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THE SPECIFICATION OF GRAMMATICAL NUMBER IN ENGLISH

By

Kathleen M. Eberhard

A DISSERTATION

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ABSTRACT

THE SPECIFICATION OF GRAMMATICAL NUMBER IN ENGLISH

By

Kathleen M. Eberhard

Subject-verb agreement provides a means for examining the nature of the information that must be transmitted among sentence constituents during language production. The four experiments reported here exploited this phenomenon in an effort to gain insight into the nature of the grammatical information that underlies the overt marking of number in English. Results from previous investigations of verb agreement errors (Bock and Eberhard, 1993) suggest that the overt morphological properties of singular and plural count nouns are indicative of an underlying difference in the specification of a grammatical feature of number. The concepts of markedness theory further informed this hypothesis and four agreement-error elicitation experiments empirically examined it. The results of all four experiments suggest that singular count nouns are grammatically unmarked or unspecified for number whereas plural count nouns are marked or specified and that the syntactic operations underlying agreement are sensitive to whether number is specified.

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INTRODUCTION

Language exhibits oppositional relationships at all levels of linguistic representation. This is readily apparent at the conceptual level where there are opposing concepts such as good and bad, male and female, big and small. Perhaps less obvious are the oppositions at the level of phonology where two opposing sounds differentiate words. For example, the phonemes /p/ and /b/ differentiate the English words pit and bit. Just as opposing sounds at the level of phonology differentiate words, the oppositions at the level of morphology differentiate basic conceptual categories. For example, the conceptual opposition between male and female gender is sometimes reflected in contrasting morphological forms such as, host and hostess, waiter and waitress, he and she. A more consistent morphological opposition in English is number. The contrasting forms of count nouns (e.g., cat and cats) differentiate the meanings 'one' and 'more than one'.

Markedness theory, pioneered by Jakobson and Trubetzkoy, views the poles of every linguistic opposition as expressing a difference in complexity. One pole, the unmarked, is simple; the other, the marked, is more complex. At the phonological level, complexity is in terms of the acoustic or articulatory elaboration of the sound. For example, the marked phoneme /b/ may be considered as more complex than the unmarked phoneme /p/ because it is produced with the vibration of the vocal cords whereas /p/ is produced without the added vibration. At the morphological level, complexity is in terms of the augmentation of the morphological form. For example, in English the base form of singular count nouns, e.g., cat, is the unmarked form whereas

the inflected form of plural count nouns, e.g., cats, is the marked form. As will be discussed in greater detail below, Jakobson defined the difference in complexity as one between the possession versus absence of a feature or property. For example, the opposition between the phonemes /b/ and /p/ can be defined as the presence versus absence of the articulatory feature of voicing (vibration of the vocal cords), respectively.

The concepts of markedness theory were used to inform a hypothesis about the nature of the grammatical information that may underlie the overt morphological markings of number in English. In particular, it is proposed that the opposition between singular and plural count nouns may be characterized as an unspecification (absence) versus specification (presence) of the grammatical feature of number, respectively. Since grammatical number information is important for the implementation of subject-verb agreement (i.e., a finite verb agrees in number with the subject noun phrase of the clause), the research examined whether this difference in the specification of number differentially affects the syntactic operations underlying agreement in language production.

The impetus for the research came from the consistent findings of an asymmetrical distribution of agreement errors both in sentence production tasks (Bock and Cutting, 1992; Bock and Eberhard, 1993; Bock and Miller, 1991) and in natural observations (e.g., Strang, 1966; Zandevoort, 1961; Bock and Miller, 1991). The agreement errors are referred to as errors of attraction (Strang, 1966), a term which characterizes the erroneous verb-agreement with an immediately preceding noun (or local noun), rather than with the subject noun of the clause as in sentence (1).

1.)*The key to the green filing cabinets were beautiful.

In sentence (1), the verb agrees in number with the local noun cabinets rather than with the subject noun, key. The subject phrase in sentence (1) also exemplifies

the circumstances that create the asymmetrical distribution of attraction errors, i.e., a singular subject noun followed by a phrase ending in a plural local noun. In other words, there is a much greater likelihood of an attraction error following a subject phrase that has a singular subject-plural local noun number pattern than following a subject phrase that has the reverse number pattern (i.e., plural subject-singular local noun).

The question that arises from the asymmetry of the singular-plural attraction errors is, what is the attractive property that a plural local noun possesses, and a singular local noun lacks, that causes the verb-agreement process to occasionally derail? The findings from a series of error-elicitation studies by Bock and Eberhard (1993) led them to suggest that the property is a specification of lexical or grammatical number for plural nouns which is lacking or unspecified for singular nouns.

According to Bock and Eberhard, lexical or grammatical number is separate from, though often consistent with, a noun's notional number, i.e., the number of the noun's denotation. The determination of a noun's grammatical number comes from the grammatical role of the noun, not its denotation. For example, the noun pants may be used to denote one object, but since its grammatical role is obligatorily plural (e.g., the pants were on the mannequin/ *the pants was on the mannequin) its grammatical number specification is plural. Consistent with the representations in several formal linguistic theories (e.g., Lexical Functional Grammar, Kaplan and Bresnan, 1982), it is assumed that, in addition to grammatical category information (e.g., noun, verb, etc.), the lexical entries of nouns contain grammatical number information. The grammatical number information may be represented as a feature that is either unspecified with a value as in the case of singular unmarked nouns or is specified as in the case of plural

marked nouns. The syntactic mechanisms that implement verb-agreement in production are assumed to operate on the basis of this number information.

Bock and Eberhard propose that because singular nouns are unspecified for grammatical number, the retrieval of an agreeing singular verb form is not based on explicit number information; rather, singular verbs are retrieved by default. In contrast, since plural nouns are grammatically specified for number, plural-agreeing verbs may be retrieved directly on the basis of this explicit information. The singular-plural pattern in a subject phrase creates the circumstances for an attraction error because the explicit plural specification of the local noun may occasionally preempt the default retrieval of a singular verb form for the unspecified (singular) subject noun. In other words, even though the explicit number specification is not from the subject noun, its existence within the subject phrase (i.e., on a local noun in a postmodifying phrase) may overshadow the subject noun and attract the mechanism that is responsible for retrieving agreeing verb forms. The plural-singular pattern, however, does not create the circumstances for an attraction error because the explicit number on the plural subject noun is not likely to be overshadowed by the number specification on a singular local noun if it has none.

Previous investigations of errors of attraction.

As stated above, this hypothesis was motivated by the asymmetrical distribution of agreement errors that points to the grammatical plurality of the local noun as the overriding cause of the errors. The investigations of experimentally-elicited agreement errors have systematically eliminated other potential properties that may be influential in the verb-agreement processes. The following section provides an overview of these previous investigations.

The experimental paradigm for investigating errors of attraction.

Beginning with Bock and Miller (1991), the experimental paradigm for investigating errors of attraction involves the auditory presentation of sentence preambles (e.g., The picture on the postcards). The sentence preambles serve as subject phrases for sentences that are generated by the experimental participants (e.g., The picture on the postcards was beautiful). The generated sentences are subsequently inspected for correct and incorrect verb-agreement.

To mimic the circumstances that result in naturally occurring attraction errors, the experimental preambles contain a subject noun followed by a phrase containing a local noun that differs in number (i.e., a singular-plural pattern or a plural-singular pattern). Control preambles contain subject and local nouns that are matched in number (singular-singular pattern or plural-plural pattern) and are designed to indicate the effects of extraneous errors and dialects that do not mark agreement. Thus, the incidence of errors for the experimental conditions are assessed according to the incidence of errors that occur for the match control conditions.

The properties of the preambles are manipulated under the assumption that if particular properties are found to reliably induce verb-agreement errors, then these same properties are also likely to be involved in the processes behind normal error-free agreement (Bock and Eberhard, 1993). A similar assumption has guided most research on speech errors since Fromkin (1971).

Bock and Miller (1991) examined several potential properties that might influence the verb-agreement process. In one experiment (Experiment 2), they examined whether attraction errors are a result of the misidentification of the local noun as the subject of the verb. They proposed that if misidentification is a culpable factor, then the incidence of errors should be greater following preambles that contain a "subject-like" local noun (one that is animate and concrete) than for preambles that

contain a local noun that does not possess subject-like properties. It was predicted that if concrete, animate local nouns attract verb-agreement then there would be a greater incidence of errors in the conditions represented in (3) than in (4).

- 3 a.) The speech of the authors
- b.) The speeches of the author
- 4 a.) The author of the speeches
- b.) The authors of the speech

The results, however, showed that, relative to controls, which had a match in number on the subject and local nouns, neither the animacy nor the concreteness of the local noun affected the occurrence of agreement errors. The only factor that reliably influenced the occurrence of errors was the plurality of the local noun (both the conditions represented in 3a and 4a above). Bock and Miller suggest that although animate entities in the to-be-communicated message may be more likely to be assigned to the grammatical role of subject than inanimate ones, once they are assigned to this role their animate or concrete features do not affect the verb-agreement process.

Bock and Miller (Experiment 1, 1991) also examined whether plurality in the message (or meaning) of the preambles affects the occurrence of errors. The manipulation involved a comparison of the ability of two different types of preambles to elicit an error of attraction. One type of preamble was independently judged to refer to multiple entities. The other type of preamble was independently judged to refer to only a single entity. The contrasting preamble types are exemplified in (5).

- 5 a.) The picture on the postcards
- b.) The key to the cabinets

In (5a) the referent of the preamble is multiple tokens of the same picture, whereas in (5b) the referent is a single token of a key. The correct agreement for both preambles is singular which is consistent with the single referent meaning in (5b), but inconsistent with the multiple referent meaning in (5a). Therefore, if plurality in the

referent of the preambles causes attraction errors, it was predicted that there would be a greater incidence of errors following the multiple referent condition (5a) than following the single referent condition (5b). However, the number of errors following both types of preambles was equal, and there was no correlation between the judged multiplicity of the preamble's referent and the incidence of errors. This finding, together with the findings of the animacy manipulation, suggests that the disruptive source of information in attraction errors is the plurality of the local noun.

Bock and Cutting (1992) provided evidence that the disruption by a plural local noun is greatest in cases where it is a clausemate of the subject noun and the agreeing verb. They found agreement errors to be more frequent following subject phrases that contained a plural local noun in a prepositional phrase (e.g., The claim about the babies), than following subject phrases that contained a plural local noun in a relative or complement clause (e.g., The claim that wolves had raised the babies).

With the likely cause of attraction errors narrowed to the plural properties of a local noun within the subject phrase, Bock and Eberhard explored three possible sources of plural number that may be found on a local noun: semantic, grammatical, and morphophonemic. In one experiment they examined whether plurality in the denotation of a local noun alone would influence the occurrence of errors. This was accomplished by employing preambles that contained collective local nouns. Despite their singular form and consistent singular verb-agreement for American English speakers, collective nouns (e.g., army, committee, etc.) possess a plural meaning which results from their denotation of multiple entities.

