a jigsaw puzzle, to assemble a fuller picture of a single event. However, if this were the case, then the choice of and instead of nesting would be a violation of the R Principle, since nesting would result in an unambiguous single-event reading, whereas and leaves allows for a single event or multiple events. But if the speaker is flouting rather than violating the R Principle, the Q-implication is that the and is conveying some

message that nesting would not. One such message might be that two events are being referred to, and indeed, a clear indication of separate events, shown in (35), improves the sentence:

(35) John ate with his mother yesterday, and with good appetite today.

Nevertheless, this sentence is not completely normal; the coordination is still something of a non-sequitur. With the or-coordination, acceptability was attained when the exclusive-or Q-implicature was explicitly reinforced (by adding but not both), but here, when the separate-events Q-implicature is explicitly reinforced (by adding yesterday and today), the R Principle is still not satisfied. Why not? The answer is that with the or-coordination, imagining the mutual exclusivity of John eating with good appetite and eating with his mother easily leads one to turn the non-sequitur into a sequitur, specifically a causation relation: Eating with his mother causes John to have a poor appetite! (Alternatively: Having a poor appetite causes John to avoid eating with his mother.) With the and-coordination, on the other hand, such a connection still needs to be imagined. In other words, the Q-implicated message that and is sending is not so much that there are separate events, but that the hearer needs to imagine a sensible connection between the two conjuncts.

There are at least two possibilities for this to happen. One possibility is that there is a causal relation (or at least a correlation) between John eating with his mother and John eating with good appetite; that is, when John eats with his mother, he has a good appetite. A causal relationship can even be uttered explicitly, resulting in an impeccable coordination: John ate with his mother (yesterday) and therefore with good appetite (today). Another possibility is that instead of a positive correlation between eating with his mother and eating with good appetite, there might be a negative one—that is, the same scenario envisioned earlier, where John usually has a poor appetite when he eats with his mother (context suggested by David Dowty). In that case, when he eats with his mother and has a good appetite, the relation between the two conjuncts is one of contrast, or violated expectations, and (34) is acceptable. In fact, it sounds even better in this scenario when and is replaced by a conjunction that conventionally implicates contrast: but, as illustrated below:

(36) John ate with his mother but with good appetite.

Finally, even if neither of these scenarios is part of the common ground, the speaker can induce the hearer to accommodate that there is something noteworthy about John eating with his mother and with good appetite simultaneously, simply by adding simultaneously after the coordination—in other words, explicitly canceling any multiple-events implicature, just as adding or maybe both canceled the exclusive-or implicature earlier.

To sum up, an and-coordination of functionally different adverbial phrases Q-implicates (i) that a multiple-event reading is intended, or (ii) that there is some connection between the conjuncts that nesting would not convey, or (iii) both. When the context can support any of these implicate, the coordination is acceptable.

A similar analysis can be performed on the locative-temporal coordination in (37):

- (37) a.       ?Kim sings in the shower or at night.  
      b.       ?Kim sings in the shower and at night.

The choice of or over nesting in (37a) Q-implicates that the events of Kim singing in the shower and the events of Kim singing at night are mutually exclusive, and if it is known (or can be accommodated) that this is true, then (37a) is acceptable. or else Kim singing in the shower and at night simultaneously is worthy of special note.

The choice of and over nesting in (37b) Q-implicates either that the events of Kim singing in the shower and Kim singing at night are at least sometimes be separate events (since otherwise, nesting the adverbial phrases would be the more informative choice), or that there is some other message to be conveyed that nesting would not convey.

Turning first to the possibility of separate events, suppose it is known that Kim showers only in the morning. Then clearly Kim singing in the shower and Kim singing at night are separate events, and (37) becomes perfectly sensible. Indeed, in this case, coordinating the adverbial phrases is the only choice, since nesting them would result in a falsehood. Even if Kim does not shower exclusively in the morning, as long as it is known that Kim does not shower exclusively at night, the coordination is acceptable, and the Q-implication is that at least some of the events of Kim singing in the shower do not take place at night. Also, the sentence improves if it explicitly notes different time periods for the different conjuncts, as in (38):

(38) Kim sings in the shower on the weekends, and at night during the week.

And finally, simply adding the qualifier simultaneously, as done in the previous example, makes the coordination of in the shower and at night acceptable by canceling any multiple-events implicature.

Turning next to the possibility of some other message, the possibilities are much the same as with the John ate examples. One possibility is that there is a causal relation (or at least a correlation) between singing in the shower and singing at night. For instance, if a researcher has observed that people who sing in the shower are much more likely than the general population to sing at night, then the speaker making observation (37) about Kim is offering corroborative anecdotal evidence, and obeying the R Principle. The speaker might put it this way: ‘Well, that’s certainly true in Kim’s case. Kim always sings in the shower, and showers only at night. So we know for sure that Kim sings in the shower and at night.’ The possibility of a negative correlation instead of a positive one also exists, as with the previous example. If a researcher has observed that people who sing in the shower almost never sing at night, then the speaker uttering (37) is providing a surprising counterexample, and still obeying the R Principle. The speaker might put it this way: ‘Oh yeah? Well, my good friend Kim always sings in the shower, and showers only at night. So, Kim sings in the shower and at night.’ (As with the previous example, using but instead of and in this case makes the coordination sound better.) There is even a third possibility for a marked single-event reading. Perhaps in order for some other condition to hold, two things must be true: that Kim sings in the shower, and that Kim sings at night. For example, maybe eligible participants in a psychological experiment are only those who habitually do both of the following: sing in the shower, and sing at night. In that case, even though Kim happens to do both simultaneously, someone might phrase it as (37) in order to emphasize the meeting of the requirements. In fact, phrasing it this way would be more perspicuous, since nesting the adverbial phrases might lead the hearer to think that the speaker had misunderstood the eligibility requirements, thinking that participants had to sing in the shower and at night simultaneously.

Having considered two examples of coordinations of functionally different adverbial phrases, we will now consider coordinations of functionally similar ones. As noted in section 3.1, when functionally similar adverbial phrases are coordinated, there is a greater chance of their contributing contradictory information than with functionally different adverbial phrases. When they contribute contradictory information, then nesting is not an option, as noted earlier with examples such as yesterday {and, or} today, here {and, or} there. However, **discussion**

of one class of coordinations of functionally similar adverbial phrases with contradictory information was deferred to section 3.3, and it is time to revisit them now. They consist of manner adverbials coordinated by or, as in (39):

(39) ?Kim worked slowly or quickly.

Though this coordination sounds somewhat better than ?slowly quickly, it is still a bit odd, which is not predicted by a requirement of functional similarity of the conjuncts. The problem is once again a seeming violation of the R Principle. To see how, suppose that it is known that Kim always works either slowly or quickly, and never at some moderate, in-between speed. In that case, (39) is uninformative. Of course, slowly and quickly are only the poles of a continuum, so logically (39) should be informative, telling us that Kim works at the extremes of the speed continuum, not in the middle. For whatever reason, though, mentioning just the extremes has the effect of removing the middle ground, and once one makes the information about the excluded middle explicit, as in (40a), the coordination is acceptable: Another way to make (39) satisfy the R Principle is to embed the coordination inside I don't know whether (which does offer new information, specifically as to the speaker's ignorance) as in (40b):

- (40) a. Kim worked slowly or quickly, never at some moderate, in-between speed.  
b. I don't know whether Kim worked slowly or quickly.

In short, these coordinations are rescued when it is clear that they are obeying the R Principle of being informative.

Of course, functionally similar adverbial phrases need not contradict one another, and in these cases, acceptability is sometimes degraded for both and- and or-coordination, as seen in (41):

- (41) a. ? Kim saw Robin in New York {and, or} in a barbershop.  
b. ?Kim saw the movie on Saturday {and, or} at noon.

The oddness of these coordinations is not predicted by a requirement of functional similarity of conjuncts, but is perfectly in line with the Q and R Principles. Given the functional similarity of these adverbial phrases, and the fact that in each example, one is more specific than the other, the tendency is for the hearer to want to snap the

two pieces of information together like jigsaw puzzle pieces, into a single event. But if a single-event reading were intended, then nesting would be more appropriate, and using and or or would violate the R Principle. Therefore, one possible Q-implicature is that separate events (for and) or mutually exclusive events (for or) is intended. In fact, the and coordinations do improve when separate events are explicitly indicated, as in (42), with the addition of in Ohio and today:

- (42) a. Kim saw Robin in New York and in a barbershop in Ohio.  
b. Kim saw the movie on Saturday and at noon today.

The or-coordinations can be rescued in this manner, too, if one imagines that there are no barbershops in New York, or that there were no noon showings of the movie on Saturday. Also, simply adding but not both after the or-coordinations makes them acceptable, just as in example (33), leaving the hearer to accommodate that an exclusive-or reading is intended for some good reason.

The other possible Q-implicature is that there is some other connection between the conjuncts that simply nesting them would not convey. The movie example will be used to illustrate. First, suppose the question under discussion is whether on Saturdays, this movie is ever shown at any time other than at noon; in other words, the claim is that a Saturday showing entails a noon showing. Then someone uttering (41b) is offering corroborative evidence (albeit circumstantial). Second, if the claim is that this movie is never shown at noon on Saturdays, a speaker could felicitously declare (41b) to disprove the claim, perhaps substituting but for and as with earlier examples. And finally, if seeing both a Saturday showing and a noon showing of this movie are necessary conditions to, say, win a sweepstakes, a speaker who has met both requirements simultaneously by seeing the show at noon on Saturday could still felicitously utter (41b) to emphasize the meeting of both requirements (a context suggested by Brian Joseph).

Next we consider a coordination of non-contradictory manner adverbials, shown in (43). Here, it is only the or-coordination that sounds bad; the and-coordination is acceptable for reasons discussed in section 3.1.

- (43) a. Kim worked slowly and meticulously.  
b. ?Kim worked slowly or meticulously.