The notional plurality of collective nouns is reflected in several ways. Their singular form can often be the antecedent for a plural pronoun. This occurs even in the presence of singular verb agreement as in (6) (Nixon, 1972; Gernsbacher, 1990) .

6.) The committee is going to meet tomorrow. They will decide on the issue then.

Additionally, although American English speakers predominantly use singular verb agreement with the singular form of collectives, British English speakers are inclined to use plural verb agreement (Quirk, Greenbaum, Leech, and Svartvik, 1972; Nixon, 1972; Bauer, 1988). Lastly, in a judgment task Bock and Eberhard found that the singular forms of collectives (e.g., army) are judged to refer to 'more than one thing' reliably more often than the singular forms of non-collective count nouns (e.g., soldier).

Given these notional characteristics of collective nouns, Bock and Eberhard investigated their effects on agreement errors by presenting preambles such as (7) below.

- 7 a.) The strength of the army
- b.) The strength of the armies
- c.) The strength of the soldier.
- d.) The strength of the soldiers

They reasoned that if the plural information on a local noun that influences errors of attraction is semantic, then there should be a greater incidence of errors following singular collective local nouns (7a) than following singular non-collective control local nouns (7c). Their results showed that there were no more errors following the singular collective local nouns than following singular non-collective local nouns; only when the local nouns were marked as grammatically plural (both collective (7b) and non-collective (7d)) was there a significant occurrence of errors. This provides additional evidence that the source of the disruptive plural information in attraction errors is not semantic.

In three other experiments, Bock and Eberhard examined the effects of the morphophonological markings of number on attraction errors. Morphophonological markings are highly correlated with the grammatical number of lexical items. Both nouns and verbs indicate number with the allomorphs /z/, /s/, or /ðz/, and there is a

systematic covariation in the morphophonemic indications of number between a subject noun and the agreeing verb: When one contains an allomorph the other does not (e.g., girl talks versus girls talk). The result of this covariation is the elimination of a repetition of the same phonological ending for subject nouns and agreeing verbs.

Bock and Eberhard suggested that this covariation may influence the verb-agreement process. The nature of this hypothesized influence is suggested in work by Stemberger and MacWhinney (1986). In a verb production task, they found that third person present tense verbs that end in either the phonological segment /z/ or /s/ (e.g., chooses) were more likely to result in a no-marking error (an erroneous deletion of the inflection, e.g., chooses→choose) than verbs that do not end in a third person-sounding segment. They suggested that no-marking errors occur as a result of the connections between a phonological output buffer and the morphemes in the lexicon. For example, since both the morphemes choose and the present tense inflection -s require the segment /z/ as their final output segment, the insertion of /z/ into the output buffer by choose occasionally fools the -s morpheme into believing that it has already been instantiated in the output buffer.

According to Bock and Eberhard, a similar explanation could account for the singular-plural asymmetry in attraction errors. For example, an error such as The king of the islands rule... may be a side-effect of the encoding of the plural affix /z/ of the local noun islands. This encoding may have fooled the production system into believing that the singular affix on the verb (i.e., the /z/ for rules) was instantiated.

Based on this proposal, Bock and Eberhard's first experiment was designed to examine whether the verb-agreement processes could be fooled or influenced by a plural sounding segment on a singular local noun. This required the use of singular nouns that contained a final segment that was matched to the /z/ or /s/ of a true plural form. The incidence of errors in this "pseudoplural" local noun condition was compared to a

condition that contained a local noun that was actually marked as plural. The control condition contained a singular local noun that did not end in a plural sounding segment.

The three conditions are represented in (8).

- 8 a.) The player on the course
- b.) The player on the courts
- c.) The player on the court

The findings demonstrated no errors following either the pseudoplural local noun condition or the true singular local noun condition (8a and c, respectively). Only when the local noun was a true plural did errors occur (8b).

Although the final segments of the pseudoplural local nouns were matched to the final segment of actual plural nouns, they were illegal plural allomorphs for the sequence of sounds that would be taken as the stems of the pseudoplurals. For example, the stem of the pseudoplural word course would be core, and the legal plural allomorph for a stem such as core is /z/, not /s/. So, in the second experiment, Bock and Eberhard employed local nouns that were homophones. One version of the homophone was a true plural noun (e.g., crews) and the other was a singular unmarked noun (cruise). As homophones, the local nouns were completely matched in phonology; only their grammatical number differed. Bock and Eberhard proposed that if the encoding of a local noun's plural phonology influences the agreement process, then the incidence of attraction errors following both versions of the homophones should be equal. Although this manipulation required visual rather than the usual auditory presentation, it was successful in eliciting errors. Consistent with the findings of the previous experiment, the agreement errors occurred only when the local noun was a true plural. This evidence suggests that the local noun's plural morphophonology is not the major source of disruptive information in attraction errors, and it points to grammatical number as being the prominent factor.

A third experiment offered additional confirmation of the role of grammatical number in errors of attraction. In this experiment, Bock and Eberhard examined the incidence of attraction errors following regularly and irregularly marked plural local nouns. This involved the comparison of preambles that contained local nouns such as rats, boys, kids, etc. to those that contained local nouns such as mice, men, children, etc., respectively. The results showed that both types of plural marked local nouns were equally likely to elicit agreement errors, suggesting that it is the abstract grammatical information behind the overt marking of plurality that influences the verb-agreement process.

Bock and Eberhard suggest that this abstract information is lexical information in the form of a grammatical specification of number for plural nouns. Since the asymmetrical distribution of attraction errors demonstrates a weakness of singular local nouns in attracting erroneous agreement, singular number information appears to be different from that of plural number. If the overt markings of number indicate the nature of the lexical/grammatical information that is behind them, then the difference may be in the underlying explicit markings or specification of number information. In particular, it is proposed that since plural nouns often contain an overt inflection, this inflection is indicative of the explicitly marked specification of the noun's grammatical role as plural. In contrast, since singular nouns are the base form from which the plural is derived, the unmarked basic form is indicative of unspecification of number.

This markedness relationship in grammatical number specification is proposed to influence the syntactic operations that underlie verb-agreement. In particular, there may be a mechanism which operates during verb-agreement that is sensitive to whether there is grammatical number specification on the subject noun. If the mechanism does not detect any explicit specification of number, it may retrieve a singular verb by default or, in other words, as a last resort.

Thus, although the unmarked singular may be viewed as simpler in both meaning and morphological form than the marked plural, its simpler unspecification of grammatical number may result in a less direct retrieval of an agreeing verb. In other words, if the lexical entries for singular nouns do not supply a value or specification for the grammatical feature of number, then the mechanism that is responsible for retrieving an agreeing verb may have to determine the value by a default process. In contrast, if the lexical entries of plural nouns contain a specification for the grammatical feature of number, the agreement mechanism may be able to directly retrieve an agreeing verb on the basis of this explicit information. Based on this account, an error of attraction results when the explicit specification of number by a plural local noun in the singular subject phrase is mistakenly detected by the agreement mechanism.

An alternative account of agreement errors.

This marked/unmarked grammatical number account can be contrasted with an alternative account, proposed by Stemberger (1985), for what superficially appear to be agreement errors. An analysis of bound morpheme loss errors (e.g., The bird sings --> The bird sing) led Stemberger to suggest that they may originate in two different processing failures. First, a failure of the agreement process and second, a general failure to access bound morphemes.

According to Stemberger, the first type of failure is an agreement error that arises from the blending of two sentence structure rules. The erroneous blending generates either a structure that contains a singular subject phrase followed by a plural verb phrase (singular NP-plural VP), or a structure that contains a plural subject phrase followed by a singular verb phrase (plural NP-singular VP). The phrases of these structures are assumed to contain diacritic features for number to ensure that the

lexical items inserted into them are appropriately singular or plural. The first erroneous structure (singular NP-plural VP) increases the rate of bound morpheme loss errors for present -s. The second erroneous structure (plural NP-singular VP) is reflected in the existence of addition errors for the present -s of regular verbs in the error corpus (e.g., The birds sing → The birds sings).

This structural account claims that the agreement errors are independent of the lexical items that are ultimately inserted into the phrase structures; thus, the number information of the inserted lexical items does not influence the occurrence of an agreement error. When applied to errors of attraction, this account claims that a singular subject phrase that contains a plural local noun (i.e., singular subject-plural local noun pattern) should result in a plural verb error equally as often as a singular subject phrase that contains a singular local noun (i.e., singular subject-singular local noun pattern). This is clearly not found in the attraction error experiments that were discussed above. In all investigations, the singular-plural pattern of the subject phrase resulted in a plural verb-agreement error reliably more often than the control subject phrase which had a matched singular-singular pattern.

The second type of failure, which superficially results in an agreement error for regular verbs, is attributed to a difficulty in accessing morphological structures that contain bound morphemes. Sternberger argues that some characteristic of bound morphemes, in general, makes them difficult to access. The difficulty may arise from the greater superficial complexity of the bound morpheme form (i.e., they are marked by an additional segment), a greater semantic complexity (i.e., the additional morpheme often adds meaning), or, as he argues, a higher frequency related morphological structure (i.e., the base or unbound form) is accessed instead.

The control conditions employed in the attraction error studies are designed to assess the incidence of this second type of error. The subject phrases in the control

condition always have a match in number between the subject and local nouns. If an experimental condition has a mismatch singular-plural number pattern, the corresponding control condition will have a match singular-singular number pattern. Thus, the match control condition requires the same agreeing verb form as its corresponding mismatch experimental condition. This means that, for whatever reasons bound-morpheme loss (or addition) errors arise from, there are as many opportunities for them to occur in the control conditions as in the experimental conditions. Since the incidence of errors is always greater in the mismatch experimental conditions than in the match control conditions, the errors in the experimental conditions cannot be explained as simple loss errors.

The insecurity of singular agreement.

As discussed above, because singular nouns are assumed to be unmarked or unspecified for grammatical number the implementation of singular agreement may be less direct than the implementation of plural agreement. This implies that singular verb agreement is less secure. If this is true then it may be reflected in a comparison of the verb agreement following the singular subject-singular local noun subject phrases with the agreement following the plural subject-plural local noun subject phrases. This comparison in Bock and Eberhard's third experiment supports the implication. This is the only experiment in that paper that contained both patterns of number in their experimental subject phrases (i.e., singular-plural as well as plural -singular). Thus, both match control conditions were also employed (i.e., singular -singular and plural -plural). The results showed that singular subject nouns were associated with fewer correct responses than plural subject nouns in both the experimental mismatch and the control match conditions.

Bock and Eberhard point out that although these findings suggest that agreement with singular subject nouns is less "secure", there are no similar findings in the studies of Bock and Miller. The experiments conducted by Bock and Miller also included both match control conditions (singular-singular subject phrases and plural-plural subject phrases). However, the comparison between their control conditions shows that correct agreement was equally likely following singular subject nouns and plural subject nouns.