Again, the questionability of (43b) is not predicted by a requirement of functional similarity of conjuncts, but falls into place when the Q and R Principles are brought to bear. Since meticulousness usually requires slowness, it is reasonable for a hearer to think Kim might have worked both ways at the same time, in which case it would be more informative to say Kim worked slowly and meticulously. Thus, the speaker seems to be violating the R Principle. However, if the speaker is taken to be flouting the R Principle, forcing an exclusive-or Q-inference, the hearer is invited to conclude that Kim worked slowly or meticulously, but not both. It is difficult to imagine a context that would support this inference, but as with the preceding examples, if the inference is specifically supported (as in Kim worked slowly or meticulously, but not both) then the coordination improves.

Lastly, consider the coordination of accompaniment adverbial phrases in (44), which are compatible with each other, but are not so closely associated with each other as to lead the hearer to a single-event reading (as slowly and meticulously do). In this case, no seeming violation of the R Principle leads to the kinds of Q-implicatures discussed above, and the coordination is acceptable with no special context required.

- (44) Kim worked with Robin or with Sandy.

To sum up, the Q and R Principles explain why some adverb phrases are difficult to coordinate (Questions 3 and 4 from the beginning of section 3). The analysis does not need to resort to the intuitively and poorly defined ideas of functional (dis)similarity of adverb phrases, since it applies regardless of the similarity or dissimilarity of the coordinated adverb phrases.

### 3.4 Summary

In this section, it has been seen that the semantics of and and or explain to some extent why coordination is sometimes obligatory for adverbial phrases, and that neo-Gricean pragmatic principles explain why it sometimes seems to be forbidden. Though the semantics of manner adverbial phrases remains in need of formalization, this

analysis covers more of the facts about verbal adjunct-adjunct coordination than any other that I am aware of: coordinations of functionally similar and different adverbials; coordinations of contradictory and non-contradictory adverbs; coordinations of non-wh and wh adverbs; coordinations employing and, or, and but. Furthermore, it does so using well-motivated, independent principles, without resorting to ad hoc distinctions between adverb classes, or between wh and non-wh adjuncts. The next two sections show how the principles applied here to adjunct-adjunct coordinations, which everyone agrees are possible, can be applied to complement-complement and adjunct-complement coordinations, which are much more controversial.

#### 4 Complement-complement coordination

This section discusses coordinations of verbal complements. The account given here is intended to cover (trivially) coordinations of complements when only one subcategorization for a verb is required (e.g., I saw Kim and Robin), as well as coordinations of complements from different subcategorizations (e.g., He remembered the appointment and that it was important to be on time, from Sag et al 1985). Therefore, I turn first to the trivial complement-complement coordinations.

Semantically, there is little to say about complement-complement coordinations involving a single verb subcategorization, except to note that the event semantics developed for and and or in section 3.1 behave as desired here: Complements coordinated with and yield both a single-event reading and a multiple-event reading, and those coordinated by or yield both the exclusive and inclusive readings. To illustrate, a derivation of Kim ate rice and beans is presented below. The NPs rice and beans each undergo Type-Raising to  $(S/NP)\backslash S$ , a theorem in type-logical grammar abbreviated as TR in this derivation. This is the boolean category that will be coordinated by and, so in this derivation X is instantiated as  $(S/NP)\backslash S$ . Note that the final semantic term has two event variables  $e_1$  and  $e_2$ , allowing for the reading in which Kim ate rice and beans at different times, and also (in the case where  $e_1 = e_2$ ) the reading in which Kim ate a single dish of rice and beans all mixed together.

(45) NPs coordinated by and: Kim ate rice and beans, X = (S/NP)\S

$$\begin{array}{c}
 \begin{array}{ccc}
 \underline{\text{Kim ate:}} & \underline{\text{rice:}} & \underline{\text{and:}} & \underline{\text{beans:}} \\
 \text{S/NP: } \lambda_{\underline{x}}.\text{eat}'(\underline{x})(\underline{\text{kim}}') & \text{NP: } \underline{\text{rice}}' & (\text{X}\text{X})/\text{X:} & \text{NP: } \underline{\text{beans}}' \\
 & \text{TR} & \text{Coor}_{(\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})) \rightarrow (\text{Evt} \rightarrow \text{Bool})}(\underline{\text{and}}) & \text{TR} \\
 & \text{(S/NP)\S:} & & \text{(S/NP)\S:} \\
 & \lambda_{\underline{P}}.\underline{P}(\underline{\text{rice}}') & & \lambda_{\underline{P}}.\underline{P}(\underline{\text{beans}}') \\
 & & & /E \\
 & & \text{X}\text{X: } \text{Coor}_{(\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})) \rightarrow (\text{Evt} \rightarrow \text{Bool})}(\underline{\text{and}})(\lambda_{\underline{P}}.\underline{P}(\underline{\text{beans}}')) & \\
 & & & \backslash E \\
 \text{(S/NP)\S: } \text{Coor}_{(\text{Ind} \rightarrow (\text{Evt} \rightarrow \text{Bool})) \rightarrow (\text{Evt} \rightarrow \text{Bool})}(\underline{\text{and}})(\lambda_{\underline{P}}.\underline{P}(\underline{\text{beans}}'))(\lambda_{\underline{P}}.\underline{P}(\underline{\text{rice}}')) \equiv & & & \\
 \lambda_{\underline{P}}.\text{Coor}_{\text{Evt} \rightarrow \text{Bool}}(\underline{\text{and}})(\underline{P}(\underline{\text{beans}}'))(\underline{P}(\underline{\text{rice}}')) \equiv & & & \\
 \lambda_{\underline{P}}.(\underline{\text{and}})(\underline{P}(\underline{\text{beans}}'))(\underline{P}(\underline{\text{rice}}')) \equiv & & & \\
 \lambda_{\underline{e}}.(\exists \underline{e}_1[(\underline{e}_1 \subseteq \underline{e}) \wedge \underline{P}(\underline{\text{beans}}')(\underline{e}_1)] \wedge \exists \underline{e}_2[(\underline{e}_2 \subseteq \underline{e}) \wedge \underline{P}(\underline{\text{rice}}')(\underline{e}_2)]) & & & \\
 \backslash E \\
 \text{S: } \lambda_{\underline{e}}.(\exists \underline{e}_1[(\underline{e}_1 \subseteq \underline{e}) \wedge \lambda_{\underline{x}}.\text{eat}'(\underline{x})(\underline{\text{k}}'\underline{\text{im}})(\underline{\text{beans}}')(\underline{e}_1)] \wedge \exists \underline{e}_2[(\underline{e}_2 \subseteq \underline{e}) \wedge \lambda_{\underline{x}}.\text{eat}'(\underline{x})(\underline{\text{kim}}')(\underline{\text{rice}}')(\underline{e}_2)]) \equiv & & & \\
 \lambda_{\underline{e}}.(\exists \underline{e}_1[(\underline{e}_1 \subseteq \underline{e}) \wedge \underline{\text{eat}}'(\underline{\text{beans}}')(\underline{\text{kim}}')(\underline{e}_1)] \wedge \exists \underline{e}_2[(\underline{e}_2 \subseteq \underline{e}) \wedge \lambda_{\underline{x}}.\text{eat}'(\underline{\text{rice}}')(\underline{\text{kim}}')(\underline{e}_2)]) & & & 
 \end{array}
 \end{array}$$

As for wh coordinations, they are straightforwardly acceptable if the coordinated elements are filling the same argument position, and the (in)animacy of who or what meets the selectional restrictions of the verb, as illustrated in (46a,b) below. If the coordinated elements are filling different argument positions, then coordination is not an option at all—a multiple-wh formulation is syntactically the only choice. Thus, unlike with wh adjuncts, coordination is not available with wh NPs as a means of indicating that a pair-list answer is not expected, and consequently the only way to override such an expectation is to have a disjunctive resolution context, as introduced in section 3.2. (46c), then, expects a pair-list answer expected unless it is known that there are only two possibilities, for example that Robin saw Kim or Kim saw Robin

- (46) a. ?Who {and, or} what did Kim eat? (possible only if Kim might be a cannibal)  
 b. Who {and, or} what did Kim see?  
 c. Who saw whom? (Ginzburg and Sag 2000:141)

Pragmatically, too, there is little to say about single-subcategorization complement-complement coordinations, since there is no alternative to coordination that would give rise to the Q- and R-implicatures seen in section 3.3. If the two elements fill the same argument slot, as with rice and beans above, then simply juxtaposing them instead of coordinating them results in the ungrammatical \*Kim ate rice beans (barring the reading in which rice beans is a compound noun denoting a rice-bean hybrid). If the elements fill different argument slots, then

juxtaposition is syntactically mandated, while coordination is impossible, since the coordinate phrase can fill only a single argument slot. Hence, the only possible reading of Kim gave Robin and a puppy is the strange one in which Kim gives both a puppy and (presumably) a fellow human being to some unspecified receiver, not a reading in which Robin is the receiver and the puppy is the theme.

We now move to complement-complement coordinations involving different subcategorizations of a verb, where the pragmatic analysis developed for adjunct-adjunct coordinations in section 3.3 is in full effect. The sample alternation to be considered here is serve, with its two transitive usages of serving food, or serving people. This alternation is illustrated in (47), where in each example, serve has the category VP/NP, but in one case the NP direct object is the recipient (the guests) of the theme, while in the other it is the theme itself (the desserts).

- (47) a. Kim served the guests.  
b. Kim served the desserts.

In fact, as noted in Dowty (1979:405-7), the alternant in (47a) can be related to the double-object alternant of serve (as in served the guests the desserts) by a role-reduction lexical rule, and the alternant in (47b) can be related to the dative transitive alternant of serve (as in served the desserts to the guests) by a different role-reduction lexical rule. This fact turns out to be significant, and because of it, the grammaticality patterns to be seen here will be shown to resemble the patterns seen with adverbial coordination.

We begin with or-coordinations, illustrated in (48). Before any other discussion of these sentences, it should be noted that they ARE derivable with the desired semantics. All that is necessary is that serve be given two categories (with appropriate semantic terms), which happen to be the same category. This is done in (49), where served has category (VP/NP) $\wedge$ (VP/NP); the rest of the derivation proceeds in the same way as the one in (9).