A very different sort of argument for a difference between singular and plural agreement comes from a study by Cowart and Cairns (1987). They provide evidence from verb naming-latencies that suggests plural nominals delay the retrieval of singular verbs. In their study, subjects heard a sentence preamble, and at the offset of the preamble they named either is or are which appeared on a computer screen. Naming latencies were collected and analyzed according to various features of the preambles. The preambles contained either the pronoun you or the plural pronoun they. Both pronouns were followed by a subordinate clause that ended in an ambiguously plural or singular lexical noun phrase. The ambiguous noun phrase had a word ending in the suffix -ing (e.g., frying) followed by a plural noun form (e.g., eggs). The suffixed word could be interpreted either as an adjective (i.e., a present participle), in which case the phrase would be plural, or as a gerund, in which case the phrase would be singular. The conditions were designed to explore whether the pronoun they would bias the interpretation of the subsequent ambiguous noun phrase to be plural. This biasing effect was compared to a control condition that contained the pronoun you. Examples of the conditions are below.

- 1.) Even though they use very little oil, frying eggs...
- 2.) Even though you use very little oil, frying eggs...
- 3.) Even though they eat very little oil, frying eggs...
- 4.) Even though you eat very little oil, frying eggs...

In (1) the ambiguous noun phrase frying eggs may be coreferenced with the plural pronoun they, thereby biasing a plural interpretation. However, a coreference of they with frying eggs in (3) results in an anomalous meaning due to the selectional restrictions of the verb eat.

The naming latencies showed that is was named 28 milliseconds more slowly in the preambles containing they than in the preambles containing you. This slowing effect for naming is occurred regardless of whether a coreferencing of they with the ambiguous noun phrase was anomalous (e.g., sentence 3 above). The naming latencies for are did not differ when the preceding context contained you or they. Furthermore, the mean naming latencies for are and is were about equal in the context that contained the pronoun you. These findings suggest that the presence of a plural nominal (i.e., they) interferes with the naming of a singular verb form, whereas a singular pronoun does not seem to influence the time that it takes to name either a singular or plural verb form.

This is similar to the asymmetrical distribution of attraction errors that suggests a plural local noun interferes with correct singular verb agreement more so than a singular local noun interferes with correct plural agreement. In the case of attraction errors, the interference by a plural local noun is proposed to be a result of a marked specification for grammatical number that, by virtue of being explicit, may become mistakenly detected by the verb agreement operations. The apparent undisruptiveness of a singular local noun is proposed to result from an unmarked specification of number that, by virtue of being less specific, does not attract the verb agreement operations.

Both linguistic and psycholinguistic inquiries into the markedness relationship view the unmarked term as less specific than the marked. The following two sections address this view.

Markedness in Linguistics.

Jakobson and colleagues' early work on markedness theory focused on analyzing the phonemic systems of various languages (e.g., Jakobson and Halle, 1956). These analyses resulted in several core principles of markedness theory. One principle is that lexical representations can be decomposed into sets of features. Each feature is binary; i.e., it can be specified as either "present" (+) or "absent" (-). A feature that is specified as "present" is referred to as a marked feature.

Jakobson's application of these markedness principles to the level of phonology resulted in phonemic systems that exhibited a definite structure, pattern, and symmetry. A simplified illustration of this is in Table 1 which contains the phonemic feature classification of 12 of the English consonants.¹ Each of these 12 consonants is opposed to every other creating a total of 66 oppositions. This number, however, is reduced to six when the consonants are decomposed into sets of articulatory or acoustic features. This is because the decomposition allows phonemes to be classified according to shared feature specifications. The oppositions can then be defined for classes of phonemes. For example, the consonants /m/, /n/, and /ŋ/ are classified as nasals because they share a marked specification for the feature [nasal]. The opposition between these three nasals and the consonants /p/, /t/, and /k/, respectively (as illustrated in the word pairs seem/seep, seen/seat, sing/seek) is due to the difference in the specification of this one feature.

Table 1. Markedness values for 12 of the English consonants.

	12 of the English Consonants											
Features ²	p	t	k	b	d	g	f	s	ʃ	m	n	ŋ
nasal	-	-	-	-	-	-	-	-	-	+	+	+
compact	-	-	+	-	-	+	-	-	+	-	-	+
continuant	-	-	-	-	-	-	+	+	+	-	-	-
strident	-	-	-	-	-	-	-	+	+	-	-	-
voiced	-	-	-	+	+	+	-	-	-	-	-	-
grave	+	-	+	+	-	+	+	-	-	+	-	+

Markedness theory not only provides an economical description of the phonemic oppositions but it also defines the nature of the oppositions. In particular, because the unmarked phoneme of an opposing pair lacks a feature that the marked phoneme possesses, its articulation is considered to require less deformation of the vocal tract from the neutral rest position; i.e., it is articulated more simply or naturally than the marked phoneme (Battistella, 1990).

Greenberg (1966) argues that the simplicity of the unmarked phoneme is reflected in its distributional properties. One such property is its ability to occur in environments of neutralization, i.e., environments where the opposition between two phonemes is suspended. For example, although the opposition between the consonants /p/ and /b/ is evident in the environment immediately preceding -ill where they differentiate the two words pill and bill, the opposition between them is neutralized in the environment following s_ where only the simpler unmarked phoneme /p/ can occur, e.g., spill but not *sbill. The ability to occur in environments of neutralization leads to the wider distribution of unmarked phonemes, and Greenberg (1966) has found that

unmarked phonemes consistently show a greater frequency of occurrence than marked phonemes.

The ability to structure the phonemic system through markedness theory inspired Jakobson to extend the theory beyond the phonological level of language. In his analysis of the Russian verbal system (Jakobson, 1957), he structured the verbal categories according to the presence or absence of semantic features which were determined by the meanings of verbs. For example, he viewed the opposition between finite and infinitive verbs as a difference in the specification of the feature of tense. Since infinitives do not specify tense, whereas finite verbs do, he considered infinitives to be the unmarked or more basic verb.

The application of the principles of markedness to semantic categories led Jakobson to the following statement:

The general meaning of a marked category states the presence of a certain property A; the general meaning of the corresponding unmarked category states nothing about the presence of A and is used chiefly but not exclusively to indicate the absence of A. (Jakobson, 1984, p.47).

Thus, just as the absence of an articulatory feature specification permits the unmarked phoneme to occur both in environments of contrast and in environments of neutralization, the absence of a semantic feature specification should allow the unmarked semantic meaning to occur both in contexts where it represents the specific opposite of the marked meaning and in contexts where it represents a neutral meaning. This duality in usage is illustrated with the opposing lexical items host and hostess. In traditional English, male gender is semantically unmarked and female gender is marked. As the unmarked term, host may be used in a context that reflects the specific opposite of the marked female meaning as in (7),

(7) Your host and hostess this evening are Mr. and Mrs. Smith.

or host may be used in a context that reflects a neutral meaning (i.e., one that represents both male and female simultaneously) as in (8).

(8) Your hosts/*hostesses this evening are Mr. and Mrs. Smith.

Wagh (1982) illustrates the duality in the use of the unmarked meaning with opposing singular and plural lexical items. The specific opposition is evident in the contrasting meanings of the singular phrases one man and a horse and the plural phrases many men and several horses. However, the unmarked singular can also be used to express a neutral meaning of number as in the statements man is an animal and the horse is an unpredictable beast, where the meaning of number is not known or pertinent.

The markedness assignments of semantic oppositions are not only reflected in contextual distributions but they are also consistently reflected in the morphological forms. The reflection is in what Jakobson referred to as the "zero-marking" of the unmarked item (Jakobson, 1939; Greenberg, 1966). Zero-marking refers to the tendency of the semantically unmarked item to be the base form of a lexical paradigm and the more specific marked form to be a derivation of the base by affixation or inflection, e.g., host and hostess, horse and horses. Thus, the inflection on a marked lexical form is viewed as indicative of the presence of a semantic feature that is absent for the opposing unmarked form.

Finally, just as the markedness relation between two opposing phonemes was reflected in the greater frequency of occurrence of the unmarked phonemes than the marked phonemes, with respect to the markedness relation of the semantic category of number, Greenberg found that the unmarked singular form of nouns has an overall greater text frequency than the marked plural form (Greenberg, 1966).

Psycholinguistic inquiries into the markedness relationships.

Several psycholinguistic inquiries into the markedness relationships at the semantic level have empirically examined the view that the unmarked meaning is less specific than the marked meaning. Clark and Chase (1974) found that when speakers were presented with the task of simply describing two objects, one above the other, they prefer to say "A is above B" rather than "B is below A". This led Clark and Chase to claim that "above" is the default or unmarked description; i.e., the one that is reliably elicited when there is no constraint on the focus of the description.

The contrast between the unfocused and focused meanings of opposing adjectives is illustrated in the questions "How short/small are you?" versus "How tall/big are you?" There is a presupposition of size in the first question that is not present in the second. The unmarked adjectives tall and big are used in a general or unspecified way when inquiring about size. Recently, Schriefers (1990) examined these dimensional adjectives in a production task. He presented subjects with a display of two geometric figures that differed in either the size dimension (bigger versus smaller) or the length dimension (shorter versus taller). One of the figures was indicated with a cross that cued the subject to name the relation from the perspective of that figure. For example, subjects responded with "smaller" when presented with two circles that had the smaller one indicated by a cross. The findings showed that the unmarked responses (e.g., bigger, taller) were significantly faster than the marked responses (e.g., smaller, shorter). When the same task required a key press response, rather than a naming response, the markedness effects disappeared. Furthermore, when subjects merely pronounced the adjectives instead of naming them on the basis of making a dimensional judgment, the markedness effects also disappeared. These findings led Schriefers to suggest that the markedness effects were located at a stage of lexical access rather than at an earlier conceptual encoding stage or at a later articulatory stage.

Schriefers' findings are consistent with the view that the more specific meaning of marked lexical items reflects an underlying specification of semantic features or properties that the less focused unmarked meaning lacks. This view has been applied to research into the memory for both adjectives (Clark and Card, 1969) and verbs (Clark and Stafford, 1969). The assumption underlying this research is that if the more specific meaning of marked lexical items is due to the possession or specification of semantic features these additional features may become lost during the retrieval or recall process. As a result there should be a systematic observation in recall errors that results in the unmarked items being substituted for the marked items.

Clark and Stafford (1969) provided evidence for this assumption in their examination of recall for verb forms that varied in the markedness oppositions of tense and aspect. They defined the markedness relations according to which pole possessed a greater restriction on the verb's meaning. For example, since the non-progressive verb's meaning (e.g., walked) is less limited or restricted in duration than the progressive verb's meaning (e.g., was walking), the non-progressive was considered to be unmarked and the progressive was considered to be marked. Participants were presented with sentences that had one of eight different verb forms that varied according to either tense or aspect oppositions. Recall was cued by the subject noun phrase of each sentence. The results showed that recall errors for verb forms were systematically simplified in the direction of the unmarked form being recalled instead of the marked form (i.e., non-progressive forms were recalled in place of progressive forms).

Lapointe and Dell (1989) conducted a similar investigation of the effects of markedness relations among verbs, but in a short- rather than long-term recall task. Subjects were presented with two simple sentences each of which had one of four possible verb forms. Ordered from least complex (most unmarked) to most complex (most marked), the four verb forms were: is V+ing, was V+ing, has V +ed, or must V.