- (48) a. ?Kim served the VIPs or the desserts.  
b. ?Kim served the desserts or the VIPs.

(49) Derivation of served the VIPs or the desserts;  $X = ((VP/NP) \wedge (VP/NP)) \backslash VP$

<u>ate</u> :	<u>the VIPs</u> :	<u>or</u> :	<u>the desserts</u> :
$(VP/NP) \wedge (VP/NP)$	NP	$(X \backslash X) / X$	NP
	TR		TR
	$(VP/NP) \backslash VP$		$(VP/NP) \backslash VP$
	ASt		ASt
	$((VP/NP) \wedge (VP/NP)) \backslash VP$		$((VP/NP) \wedge (VP/NP)) \backslash VP$
			/E
		$X \backslash X$	
			\E
	$X = ((VP/NP) \wedge (VP/NP)) \backslash VP$		\E
	VP		

The coordinations in (48) are questionable for the same reason as the coordination ?slowly or carefully in section 3.1: The Q-implicature is that Kim did one or the other and not both, but the complementarity of the two conjuncts (an apparent recipient in the VIPs and an apparent theme in the desserts) seems to suggest that Kim did indeed do both, in a single event of serving. However, if it is known that Kim is a server in a restaurant so fancy that (i) the desserts are served by a special server, and (ii) an exclusive party room for VIPs is attended by specially designated servers, then the above sentences improve. And a similar coordination, possibly uttered by Kim, is impeccable:

(50) Tonight, I don't know whether I'll be serving the desserts, or the VIPs.

Moving on to and-coordinations of the NP complements, consider the sentences in (51):

- (51) a. [\*]Kim served the guests and the desserts.  
 b. [\*]Kim served the desserts and the guests.

The only possible readings for (51a,b) are the bizarre ones in which the guests and the desserts are both the recipients of some item of food, or are both the theme. The unacceptability of (51a,b) under the desired reading is predicted for the same reason that some of the adjunct-adjunct and-coordinations are. Specifically, the existence of a suitable theme argument (the desserts) and a suitable recipient argument (the guests), a natural expectation is for

them to be associated with a single event of serving. However, in this case there happens to be a subcategorizations for serve that would more succinctly and precisely indicate a single-event reading—that is, the ditransitive version, which would license Kim served the guests the desserts. Therefore, the usage of and Q-implicates that the speaker is referring either to multiple events, or that the speaker means to convey some other message that juxtaposition of the guests and the desserts would not.

To demonstrate how the and makes a multiple event reading possible, the semantics of both sentences are compared below. The meaning for double-object serve (as in served the guests the desserts), with category  $(VP/\underline{w}NP)/NP$ ,<sup>4</sup> will be translated as  $\lambda x \lambda y \lambda z. \text{serve}_1'(x)(y)(z)$ . The semantics generated for Kim served the guests the desserts is shown in (52a). The transitive serve seen in serve the guests will be translated as  $\lambda y \lambda z. \text{serve}_2'(y)(z)$ , which will be defined as equivalent to  $\lambda y \lambda z \exists x. \text{serve}_1'(x)(y)(z)$ . The transitive serve seen in serve the desserts will be translated as  $\lambda x \lambda z. \text{serve}_3'(x)(z)$ , which will be defined as equivalent to  $\lambda x \lambda z \exists y. \text{serve}_1'(x)(y)(z)$ . When these translations are used, the semantics generated for Kim served the guests and the desserts is that shown in (52b).

(52) a. Single-event reading: Kim served the guests the desserts.

$$\lambda e. (\text{serve}_1'(\text{desserts}')(\text{guests}')(\text{kim}'))(e)$$

b. Multiple-event reading: Kim served the guests and the desserts.

$$\lambda e. (\exists e_1 \exists x [(e_1 \subseteq e) \wedge (\text{serve}_1'(x)(\text{guests}')(\text{kim}'))(e_1)] \wedge \exists e_2 \exists y [(e_2 \subseteq e) \wedge (\text{serve}_1'(\text{desserts}')(\text{kim}'))(e_2)])$$

As with the single- and multiple-event readings for the adverbial combinations discussed in section 3.1, the single-event reading in (52a) is a special case of the multiple-event reading in (52b). Specifically, it is the case in which  $e_1 = e_2 = e$ , and  $x = y$ .

As with the earlier adverbial coordinations, if the context makes it clear that a multiple-event reading is indeed intended, the coordination should improve. This is in fact the case, as demonstrated in (53):

(53) You'll be serving the head table when the food arrives, and the wedding cake after the cutting ceremony.

As for the higher acceptability seen in the coordinated-wh interrogatives, it is predicted in the same way here as in section 3.2: Coordination of the wh elements is the simplest way to ask both who someone was serving and what someone was serving without expectation of a pair-list answer. For example, a public health inspector investigating an outbreak of E. coli infections among diners at a certain restaurant might well ask either of the questions in (54):

- (54) a. Who and what did Kim serve?  
b. What and who did Kim serve?

The serve alternation is especially interesting since it allows for cross-subcategorization complement-complement coordination with like categories for the complements. However, there are many other verbal valence alternations that raise the possibility of complement-complement coordinations with unlike categories. Some of them work very well—for example, the coordinations of NPs with complementized sentences with verbs such as remember or frighten, noted by Sag et al. (1985). Others are unacceptable out of context, but improve in the same way as the serve example above; one such example is given in (55):

- (55) \*I wrote an essay and to John. (Bechhofer 1977, (73b))  
(i.e., I wrote an essay and wrote a letter to John)

Still others, however, get varying responses from speakers ranging from acceptable to somewhat strange to downright ungrammatical, with little discernible difference when conducive contexts are described. A selection is shown in (56):

- (56) a. ?Robin gave the dog a bone and then to Kim.  
(i.e., Robin gave a bone to the dog, then gave the dog to Kim)  
b. ?We loaded the crates with oranges and onto the truck.  
(i.e., we put oranges into the crates, and put the crates onto the truck)  
c. ?I rented the apartment from Mr. Roper and to Kim.  
(i.e., I rented it from Mr. Roper and subleased it to Kim)

Sometimes these coordinations seem to improve if each conjunct contains two complements, as in (57), but clear judgments are hard to obtain.

(57) ?Robin gave the dog a bone and a toy to the cat.

The analysis given above does not satisfactorily account for the data with these verbs, and they are left as an open question (but for a speculative analysis see Whitman 2002a). However, the semantic and pragmatic groundwork laid in section 3 holds true no matter what, and the facts about complement-complement coordinations that it does capture fit neatly into an independently motivated account of verbal dependent coordination.

## 5 Adjunct-complement coordination

The same semantic and pragmatic analysis developed in section 3 and extended in section 4 can be extended to cover at least some adjunct-complement coordinations. Two transitivity alternations are considered here: the understood indefinite object alternation, and the understood definite object alternation.

The understood indefinite object alternation is exemplified by the verb eat, as illustrated in (58):

- (58) a. John ate a grilled cheese sandwich.  
b. John ate quickly.

Adjunct-complement coordinations involving or are given in (59):

- (59) a. ?John ate quickly or a grilled cheese sandwich.  
b. ?John ate a grilled cheese sandwich or quickly.

It bears emphasizing that the coordinations in (59) are generated in a type-logical grammar in which signs are allowed to have multiple categorizations; refer back to (13) for a derivation. The same exclusive-or Q-implicature seen before is in effect here: The or-coordination suggests that John performed only one of the actions, but the

complementarity of the complement and adjunct information suggests that he did both, in a single event. But if the context supports the implicature that eating quickly and eating some particular item are mutually exclusive, the coordination improves somewhat. For example, maybe John eats everything fast, except for grilled cheese sandwiches, which he slows down to savor. And a similar attested coordination within the scope of a negation (shown below with brackets added to highlight the relevant conjuncts) is impeccable:

- (60) Don't eat [fast food] or [at restaurants, food-service companies or caterers].  
 (William H. Balson, Jr., Columbus (Ohio) Dispatch letter to the editor, 19 Jan. 2003)

Moving on to and-coordinations, sample sentences are given in (61):

- (61) a. \*John ate quickly and a grilled cheese sandwich. (Schachter 1977, (4))  
 b. [\*]John ate a grilled cheese sandwich and quickly.  
 (i.e. John ate a sandwich, and John also ate some meal or snack quickly.)

As already noted, these sentences are unacceptable, or at least unacceptable under the desired reading; (59b) is acceptable only with the idiomatic interpretation meaning, 'John ate a grilled cheese sandwich, and did so quickly.'

Once again, the complementary information contributed by the adjunct and complement invites a single-event interpretation, but the single-event reading could be conveyed simply by juxtaposing the adjunct and the complement, as in ate a sandwich quickly (or in this example, by putting the adjunct before the VP: quickly ate the sandwich). Therefore, if a speaker chooses and-coordination, the Q-implication is that there is some other meaning to be conveyed than the one in a single-event reading. One possibility is that the speaker is actually referring to multiple events; another is that the speaker is referring to a marked, noteworthy single event. The better the context can support either of these possibilities, the better the coordination.

To illustrate how the semantics for John ate a sandwich quickly is a special case of the semantics for John ate quickly and a sandwich are compared, the terms are written out in (62). The meaning for transitive eat will be translated as  $\lambda x \lambda y. \mathbf{eat}_1'(x)(y)$ . Intransitive eat will be translated as  $\lambda y. \mathbf{eat}_2'(y)$ , which will be defined as equivalent to  $\lambda y \exists x. \mathbf{eat}_1'(x)(y)$ .

- (62) a. Single-event reading: John ate a sandwich quickly.  
 $\lambda e.(\text{quickly}'(\text{eat}'_1(\text{a-sandwich}')))(\text{john}')(e)$
- b. Multiple-event reading: John ate quickly and a sandwich.  
 $\lambda e.(\exists e_1 \exists y[(e_1 \subseteq e) \wedge (\text{quickly}'(\text{eat}'_1(y)))(\text{john}')(e_1)] \wedge \exists e_2[(e_2 \subseteq e) \wedge (\text{eat}'_1(\text{a-sandwich}'))(\text{john}')(e_2)])$

The single-event reading, then, is the special case in which  $e_1 = e_2 = e$ , and  $x = \text{a-sandwich}'$ .