The ordering was based on the complexity of semantic notions that the particular verb forms expressed (Lapointe, 1985; 1988). The participants viewed the sentences for eight seconds and then were cued with the subject noun phrase of one of the sentences to produce the remainder of the sentence.

The results showed that 9% of the responses resulted in a substitution error. The substitution errors were generally favorable to the predictions of the markedness rankings. The less marked progressive forms ("was V+ing", and "is V+ing") replaced the more complex perfect forms. However, the past form of the progressive was produced in place of the present form, and "must V" was substituted more often than "has V+ed". Lapointe and Dell suggest that the tense reversal may not be reflective of the markedness rankings, but rather due to a task bias: Since the sentences were presented before a production cue, producing them in the past tense may have seemed more accurate. However, the reversal of the ranking for the two most complex forms was viewed as more challenging to the predictions, and Lapointe and Dell suggest that the reversal may be attributable to factors other than their semantic markedness.

Although the overall evidence from memory tasks suggests that the additional features of the marked meaning become lost during the retrieval or recall process, there is an alternative explanation for these results. The additional features may have been lost during the initial encoding or comprehension of the stimuli in the study phase. Harris and Brewer (1973; Brewer and Harris, 1974) argued that a relevant context is needed to fully understand the more complex meaning of verb tense; i.e., a shift in recall to simpler forms is also predicted if full understanding is not achieved in the first place.

Whether these findings of less secure processing of marked items at the semantic level are viewed as having occurred during either comprehension or recall, they nonetheless contrast with recent findings of less secure processing of unmarked items at the phonological level in a production task. In particular, Stemmer (1991) found

that in both naturally occurring and experimentally elicited contextual errors (i.e., errors in which a phonological segment was mispronounced as a segment that appeared in a nearby word) marked phonological segments tended to replace unmarked segments more often than the reverse. The asymmetries were systematically explored in several experiments employing an error induction technique. The technique involved the presentation of word pairs for participants to silently prepare to say aloud. On some trials, the presentation of two words was followed by a cue for their overt production. On critical trials, the cued (target) pairs were preceded by prime pairs that prepared the participants to say the initial consonants of the target pair in a particular order, e.g., the prime pair, sum-ship prepared the initial consonant order /s/-/sh/. The target pair, however, had the initial consonants reversed, e.g., the target pair shuck-sift. Thus, a primed error resulted in the replacement of /sh/ with /s/ in the production of the first word of the target pair (e.g., shuck→ suck). Because there was an equal number of target pairs that had preceding primes that prepared the opposite replacement error (e.g., the pair, ship-sum primed the target pair, sift-shuck) Stemberger was able to examine whether there were asymmetries in the direction of replacement errors between the two opposing consonants.

His findings showed that consonants unmarked for voicing were replaced by consonants marked for voicing more often than reverse; consonants unmarked for the feature continuant (i.e., stop consonants) were replaced by consonants marked as continuants more often than reverse, and consonants unmarked for nasal were replaced by nasals more often than the reverse.

These findings were explained in terms of the underspecification of features. According to Stemberger, early phonological theories assume that all features in the lexical entries of segments must be specified as either [+F] or [-F]. However, more recent theories allow for some feature values to be left blank or underspecified. In

particular, it has been proposed that the underspecified value should correspond to the universally unmarked value of the feature, i.e., the most frequent value for the segment class across languages. For example, Stemberger claims that most phonologists view unvoiced non-continuants (stops) as more frequent cross-linguistically than voiced non-continuants; therefore, unvoiced is usually considered to be an unmarked feature for these consonants. Given this, it may not be necessary to specify this feature value in the lexical entries of unvoiced non-continuants. The blank value for the feature may be specified at a later point in the processing. Because the values of features are assumed to be binary (+, present; -, absent), the specification of a blank value can be determined by virtue of knowing that it is not the other (specified) value. Thus, the process that is responsible for specifying blank values would use the most frequent (i.e., unmarked) value of the segment's class as a default specification unless the contrasting binary value is specified. Stemberger argues that by eliminating specified values for features in the lexical entries, the amount of information that is stored in the lexicon is reduced. However, he points out that the need for a default specification process does increase the complexity of the processing system.

This increase in the complexity of processing segments with underspecified values causes them to be processed less securely than segments that have their feature values specified. Stemberger claims that the asymmetry in the contextual errors involving underspecified and specified segments reflects a processing failure that occurs at a point before the underspecified value becomes specified. He suggests that the failure occurs when the specified value of an upcoming marked segment is highly activated and is erroneously selected as the value for a current underspecified segment. The asymmetry arises because an activated specification of a current marked segment will not have any competition from the specification of an upcoming unmarked segment if it has none.

This account of the asymmetry in errors at the phonological level is similar to Bock and Eberhard's account of the asymmetry of agreement errors at the grammatical level. They propose that the singular forms of count nouns lack a specification for the grammatical feature of number whereas the plural forms contain an explicit specification. The syntactic mechanisms underlying verb agreement are assumed to be sensitive to whether number is explicitly specified. When it isn't, singular verbs are retrieved by default. The greater number of agreement errors following subject phrases with a singular subject-plural local noun number pattern is due to the explicit specification of number on a local noun overshadowing the unspecification of number on the subject noun. The type of number information that the agreement mechanism is claimed to be sensitive to, however, is grammatical- not semantic or morphophonemic. The next section addresses this issue.

Markedness and the specification of the grammatical feature of number.

The category of number is not only a semantic property that is highly correlated with morphological properties, but it is a grammatical or syntactic property as well. Although there is a relatively consistent reflection of notional number in the grammatical roles and morphological properties of lexical items, there are many cases where the reflection is not explicit or is misaligned. Number is not explicitly reflected in the morphology of "zero-plural" nouns such as salmon, sheep, deer, etc., where the same form is used to denote both singular and plural entities. This is also the case for a few invariable plural nouns in English such as cattle, police, and people. Number is misaligned in both the morphology and grammatical roles of pluralia tantum nouns (i.e., the summation plurals, scissors, pants, etc.) when their use refers to single objects. There are also nouns whose morphological and semantic properties would suggest that

their grammatical role could or should be plural (e.g., linguistics, news, politics), yet they are grammatically singular.

These cases suggest that there is a grammatical category of number (Bock and Eberhard, 1993), and that the determination of whether a lexical item (e.g., a noun) is grammatically singular or plural depends on the role the item plays in the grammar. Furthermore, as discussed above, the evidence from studies of errors of attraction suggests that it is grammatical number, rather than number meaning or morphophonology, that effectively influences the verb agreement process.

Thus, although the markedness relation is typically applied to the conceptual opposition of number meaning (one versus more than one), which is correlated with the morphological properties of count nouns (uninflected versus inflected), it is proposed that there is also a markedness relation in the opposition of the grammatical number of nouns (unspecified singular versus specified plural).

In terms of the operations that underlie subject-verb agreement, the greater specificity of grammatically plural nouns may exert a dominance over the unspecification of grammatically singular nouns. The asymmetric distribution of attraction errors appears to reflect this dominance. The experiments reported here examine this issue by investigating whether singular number may become grammatically marked or explicitly specified as singular. If so, then the marked plural specification of a local noun should be less dominant; i.e., it should be less likely to attract erroneous agreement.

A grammatical marking of singular number may arise from the combination of an unmarked noun with a singular quantifier such as one. For example, the phrase one horse not only semantically specifies the opposite of the plural meaning (i.e., 'one' versus 'more than one'), but the quantifier one grammatically marks the noun phrase to be singular. This singular marking is reflected in the quantifier's inability to combine

with a noun that is grammatically marked as plural (e.g., * one boys, * one scissors). In contrast, the determiner the may combine with either a grammatically unmarked singular noun (e.g., the boy) or a grammatically marked plural noun (e.g., the boys, the scissors). All previous investigations of subject-verb agreement employed noun phrases that contained the determiner the and therefore did not examine whether singular number can be specified by an overt morpheme.

The quantifiers each and every, like the cardinal quantifier one, must also combine with an unmarked count noun. Although the quantifiers are not bound to the noun that they combine with, their requirement of singular verb agreement resembles the requirement of plural verb agreement imposed by a bound plural morpheme. Thus, it may be assumed that all three of these quantifiers grammatically mark or specify number information to be singular (e.g., Pollard and Sag, 1991).

The experiments.

Based on the above analysis, when an unmarked subject noun is preceded by the quantifiers every, each, or one , the operations of verb-agreement should be able to access the singular verb form on the basis of specified number information, rather than by an indirect default computation. If there is a mechanism that is sensitive to the specification of number, a detection of singular specification may result in more secure retrieval of a singular agreeing verb form. Thus, a plural specification by a local noun should be less likely to cause an error of attraction. This was examined in the first experiment.

It was argued that a plural-singular number pattern in subject phrases (e.g., The pictures on the postcard) does not result in as many attraction errors as the reverse pattern because singular unmarked local nouns are less likely to interfere with the plural marking on the subject nouns in the agreement process. However, a marked

specification of singular number by a quantifier on a local noun phrase may interfere with the retrieval of a plural verb form for a plural marked subject noun (e.g., The pictures on every postcard). If so, there should be an increase in attraction errors for the plural-singular pattern of subject phrases. This was examined in the second experiment.

The proposed effect of a quantifier is that it marks or specifies as singular an otherwise unmarked noun phrase. However, there is an alternative interpretation of the effects of a quantifier. It may be that unmarked singular nouns do contain a singular specification but, relative to the plural specification of marked nouns, it is weak. Thus, a quantifier may not specify singular number, but rather enhance or strengthen a specification. If so, plural quantifiers (e.g., many, several, a few) should enhance the plural specification of a following plural marked noun. This issue was explored by examining the incidence of attraction errors following local nouns that were only marked as plural, or marked as plural plus plurally quantified. If there is a greater incidence of errors following plurally quantified local nouns than simple plural local nouns, quantifiers may be regarded as simply enhancing the number specification on their following nouns. However, if the incidence of attraction errors is the same then this would be consistent with the hypothesis that the singular is grammatically unmarked. This was explored in the third experiment.

The combination of a quantifier with an unmarked noun should create a noun phrase that is grammatically marked or specified for number. However, this does not necessarily mean that an unmarked noun, itself, becomes grammatically specified as singular. To examine whether a noun may on its own carry explicit specification of singular number, the fourth experiment exploited the grammatical distinction between mass and count nouns.

Although count nouns tend to denote objects (e.g., cat, flower, book) and mass nouns tend to denote substances (e.g., gold, water, mud) the determination of whether a noun is mass or count depends not on the properties of its denotation, but rather on whether the grammar allows it to be individuated (Quirk, Greenbaum, Leech, and Svartvik, 1985; Gordon, 1975). Only count nouns have the ability to be individuated by combining with distributive quantifiers such as every and each (e.g., every cat, each flower versus *every mud, *each water). Additionally, count nouns, as the term implies, have the ability to be counted by combining with cardinal quantifiers (e.g., one dog, two boys versus *one gold, *two mud). Consistent with their ability to be individuated and counted, only count nouns may be grammatically marked as plural (e.g., cars, dogs versus *muds, *waters). Although some mass nouns may become reclassified as count nouns (Quirk, Greenbaum, Leech, and Svartvik, 1985) when there is a semantic shift that results in a "kind of" denotation (e.g., the waters of the great lakes), the majority of mass nouns cannot become plurally inflected. Furthermore, only mass nouns may combine with non-individuating quantifiers such as much and little (e.g., much water, little mud versus *much cat, *little book, where little is used as a determiner and not an adjective).