In (63), a multiple-event reading for the sentences from (59) is forced by adding the adverbs yesterday and today to the conjuncts, and the sentences show improvement:

- (63) a. John ate quickly yesterday and a grilled cheese sandwich today.  
b. John ate a grilled cheese sandwich yesterday and quickly today.

However, like the examples of John eating with his mother and with good appetite in section 3.3, these sentences are still questionable, since whether we are talking about a single event or separate events, the coordination of quickly with a grilled cheese sandwich, absent any context, is a non-sequitur. For the coordinations to be completely acceptable, there has to be some sensible connection between the conjuncts. One such context (for a single-event reading) was suggested earlier: It is understood that a grilled cheese sandwich is something that must be eaten slowly, and therefore eating something quickly when that something is a grilled cheese sandwich is unexpected. Inserting an and, or even better, a but, is acceptable in such a context. Other contexts are harder to envision, but as with earlier examples, simply adding at the same time leads to improvement and leaves it to the hearer to figure out what the relevant context might be.

Finally, it happens that some adjunct-complement coordinations involving the understood-object alternation seen in eat and other verbs can be dramatically improved with judicious choice of the adverb and direct object. For example, consider (64):

- (64) John ate ravenously yesterday but hardly anything today.

Here, the adverb ravenously is not merely a manner adverb; it entails that the amount of food John ate is large. Likewise, the direct object hardly anything does not say what John ate, but indicates that the amount is small. In this way, the adverb and the direct object have been chosen so as to carry the same kind of semantic information, and the sentence does not violate the R Principle as those in (63) do. The indication of separate events removes the contradiction of saying that John ate a lot and a little simultaneously, and the sentence makes sense, much more so than the original ate quickly and a grilled cheese sandwich example. Similar adverbs can be chosen for certain other verbs in this class, for example, prolifically with write.

Concerning coordination of a wh adjunct and complement, as in (65), the same argument made for wh adjunct-adjunct and complement-complement coordinations is in effect here: The wh coordination is the easiest way to ask the two desired questions without conveying an expectation of a pair-list answer.

(65) What and when can I eat?

Moving on to the understood definite object alternation (Levin 1993, Fillmore 1986), an illustration with the representative verb notice is shown in (66):

- (66) a. Kim noticed that Robin had entered the room.  
b. Robin entered the room. Kim noticed.

An ordinary coordination of adjunct and complement is constructed in (67a), and a wh coordination in (67b). For apnly and is used one order is tried, since the understood-object usage needs to immediately follow the utterance of the noticed event. In addition, only and is used, since or results in crashingly bad sentences, a fact for which I have no explanation.

- (67) John entered the room.  
?Mary noticed immediately, and also the lipstick on his collar.

The sentences are questionable, but improve when separate events are indicated, as in (68):

(68) Mary noticed [immediately when John left], and [the lipstick on his collar when he returned].

Here, not only does the indication of separate events seem to help, but the choice of the adverbial phrase when John left in the first conjunct increases the sentence's acceptability. This phrase is doing the job of identifying what Mary noticed, even though notice is being used intransitively, in much the same way as ravenously provided information about what John ate in (64). Before moving on to wh adjunct-complement coordinations with notice, it is worth noting that even an or coordination becomes acceptable, with the conjuncts lengthened as in (69), and embedded under a negation:

(69) Mary didn't notice [at all when John left], or [the lipstick on his collar when he returned].

A wh adjunct-complement coordination with notice is given in (70). In this example, since the when question presupposes that something that Mary noticed is common knowledge, what else is used instead of what:

(70) John entered the room.

?When and what else did Mary notice?

This example is much less acceptable than What and when can I eat? above, a fact about notice for which I have no explanation.

In addition to the glitches in the notice data, there are many other transitivity alternations that do not fit at all into the pragmatic analysis developed here. In particular, causative and middle alternations do not work, as seen in the sampling below:

- (71) a. \*Kim frightens [easily] and [Robin].  
b. \*[How easily] and [whom] does Kim frighten?

- c. \*The rock broke [the scissors] and then [into three pieces].
- d. \*[What] and then [into how many pieces] did the rock break?
- e. \*Kim walked [briskly] and [the dog].
- f. \*[How] and [what] did Kim walk?

These coordinations do not seem to improve, even with congenial contexts supplied. One might be tempted to say that these verbs exist as multiple entries in the lexicon (i.e. are ambiguous), which rules out using them in two senses at once, but as noted in section 2.2, this option must be pursued with caution, making sure that invoking ambiguity for these verbs but not for verbs such as eat or notice is not an ad hoc device.

Overall, then, though there are many adjunct-complement coordinations that still appear to be downright ungrammatical, there are some that have turned out to be grammatical and acceptable in the proper context. Moreover, the explanation for the acceptability or unacceptability of these adjunct-complement coordinations is the same independently motivated one that was developed for adjunct-adjunct coordinations in section 3, and extended to complement-complement coordinations in section 4.

## 6 Further directions and conclusion

The analysis presented here suggests several lines for further research. First of all, there are all the possible test coordinations to be constructed with verbs not investigated here. In addition to those mentioned earlier, there are also the following examples from Schachter (1977):

(72) (Schachter 1977, (7,8))

- a. \*Running and to overeat may be unhealthy.
- b. \*It's odd for John to be busy and that Helen is idle now.

Other coordinations of unlike verbal complements were actually found attested during the writing of this paper, and are presented in (73), with brackets clarifying the conjunct edges where necessary. It is hard to tell whether these attestations are intended to have a humorous, zeugmatic effect (indicating that the relevant verbs are

ambiguous), or are merely clever turns of phrase—or indeed, whether there is a clear distinction between outright zeugma and more subtle wittiness.

- (73) a. But the jiggling made Tabby nervous and Zeke itch.  
(Cynthia Rylant, Mr. Putter and Tabby Toot the Horn, 1998)
- b. The soldiers did their best to evaluate their resources, but most had little idea of what they were looking [for when they went after it], or [at when they found it].  
(Bill Bryson, In a Sunburned Country, 2000, p. 73)<sup>5</sup>
- c. From her office window, she could see debris floating through the air but not that the north tower was in flames.  
(Columbus (Ohio) Dispatch, 13 Sept. 2001, A4)
- d. Come on out and see [Dave’s cargo shirt] and [me sweat].  
(Jimmy Jamm on WNCI’s Morning Zoo radio program, Columbus, Ohio, 7 June 2002)

In analyzing complement-complement and adjunct-complement coordinations with other verbs, there is one overarching caveat: Attempting to rule out some of these coordinations by declaring that a verb is ambiguous between the relevant subcategorizations should be done with extreme caution. First of all, it has already turned out that some of these coordinations are acceptable after all, in the right context. If one accepts this truth and then says without strong independent motivation, ‘All the REST of these coordinations are ungrammatical because of ambiguity of the verb’ then ambiguity will be to a logical theory of coordination as magic is to science: the ‘we just don’t know’ throwing up of hands that occurs when the frontier of knowledge is reached.

Moving beyond coordination of verbal adjuncts and complements, it may be that the analysis detailed here can be extended to cover coordination of nominal adjuncts and complements. For example, the contradictory information contained in green and purple forces the phrase green and purple pill to be interpreted as a pill of which some parts are green and some purple. This ‘multiple-locations’ reading seems to be related to the ‘multiple-events’ readings discussed for coordinations of verbal adjuncts and complements.

The pragmatic part of the analysis here meshes well with an analysis by Kehler (2002) of coordinations that violate the Across-the-Board constraint but are nonetheless acceptable. Lakoff (1986) enumerated three kinds of these coordinations: those in which the conjuncts formed some kind of natural sequence of events, as in (74a); those in which the conjuncts formed an unexpected sequence of events, as in (74b); and those in which a causal relation was implied between the conjuncts, as in (74c):

(74) (from Lakoff 1986)

- a. What did Harry go to the store and buy \_\_\_?
- b. How much can you drink \_\_\_ and still stay sober?
- c. That's the stuff that the guys in the Caucasus drink \_\_\_ and live to be a hundred

Kehler analyzes all these cases in terms of 'coherence relations' of Result, Violated Expectation, and Contiguity, which are essentially the same kinds of contexts imagined earlier for certain coordinations that seemed to violate the R Principle at first glance.

Though the analysis of the non-wh coordinations was based on event semantics and non-language-specific pragmatic principles, that for the wh coordinations depended on an English-specific fact concerning the relationship between multiple-wh interrogatives and coordinated wh-interrogatives. are interpreted as calling for a pair-list answer. In other languages, though, this is not the case: In Russian, all wh elements are fronted; in Chinese, all are left in situ.

In this study of coordination of verbal adjuncts and complements, all three binary possibilities were considered: coordinations of adjunct with adjunct, complement with complement, and adjunct with complement, for both non-wh and wh elements, with conjunctions or, and, and but. Previous analyses have never to my knowledge covered all these cases. In contrast, an analysis based on the semantics of the conjunctions and on the pragmatic Q and R Principles makes correct predictions about all three kinds of coordination.

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<sup>1</sup> One could argue that in (1b), yesterday and in the Coop have different categories: yesterday could be NP, or AdvP (depending on how one chooses to analyze adverbial NPs), and in the Coop, PP. However, the assumption here is that yesterday is an AdvP (see Whitman (2002b) for details), and in any case, declaring in the Coop to have some category other than AdvP or even NP raises the question of why more intuitively temporal PPs CAN be coordinated with yesterday—for example, yesterday and on Friday.

<sup>2</sup> The conjunction constructor  $\wedge$  is introduced in Lambek 1961, and further discussed in Morrill 1994.

<sup>3</sup> Compare the similar implicature in ‘Would Zeke be good, or would Zeke be Zeke?’ (Cynthia Rylant, Mr. Putter and Tabby Walk the Dog)

<sup>4</sup> For explanation of categories constructed with the ‘Wrap’ modality (indicated by the w-subscripted slash), see Dowty 1997.