The claim that the distinction between mass and count nouns is a grammatical distinction is supported by the existence of mass nouns whose denotation should allow them to become individuated, but they do not. For example, the mass nouns furniture, silverware, and traffic denote groups of objects, yet they cannot grammatically combine with individuating quantifiers (*each furniture, *every traffic), nor can they become grammatically marked as plural (*furnitures, *silverwares). In addition, the assignment of abstract nouns as mass or count (e.g., advice/*advices,

example/examples, etc.) appears to be based purely on their grammatical roles since their denotation is irrelevant (Gordon, 1985).

Gordon (1985) provided developmental evidence that also supports this grammatical distinction. The results of his study suggest that although children from the ages two to five show that they know there is a correlation between the semantic distinction of mass and count nouns (i.e. substance versus object, respectively), they nonetheless rely on the grammatical distribution in their assignment of nouns to these categories.

As a grammatical category that obligatorily requires singular agreement, mass nouns may contain grammatical specification that is equivalent to an underlying marked specification of grammatical number as singular. This marked singular specification may be manifested in a reduced incidence of attraction errors when a mass noun is the subject noun of a subject phrase that contains a plural local noun. The fourth experiment was designed according to this prediction.

CHAPTER II

Experiment 1

The first experiment was designed to examine whether the grammatical specification of singular number on the subject noun reduces the occurrence of errors of attraction. To do this, the quantifiers every, each, and one were compared with the determiner the. Since the quantifiers combine only with singular nouns, it may be assumed that they specify singular number (e.g., Pollard and Sag, 1991) so that the resulting noun phrase becomes specified as singular. In contrast, because the determiner the can grammatically combine with either a singular or plural noun, it cannot specify number information. Thus, the number of a singular noun phrase containing the may remain unspecified.

A finding of fewer errors of attraction following preambles that contain subject noun phrases quantified by every, each, or one, would support the hypothesis that number is grammatically unspecified for the singular form of count nouns. It would also argue that this unspecification is a contributing factor to errors of attraction.

Although the quantifiers each and every obligatorily require grammatically singular agreement, there appears to be a conflict in their notional number. When each and every combine with a noun, a notion of plurality results from the presupposition that there is more than one entity in the resulting noun phrase's referent set. However, despite the plurality in the referent set, both quantifiers focus the interpretation on the individuals or units that constitute the referent set (e.g., Croft, 1991). In particular, they force an interpretation in which each member of the referent set acted

independently of the other members. This focus on the individuals in the set by the quantifiers may be contrasted with the group focus that arises from a plural noun phrase as illustrated in the sentences below (cited by Roberts, 1987).

- 1.) The women brought a salad to the potluck.
- 2.) Each/Every woman brought a salad to the potluck.

The plural noun phrase "the women" focuses the interpretation of (1) on the group of women who, together, brought a single salad. This group interpretation is not possible with either version of the quantified noun phrases in the second sentence. The quantified noun phrases focus the interpretation of the sentence on the individual members who independently brought separate salads. The individualistic interpretation may be reflected in the grammatically singular specification of these quantifiers.

The quantifier one, unlike each and every, does not have conflicting notional number. It is both grammatically and notionally singular. The previous investigations of Bock and Miller (1991) and Bock and Eberhard (1993) did not find an influence of notional number in errors of attraction. However, a comparison of the agreement for the two quantifiers each and every with the agreement for the quantifier one will illuminate the possible effects the referent meanings may have on the agreement process.

Participants.

Thirty-two native English speaking participants were recruited from Michigan State University introductory psychology classes for this experiment. They were given extra credit or credit that counted toward a course requirement in return for their participation.

Materials.

Thirty-six sets of experimental preambles were constructed. Each of the 36 preamble sets contained four preambles, one in each of four conditions represented in Table 2. The complete list of preambles is in Appendix A.

Table 2. Examples of Sentence Preambles in the four conditions of Experiment 1.

Local Noun Phrase Number	Sentence Preamble
	<u>"the" Subject Noun Phrase</u>
Singular (Match Condition)	The slogan on the poster
Plural (Mismatch Condition)	The slogan on the posters
	<u>Quantified "each, every, or one"</u>
	<u>Subject Noun Phrase</u>
Singular (Match condition)	Every slogan on the poster
Plural (Mismatch Condition)	Every slogan on the posters

Each preamble consisted of a complex subject phrase in which the subject noun phrase was followed by a prepositional phrase. The noun phrase that terminated the prepositional phrase is called the local noun phrase. Each member of a set of preambles was identical except for the determiner that preceded the subject noun (quantifier or the) and the number of the local noun phrase (singular or plural). The three quantifiers were each, every and one. There were twelve sets of preambles for each of the three quantifiers. Each of them appeared in one third of the preambles.

Within a preamble set, two of the four preambles represented a mismatch condition. Both mismatch preambles contained a singular subject noun phrase that was followed by a plural local noun phrase. However, the mismatch preambles differed in

whether the singular subject noun phrase had a quantifier or the determiner the. The other two preambles represented the control conditions and contained singular subject and local noun phrases. Because the control preambles required the same correct verb form as the mismatch preambles but cannot create attraction errors, they reveal errors attributable to other problems in creating appropriate verb forms, such as bound morpheme loss errors and verb form variations attributable to dialect differences.

In addition to the experimental preambles, 64 filler items that consisted of simple noun phrases were created. Half of the filler items consisted of a determiner-adjective-noun sequence; the other half consisted of a determiner-noun sequence. Since all 36 experimental items contained a singular subject noun phrase, 14 of the filler items were singular and 50 were plural. This created an equal number of items on each list that were singular and plural.

In order to make the filler items comparable to the experimental items, half of the filler items contained quantifiers and half contained the determiner the. Seven of the singular filler items contained the and seven contained a quantifier (three each, two every and two one). Twenty-five of the plural filler items contained the and twenty-five contained a quantifier (nine many, eight some, and eight several).

Four lists were constructed with each list containing all the filler items and one preamble from each of the 36 experimental condition sets. Each list contained an equal number of preambles that represented each of the four conditions and an equal number of items that represented the three quantifier types (one, every, each) within the two quantifier conditions. The order of the fillers and experimental items was random except for a restriction that two experimental items could not occur consecutively. The order of the filler items and the items representing a particular experimental set were identical across the four lists.

Eight filler items began each list. Four of these items were plural and four were singular. Two of the singular items contained the and two contained a quantifier (one and every). Two of the plural filler items contained the and two contained a quantifier (many and some).

All of the items were digitally recorded by the author at a sampling rate of 20kHz. The items were edited with sound editing software (MacSpeech Lab II, GW Instruments). The items were edited using the visual display of the waveform accompanied by the audio playback. The editing removed long silent intervals in order to create a moderately fast rate of speech that is natural and perceptible. The items were then reconverted to analog form and recorded onto cassette tape in the order that they appeared on each list.

Procedure.

Participants were run individually. They were informed that they would hear phrases which were to be used as the beginnings of sentences. They were asked to repeat each phrase and to quickly continue aloud with a sentence conclusion. No other instructions about the forms of their completions were given.

The experimenter played each phrase from a cassette recorder. She paused the tape following each phrase to cue the participant for a completion. If the participant did not apprehend the phrase, the experimenter repeated it aloud. The experimenter also encouraged the participants to speak more quickly if their speech rate slowed during the experimental session. The sessions were recorded on audio tape. They lasted about 15 minutes.

Scoring.

The responses for the experimental preambles were transcribed from audio tape. Each response was assigned to one of four categories. A correct score was given to responses that contained an exact repetition of the preamble that was immediately followed by a number-inflected verb that was correct with respect to the number of the subject noun phrase. An error score was given to responses that met the criteria for the correct score, except that the number of the inflected verb was incorrect with respect to the number of the subject noun phrase. Responses that contained an exact repetition of the preamble that was immediately followed by a verb uninflected for number were assigned to an "ambiguous" category because of the undiagnosability of the number of the verb form. These responses included the past tense of verbs and modals such as should, could, would, etc.. All responses that did not meet the criteria for the above three categories were scored as miscellaneous. The majority of the responses in this category were preamble repetition failures.

Analysis.

An analysis of variance for each of the score categories was performed first with participants as a random factor and then with items as a random factor. Each analysis contained the within-participant variables of subject noun phrase type (quantified or non-quantified) and local noun number (singular or plural). An effect was considered significant if it was reliable at or beyond the .05 level. The test statistics for participants and items are designated F_1 and F_2 , respectively.

Results.

Application of the scoring criteria yielded a total of 696 correct scores (60% of all the responses), 123 agreement errors (11%), 232 ambiguous scores (20%), and

101 miscellaneous response scores (9%). Table 3 gives the number of responses in each scoring category for each of the four conditions.

Table 3. Numbers of responses in each scoring category in Experiment 1.

Local Noun Phrase Number	Response Type			
	Correct	Error	Ambiguous	Miscellaneous
<u>Subject noun phrase with "the"</u>				
Singular (Match condition)	216	2	57	13
Plural(Mismatch condition)	121	65	54	48
<u>Subject noun phrase with quantifiers</u>				
<u>"each, every, or one"</u>				
Singular (Match condition)	209	9	63	7
Plural (Mismatch condition)	150	47	58	33

Agreement error proportions for each of the four conditions were calculated. A condition's error proportion is the number of errors divided by the total number of agreement-marked responses (i.e., number of agreement errors divided by number of agreement errors and correct agreement scores). Figure 1 shows a graph of the error proportions. To discount extraneous agreement errors, as assessed in the control (number match) conditions, the control proportions were subtracted from the mismatch proportions. The resulting net error proportion in the determiner the and the quantifier conditions are shown in Figure 1.

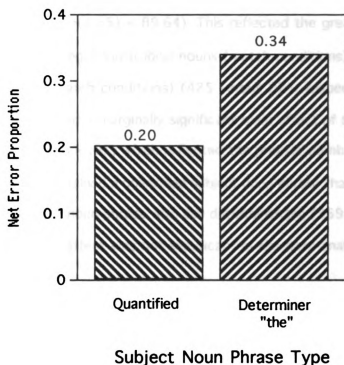


Figure 1. Net proportions of agreement errors in the determiner "the" and quantifier conditions in Experiment 1. The conditions each contained either a singular subject noun phrase that was marked with a singular quantifier (each, every, or one) or a singular subject noun phrase that was unmarked with the determiner "the".

As evident in Table 3, there were more errors and fewer correct scores in the mismatch conditions than in the match conditions, showing the usual attraction error effect. However, as shown in Figure 1, this effect was not the same for the quantified preambles as for the the preambles. Preambles with singular quantifiers in the subject noun phrase resulted in fewer errors than preambles with generic the in the subject noun phrase.

These effects on verb agreement of match versus mismatch (i.e., local noun number) and type of determiner in the subject noun phrase were confirmed statistically. An analysis of variance performed on the correct agreement responses

yielded a main effect of local noun number in both the participant and item analyses ($F_1(1,31) = 49.64$ and $F_2(1,35) = 89.64$). This reflected the greater number of correct responses following singular local nouns (match conditions) than following plural local nouns (mismatch conditions) (425 versus 271, respectively). The participant analysis yielded a marginally significant main effect of subject noun phrase type ($F_1(1,31) = 3.53$, $p = .07$) which reflected the greater number of correct scores in the conditions that contained a quantified subject noun phrase than in the conditions that contained a subject noun phrase with the determiner the (359 versus 337, respectively). This main effect was not significant in the item analysis ($F_2(1,35) = 2.19$).

Most importantly, there was a significant interaction between the factors of subject noun phrase type and local noun phrase number in both the participant and item analyses of the correct scores ($F_1(1,31) = 5.94$, $F_2(1,35) = 3.99$). The interaction resulted from the disparity in the number of correct scores in the two mismatch conditions. Planned comparisons showed that the greater number of correct agreement responses in the mismatch condition with quantified subject noun phrases (150) than in the mismatch condition with the determiner the (121) was reliable for both participants and items. The 95% confidence intervals for these comparisons were 21.34 and 26.06 for participants and items, respectively.

Relative to the correct agreement scores, the agreement errors were distributed in a similar but complementary fashion across the four conditions, and this was also confirmed statistically. There was a main effect of local noun phrase number ($F_1(1,31) = 38.87$ and $F_2(1,35) = 74.21$) which reflected the greater number of agreement errors in the plural local noun conditions than in the singular local noun conditions. The main effect of subject noun phrase type was not significant in either the participant or item analyses ($F_1(1,31) = 1.31$ and $F_2(1,35) = .97$). However, the

interaction between subject noun phrase type and local noun phrase number was significant ($F_1(1,31) = 6.77$ and $F_2(1,35) = 5.65$). The significant interaction was again a result of the disparity in the number of responses in the two mismatch conditions. The planned comparison between these two conditions showed that the smaller number of attraction errors following quantified mismatch preambles was reliable. The 95% confidence intervals for the comparisons were 13.88 for participants and 15.21 for items.

The distribution of ambiguous scores was fairly even across all four conditions and produced no significant main effects or interactions (all $F_s < 1$).

The analyses of the miscellaneous scores resulted in a significant main effect of local noun number in both the participant and item analyses ($F_1(1,31) = 6.00$ and $F_2(1,35) = 4.34$). There were more miscellaneous responses in the plural local noun (mismatch) preamble conditions than in the singular local noun (match) preamble conditions (81 versus 20, respectively). There was also a significant main effect of subject noun phrase type in both the participant and item analyses ($F_1(1,31) = 21.88$ and $F_2(1,35) = 28.23$). This effect reflected the greater number of miscellaneous responses for the the subject noun phrase preambles than for the quantified subject noun phrase preambles (61 versus 40, respectively). The interaction was not significant (both $F_s < 1.09$).

Appendix B contains examples of the miscellaneous responses as well as the various reasons for the assignment of the score. The most common reason (64 responses) was a repetition failure that changed the number of either the subject or local noun of the presented preamble.

The miscellaneous responses were also examined for verb agreement. Of the 101 responses, 95 contained complex subject phrases in which there was a subject noun phrase followed by a local noun phrase. These 95 responses were categorized as either

match subject phrases (the subject and local noun number was the same) or mismatch subject phrases (the subject and local noun number differed). All mismatch subject phrases had a singular subject noun that was followed by a plural local noun. Six responses were not assigned to either subject phrase category because of an addition of a plural morpheme on a singular quantified subject noun (e.g., Each orders for the cooks) which made the number of the subject noun phrase indeterminable. The remaining 89 responses were given a verb agreement score that was with respect to the number of the actually produced subject noun phrase. The results of this scoring are given in Table 4.

Table 4. Numbers of miscellaneous responses that had correct, error, or ambiguous verb agreement. The percentages are based on a total of 89 responses. The actual numbers of responses are given in parentheses.

<u>Agreement Type</u>		
<u>Correct</u>	<u>Error</u>	<u>Ambiguous</u>
<u>Match Subject Phrases</u>		
51% (45)	5% (4)	20% (18)
<u>Mismatch Subject Phrases</u>		
7% (6)	11% (10)	6% (6)

Table 4 shows that correct agreement was more likely following match than mismatch subject phrases, and incorrect agreement was more likely following mismatch than match subject phrases. This pattern is consistent with the pattern in the main experimental analysis. However, though not evident in Table 4, the verb agreement in the miscellaneous responses did differ in one important respect from that of the main experiment: Of the ten miscellaneous mismatch responses that resulted in an agreement error, six had subject noun phrases containing a singular quantifier (e.g., Each mistake

in the programs) and four had singular subject noun phrases containing the generic the (e.g., The advertisement in the magazines).

Although this pattern of agreement errors is opposite to that of the main experiment, it is not responsible for the main experiment's pattern. When these ten miscellaneous errors are added to the errors of the respective preamble conditions in the main experiment, the resulting net error proportions for the mismatch quantified condition and the mismatch the condition are .22 and .35, respectively. A comparison of these net proportions with those given in Figure 1 shows that the error pattern does not change.

Effects of Quantifier Type.

For the quantified subject noun preambles, the numbers of scores for each of the quantifiers (one, each, and every) in each of the score categories were calculated and are listed in Table 5.

Table 5. Numbers of responses in each scoring category for the three quantifier types in Experiment 1.

Subject Noun Phrase Quantifier Type	Response Type			
	Correct	Error	Ambiguous	Miscellaneous
<u>Singular Local Noun Phrase (Match Condition)</u>				
One	66	1	26	3
Each	73	4	17	2
Every	70	4	20	2
<u>Plural Local Noun Phrase (Mismatch Condition)</u>				
One	61	8	19	8
Each	45	16	23	12
Every	44	23	16	13

The numbers in the table show that when the subject noun phrases of mismatch preambles contained the quantifier one, there were more correct responses and fewer agreement errors than when the subject noun phrases contained either the quantifier each or every. The differential effects of quantifier type (each, every, or one) and local noun phrase number (match or mismatch) were examined in a 3X2 analysis of variance on the number of responses in each score category. A repeated measures analysis of variance was conducted with participants as a random factor, and a mixed analysis of variance was conducted with items as a random factor (quantifier type was a between-item factor).

The analysis of the correct responses yielded a significant main effect of local noun phrase number ($F_1(1,31) = 20.05$, $F_2(1,33) = 22.59$) which, consistent with

the overall experimental analysis, reflected the greater number of correct responses for match quantified preambles than for mismatch quantified preambles. The main effect of quantifier type was not significant (both $F_s < 1.00$); however, the interaction between quantifier type and local noun phrase number was significant in the participant analysis ($F_1(2,62) = 5.20$) and marginally significant in the item analysis ($F_2(2,33) = 3.16$, $p=.06$). Post hoc comparisons in the participant analysis showed that the number of correct responses following mismatch preambles with one (61) was reliably greater than the number following preambles with each (45) and every (44) (the 95% confidence interval was 14.04); however these differences were not significant in the item analysis (the 95% confidence interval was 18.46).

The analysis of the errors resulted in a significant main effect of local noun phrase number ($F_1(1,31) = 20.31$, $F_2(1,33) = 41.58$) as well as a significant main effect of quantifier type ($F_1(2,62) = 5.53$, $F_2(2,33) = 3.96$). As in the overall experimental analyses, the main effect of local noun phrase number reflected the greater number of errors following plural local nouns than following singular local nouns. The main effect of quantifier type reflected the difference in the total number of errors following the three quantifier types: There were only nine attraction errors following preambles containing one whereas there were 20 following preambles containing each and 27 following preambles containing every. Post hoc comparisons showed that only the difference between the number of errors following preambles with one and preambles with every was significant (the 95% confidence interval was 13.73 for participants and 16.64 for items). There was also a significant interaction in the participant analysis ($F_1(2,62) = 3.57$) which was marginally significant in the item analysis ($F_2(2,33) = 3.14$, $p=.06$). The 95% confidence intervals for the post hoc comparisons between the three mismatch preambles were 8.01 and 9.81 for participants and items, respectively. Thus, the difference in the number of errors

following mismatch preambles with one (8) and mismatch preambles with every (23) was reliable. However, the difference between preambles with one and those with each (16) just missed reliability, and the difference between mismatch preambles with each and those with every was not reliable.

The numbers of scores in the ambiguous category were fairly evenly distributed across the three quantifier types, and the analysis confirmed this as there were no significant effects (all $F_s < 1.62$).

The analysis of the miscellaneous response category resulted in only a significant effect of local noun number ($F_1(1,31) = 22.68$, $F_2(1,33) = 14.93$). Consistent with the overall experimental analysis, there were more miscellaneous responses for quantified preambles with plural local nouns (33) than for quantified preambles with singular local nouns (7). Neither the main effect of quantifier type nor the interaction was significant (all $F_s < 1.00$).

Discussion.

The results of Experiment 1 revealed a large number of attraction errors for singular subject phrases that had plural local nouns. The most important finding was that when the subject noun phrase was marked as singular by a quantifier such as every, each or one, a following plural-marked local noun was significantly less likely to disrupt the implementation of correct singular verb agreement. Thus the results are consistent with the hypothesis that number is grammatically unspecified for the singular form of count nouns and that this is a contributing factor in errors of attraction.

A post hoc examination of the differences among the quantifiers each, every, and one suggested that the quantifier one may be more effective at marking singular number than the other two. Specifically, there were fewer agreement errors following

preambles with the quantifier one than following preambles with either every or each. Furthermore mismatch preambles that contained one in the subject noun phrase had not only fewer attraction errors than those that contained every or each, but they also had a greater number of correct agreement responses. However, because different preambles were associated with the different quantifiers in this experiment the differences in agreement patterns cannot be confidently attributed to just the properties of the quantifiers.

Nevertheless, the indication of a decrease in the effectiveness of singular marking by every and each relative to that of one may be due to the resulting notion of plurality; i.e., every/each postcard presupposes more than one postcard in the referent set. Despite the grammatical specification of singular number, this notional plurality may occasionally cause the use of plural agreement for these quantifiers. Alternatively the decrease in effectiveness of every and each to mark singular number may be due to the greater semantic complexity that results when they combine with a noun which in turn may cause verb agreement to be less reliable for these quantifiers.

So, to examine whether singular agreement is the accepted and consistent pattern for all three quantifiers a written validation test was administered. The test contained all the subject nouns that were employed in Experiment 1. They were presented as simple noun phrases (i.e., ones without postmodifying phrases) which were either preceded by their assigned quantifier or by the generic the. Two test lists were constructed. Each list contained all the nouns with half combined with a quantifier and the other half combined with the determiner the. A noun that was combined with a quantifier on one test list was combined with the determiner the on the other. The construction of the lists was the same as in the main experiment.

Sixteen participants were recruited from the same pool as the main experiments. None of them participated in any of the other experiments that are reported. They were instructed to write a sentence completion for each noun phrase. The written responses were then scored according to whether an agreeing verb that was inflected for number was singular or plural.

A total of 72 singular quantified noun phrases was presented in the validation test (36 noun phrases were the subject noun phrases of Experiment 1, and 36 were the local noun phrases of Experiment 2, to be discussed further below). All 366 number-inflected verbs that were produced to complete the singular quantified noun phrases were singular (64% of all the completions for the singular quantified phrases). All of the 404 number-inflected verbs that were produced to complete the corresponding singular generic the noun phrases were also singular (70% of all the completions for the singular generic noun phrases). Thus, although simple quantified noun phrases such as every slogan or each picture presuppose more than one slogan and picture in the referent set, they nevertheless elicited complete singular verb agreement in the validation tests. These results provide evidence that the accepted pattern of verb agreement for each, every, and one is singular.

CHAPTER III

Experiment 2

The results of Experiment 1 provided evidence that noun phrases containing one of the quantifiers each, every, or one may be specified as singular versus those that contain the determiner the. Experiment 2 examined the same question from a different perspective: If a quantified singular noun phrase is in a local position following a plural subject noun phrase, then the opposing number specification may interfere with the use of a correct plural verb form. This would yield an increase in singular attraction errors. The results of Experiment 1 also suggested that the quantifier one may be more effective at marking or specifying singular number than each or every. If this is the case, then the incidence of singular attraction errors should be the greatest following preambles that contain one.

Participants.

Eighty-seven native English speaking participants were recruited from the introductory psychology classes at Michigan State University. They were given extra credit or credit that counted toward a course requirement in return for their participation. None had participated in the first experiment.

Materials.

The experimental preambles were modified from the preambles that were employed in Experiment 1. Each member of a set of preambles was identical except for

the determiner preceding the local noun (quantifier or the) and the number of the local noun (singular or plural). The subject noun was always plural. Table 6 provides examples for each of the three conditions. The complete list of preambles is in Appendix A

Table 6. Examples of sentence preambles in Experiment 2.

Local Noun Phrase Condition	Sentence Preamble
Control Plural (Match)	The slogans on the posters
"the" Singular (Mismatch)	The slogans on the poster
Quantified Singular (Mismatch)	The slogans on every poster

The three items in each of the 36 sets represented the two experimental conditions and the control condition. The two experimental conditions were mismatch conditions that contained a plural subject noun that was followed by a singular local noun. The mismatch conditions differed in whether the singular local noun was combined with a quantifier or the determiner the . The control condition was designed to assess the incidence of non-attraction errors on plural verbs, and so contained both a plural subject and a plural local noun.

Since each set of the preambles for this experiment was derived from a set employed in Experiment 1, if a set in Experiment 1 contained the quantifier one in the subject noun phrase, then the corresponding set for this experiment contained one in the local noun phrase. This maintained an equal number of sets (i.e., 12) that represented each of the three quantifiers (every, each, and one) in the local noun phrase.

The 64 filler items from Experiment 1 were also employed in this experiment. However, because all of the experimental items in this experiment contained a plural subject noun phrase, the fillers were adjusted so that 14 were plural and 50 were singular; otherwise they were the same as Experiment 1.

Three lists were constructed in the manner described in Experiment 1. The procedure and scoring were also the same as in Experiment 1.

Analysis.

A one-way analysis of variance was performed on the data for each of the four scoring categories. The single factor in the analysis was the type of number specification of the local noun phrase and had three levels (i.e., preceded by a quantifier, by the determiner the, or marked as plural by a plural inflection). Planned comparisons were used to evaluate the difference between the two mismatch conditions and between each mismatch condition and the control condition.

Results.

Application of the scoring criteria yielded 2,333 correct agreement responses (74% of all the responses), 40 agreement errors (1%), 481 ambiguous responses (15%), and 278 miscellaneous responses (9%).

The number of scores in each of the four scoring categories for the three conditions are in Table 7.

Table 7. Numbers of responses in each scoring category in Experiment 2.

Local Noun Phrase Condition	Response Type			
	Correct	Error	Ambiguous	Miscellaneous
Control Plural (Match)	760	6	151	127
Generic "the" (Mismatch)	811	11	134	88
Quantified Singular (Mismatch)	762	23	196	63

The table shows that there were fewer correct agreement responses and more singular attraction errors when a singular local noun phrase contained a singular quantifier than when it contained the generic the . This difference is clearly evident in the error proportions of the two mismatch conditions which, along with the error proportion for the match condition, are shown in Figure 2 .

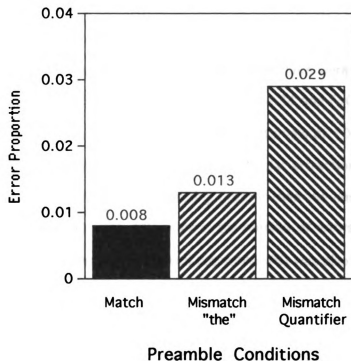


Figure 2. Proportions of agreement errors for the match (plural local noun) and mismatch (singular local noun) conditions. The match and mismatch conditions all contained a plural subject noun. The mismatch conditions either contained a singular quantified local noun or a singular unmarked noun preceded by the determiner 'the'.

The one-way analysis of variance of the correct scores was significant for both participants and items ($F_1(2,172) = 3.86$, $F_2(2,70) = 3.41$). Planned pairwise comparisons were conducted on the three condition means in both participant and the item analyses in order to determine which of the differences were significant. The 95% confidence intervals for each comparison was 36.52 in the participant analysis and 39.33 in the item analysis. Thus, the comparisons showed that the large number of correct responses in the mismatch determiner the condition (811) differed significantly from both the number in the match condition (760) and the number in the mismatch quantifier condition (762). The difference between the number of correct

responses in the mismatch quantifier condition and the match control condition was not reliable.

The analysis of the error scores also showed that there were significant differences among the three conditions ($F_1(2,172) = 4.24$ and $F_2(2,70) = 5.10$). Planned pairwise comparisons with 95% confidence intervals of 10.54 for participants and 9.73 for items confirmed that the number of singular attraction errors following quantified local noun phrases (23) was reliably greater than the number following the the local noun phrases (11). The difference in the number of errors following the quantified preambles and the match control preambles (6) was also reliable, but the difference in the number of errors following the control match and mismatch the preambles was not.

The one-way analysis of variance of the ambiguous scores was also significant ($F_1(2,172) = 8.88$, and $F_2(2,70) = 6.08$). Unplanned comparisons in the participant analysis showed that the number of ambiguous responses in the mismatch quantified condition (196) was significantly greater than the number in the match condition (151). The 95% confidence interval for each of the participant comparisons was 37.76. The difference between these two conditions was marginally reliable in the item analysis which had a greater confidence interval of 46.19. The large number of ambiguous responses in the quantified mismatch condition was also reliably greater than the number in the mismatch the condition (134) in both analyses, and the number of ambiguous responses in the mismatch the condition and the match condition did not differ significantly from each other.

There were also significant differences in the number of miscellaneous responses for the three conditions ($F_1(2,86) = 12.19$, $F_2(2,70) = 9.75$). Post hoc comparisons with 95% confidence intervals of 32.46 for participants and 36.72 for items revealed that the number in the match control condition (127) was significantly greater than

both the number in the mismatch the condition (88) and the number in the mismatch quantifier condition (63). The difference between the two mismatch conditions was not reliable in either the participant or item analysis.

Appendix B contains examples of the miscellaneous responses as well as the number of responses that occurred for the reasons for the assignment of this score. The majority of the miscellaneous scores (223) were due to preamble repetition failures. As in the first experiment, the most common failure was a change in the number of either the subject or local nouns of the presented preambles (151 miscellaneous responses). The most frequent direction of the change (118) was from plural to singular. This direction may be due to a greater difficulty in the perception of the plural morphemes in the presented preambles and/or to a greater difficulty in the production of them during the repetition (resulting in a bound morpheme loss error). Since the match preamble condition had two plural nouns that could experience these difficulties, it is not surprising that this condition had more repetition failures than either of the mismatch conditions. Seventy-one of the 127 miscellaneous match condition responses were due to a number change in the repetition compared to 24 of the 88 mismatch the responses and 11 of the 63 quantified mismatch responses. Thus, this particular repetition failure not only caused the large number of miscellaneous responses in the match condition, but it also appears to be the reason for this condition's low number of correct agreement responses.

As in Experiment 1, verb agreement in the miscellaneous responses was examined. Of the 278 miscellaneous responses, 256 contained complex subject phrases. Ninety-six of these had a match in number between the subject and local nouns (either both singular or both plural), and 160 had a mismatch in number (either singular subject-plural local noun or plural subject-singular local noun). The verbs following these subject phrases were assigned an agreement score (correct, error, or ambiguous)

with respect to the number of the actually produced subject noun phrase. The results of this scoring are given in Table 8.

Table 8. Number of miscellaneous responses in each agreement score category. The total percentages are given in parentheses and are based on all 256 responses.

	Agreement Type		
	Correct	Error	Ambiguous
<u>Subject & Local</u>			
<u>Noun Number</u>			
	<u>Match subject phrases</u>		
	"the" Local Noun		
Plural Subject & Local	46		10
Singular Subject & Local	5	14	5
	Quantified Local Noun		
Singular Subject & Local	6	9	1
TOTAL	57 (22%)	23 (9%)	16 (6%)
	<u>Mismatch subject phrases</u>		
	"the" Local Noun		
Plural Subject/Singular Local	82	3	25
Singular Subject/Plural Local	1	10	4
	Quantified Local Noun		
Plural Subject/Singular Local	27		8
TOTAL	110 (43%)	13 (5%)	37 (15%)

The numbers in Table 8 show the opposite pattern of agreement from that of the main experiment: There were fewer errors and more correct responses following mismatch subject phrases than following match subject phrases. Beginning with the opposite error pattern, all 23 of the match errors resulted in a plural-marked verb

that was preceded by a subject phrase in the repetition that contained a singular subject noun. Likewise, ten of the mismatch errors resulted in a plural-marked verb that was preceded by a singular subject. Since all of the presented experimental preambles contained a plural subject noun, these verbs correctly agreed with the presented preambles. It is impossible to determine whether the produced singular subject nouns were misperceptions of the presented plural subject nouns, and therefore were intended, or were production errors. If some of these repetitions contain production errors that resulted in the loss of the plural morpheme on the subject nouns, then the plural verbs would be in agreement with intended plural subject nouns. Thus, the opposite pattern of errors in the miscellaneous responses may reflect processing failures that differ from those underlying the error pattern in the main experiment.

The three errors that followed the mismatch subject phrases containing a plural subject and singular local noun appear to be genuine agreement errors. The question is whether they are attraction errors. Since the actually presented preambles for these three repetition responses were from the match condition, the repetition responses changed the presented local noun from plural to singular. As in the previous discussion, it is impossible to determine whether the produced singular noun was a perception or production error. If the singular local noun in any of these three responses was intended (e.g., as a result of a perception error), then a singular attraction error occurred. If, however, a plural local noun was intended, but a singular local noun was erroneously produced, then an agreement error that is not an error of attraction occurred. Despite the indeterminate reason for the repetition failure, adding these three agreement errors to the number in either the match or mismatch the conditions of the main experiment does not change the overall pattern: The quantified mismatch condition still has the greatest number of agreement errors.

The greater incidence of correct agreement among the mismatch subject phrases than the match subject phrases appears to also be a consequence of the large number of repetition failures in the match condition that changed one of the nouns in the presented preamble from plural to singular. Fifty-seven of the 82 plural subject-singular local noun subject phrases that had correct agreement scores were repetition failures of presented match preambles. If some number of these failures are production errors then the intended preamble would have been a match preamble. Thus, as in the case of the error pattern, the pattern of correct agreement among the miscellaneous responses may also reflect processing failures that are not evident in the main experiment results.

Quantifier type examination.

The numbers of scores in each score category for the three quantifier types (one, each, and every) employed in the mismatch quantifier condition are given in Table 9.

Table 9. Number of responses in each scoring category for the three quantifier types in Experiment 2.

Local Noun Phrase Quantifier Type	Response Type			
	Correct	Error	Ambiguous	Miscellaneous
One	234	13	77	24
Each	261	3	67	17
Every	267	7	52	22

When the quantifier one was in the local noun phrase, there were fewer correct agreement responses and more agreement errors relative to when the quantifiers each

and every were in the local noun phrase. A one-way analysis of variance was conducted on each of the four response score categories with quantifier type as a single factor. The factor of quantifier type was a within-participants factor and a between-items factor in the respective analyses.

The analysis of the correct scores was significant for participants ($F_1(2,172) = 3.91$) but not for items ($F_2(2,33) = 1.64$, $p > .05$). Post hoc comparisons in the participant analysis showed that only the difference between the number of correct agreement responses for preambles with one (234) and every (267) was reliable (the 95% confidence interval was 31.23). The one-way analysis of variance of the error scores was also significant in both the participant and item analyses ($F_1(2,172) = 3.73$, $F_2(2,33) = 3.47$). Post hoc comparisons in the participant analysis, with a 95% confidence interval of 9.14, revealed that only the difference between the 13 attraction errors following preambles with one and the three attraction errors following preambles with each was significant. None of the post hoc comparisons in the item analysis were reliable as the conservative 95% confidence interval was much greater at 17.08.

The differences among the numbers of ambiguous scores for the three quantifiers was only marginally significant in the analysis with participants random ($F_1(2,172) = 2.59$, $p = .08$), but not significant with items random ($F_2 < 1$). The analysis of the miscellaneous scores was not significant in either the participant or item analyses (both $F_s < 1$).

Discussion.

The error results of Experiment 2 demonstrated that a singular local noun phrase that is grammatically marked as singular by a quantifier is significantly more

likely to elicit an error of attraction than a singular unmarked local noun phrase. This offers additional support for the claim that singular count nouns are grammatically unspecified for number. When they combine with a singular quantifier such as each, every, or one the resulting noun phrase becomes grammatically marked or specified as singular. When this grammatically specified noun phrase is a local noun phrase in a sentence preamble which contains a plural subject noun phrase, the singular specification of the local noun may interfere with the correct implementation of plural verb-agreement.

An examination of the differences between the three quantifier types in their ability to attract an agreement error offered some indication that the quantifier one may be more attractive than the quantifiers each and every. The preambles that contained a local noun quantified by one had the fewest number of correct agreement responses and the greatest number of attraction errors. These findings are consistent with those of Experiment 1 which showed that the quantifier one was somewhat more effective than the other two in reducing attraction errors when it was in the subject noun phrase. However, as in the first experiment, because different preambles were associated with the different quantifiers caution must be observed in drawing conclusions based on these results. The results will nonetheless be considered further in the General Discussion.

CHAPTER IV

Experiment 3

The results of the first two experiments support the proposal that a singular quantifier specifies an otherwise unmarked noun phrase as singular. However, there is another plausible interpretation of the results: The singular quantifier may merely enhance or strengthen a weak singular specification on an unmarked count noun. If the effect of a quantifier is to enhance the number specification of a following noun then a plural quantifier (e.g., many, several, a few) should enhance the plural specification of a following plural marked noun. This proposal predicts that attraction errors should be more frequent following mismatch preambles that contain both a plural local noun and a plural quantifier than following mismatch preambles that contain only a plural local noun and the determiner the.

Participants.

Twenty-four participants were recruited for this experiment from the same source as in the previous two experiments.

Materials.

The 36 sets of preambles employed in the first two experiments were employed in this experiment. Each of the 36 sets contained three preambles to represent three conditions. The three conditions are shown in Table 10.

Table 10. Examples of sentence preambles in Experiment 3.

Local Noun Phrase Condition	Sentence Preamble
Singular Control (Match)	The slogan on the poster
Generic "the" Plural (Mismatch)	The slogan on the posters
Quantified Plural (Mismatch)	The slogan on several posters

The three items in each of the 36 sets represented the two experimental conditions and the control condition. The two experimental conditions were mismatch conditions that contained preambles with singular subjects that were followed by plural local nouns. The mismatch conditions differed in whether the plural local noun had a quantifier or the determiner the. The control preambles contained singular subject and local nouns.

The plural quantifiers that were employed in this experiment were many, several and a few, which may only occur with plural count nouns (Quirk, Greenbaum, Leech, & Svartvik, 1985). As in the previous experiments, each set of preambles contained only one of these quantifiers in the mismatch quantifier condition. The number of sets that employed each of these three types of quantifiers was equal.

The fillers were designed as in the previous experiments, and the list construction also followed the methods described earlier.

Analysis.

A one-way analysis of variance was performed on the data for each of the four scoring categories. The single factor in this analysis was the type of number specification of the local noun phrase. It had three levels, unmarked singular, plural

marked, and plural marked plus plural quantified. Planned comparisons were used to evaluate the differences between the two mismatch conditions and between each mismatch condition and the control condition.

Results.

The number of scores for each condition in each scoring category are presented in Table 11. Figure 3 contains the net error proportions for the two mismatch conditions.

Table 11. Numbers of responses in each scoring category in Experiment 3.

Local Noun Phrase Condition	Response Type			
	Correct	Error	Ambiguous	Miscellaneous
Singular Control (Match)	214	1	67	6
"the" Plural (Mismatch)	123	67	67	31
Quantifier Plural (Mismatch)	152	57	54	25

There was a total of 489 correct agreement responses (57% of all responses), 125 agreement errors (14%), 188 ambiguous responses (22%) and 62 miscellaneous responses (7%).

Table 11 shows that there were more correct responses and fewer errors following match preambles than following mismatch preambles. Furthermore, the

error proportions in Figure 3 show that within the two mismatch conditions, local noun phrases containing quantifiers did not attract more agreement errors than local noun phrases containing the.

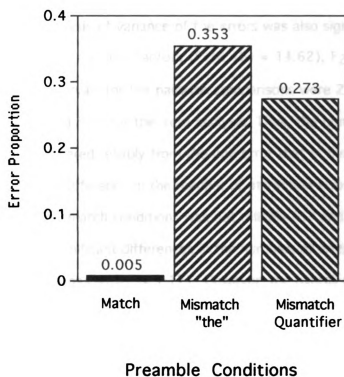


Figure 3. Proportions of agreement errors for the match (singular local noun) and mismatch (plural local noun) conditions. The match and mismatch conditions all contained unmarked singular subject nouns. The mismatch conditions contained a local noun that was plural and was either preceded by a plural quantifier or by the determiner 'the'.

The one-way analysis of variance of the correct scores confirmed that there were significant differences among the conditions ($F_1(2,46) = 25.79$, $F_2(2,70) = 25.74$). Planned pairwise comparisons were conducted with 95% confidence intervals of 23.29 and 23.03 in the participant and item analyses, respectively. The comparisons showed that the large number of correct responses in the match condition (214) reliably

differed from the number in both the mismatch the condition (123) and the number in the mismatch quantifier condition (152). Furthermore, there were significantly more correct responses in the mismatch quantified condition than in the mismatch the condition.

The one-way analysis of variance of the errors was also significant with both participants and items as random factors ($F_1(2,46) = 14.62$, $F_2(2,70) = 24.84$). The 95% confidence intervals for the pairwise comparisons were 23.67 for the participant analysis and 17.95 for the item analysis. Thus, the number of errors in the mismatch conditions differed reliably from the one error that in the match control condition; however, the difference in the number of attraction errors in the quantified and the unquantified mismatch conditions was not reliable (57 and 67, respectively).

There were no significant differences in the numbers of ambiguous responses across the three conditions (both $F_s < 1.17$). However, the overall analysis of the miscellaneous responses revealed that there were significant differences ($F_1(2,46) = 10.05$, $F_2(2,70) = 6.07$). Post hoc comparisons with 95% confidence intervals of 14.81 and 18.82 for participants and items, respectively, revealed that the number of miscellaneous responses in the match control condition (6) differed reliably from the number in the mismatch quantified condition (25). The match control condition also differed reliably from the mismatch the condition (31). However, the difference between the two mismatch conditions was not reliable.

As in the previous two experiments, examples of miscellaneous responses are given in Appendix B. Again, the most frequent reason (31) for the assignment of a miscellaneous score was due to a change in the number of either the subject or local noun of the presented preamble.

Verb-agreement in the miscellaneous responses of this experiment was also examined. Fifty-four of the 62 responses contained complex subject phrases that had

either a match or mismatch in number between the subject and local nouns. The verb-agreement in these 54 responses was scored with respect to the number of the actually produced subject noun phrase, and the results of this scoring are given in Table 12.

Table 12. The number of miscellaneous responses in each agreement score category. The percentages given in parentheses are based on a total of 54 responses.

	Agreement Type		
	Correct	Error	Ambiguous
<u>Subject & Local</u>	<u>Match subject phrases</u>		
<u>Noun Number</u>			
	<u>"the" Local Noun</u>		
Plural Subject & Local	4	1	2
Singular Subject & Local	14		5
	<u>Quantified Local Noun</u>		
Plural Subject & Local	3	1	2
TOTAL	21 (39%)	2 (4%)	9 (17%)
	<u>Mismatch subject phrases</u>		
	<u>"the" Local Noun</u>		
Plural Subject/Singular Local	1	1	
Singular Subject/Plural Local	3		3
	<u>Quantified Local Noun</u>		
Singular Subject/Plural Local	8	2	4
TOTAL	12 (22%)	3 (5%)	7 (13%)

Table 12 shows that there were more correct agreement responses and fewer agreement errors in the miscellaneous responses containing match subject phrases than in the responses containing mismatch subject phrases. Thus, the agreement pattern in the miscellaneous responses was consistent with the pattern in the main experiment.

Quantifier examination.

Table 13 gives the numbers of scores for each response type for each of the three quantifiers that were employed in the mismatch quantifier condition.

Table 13. Number of responses in each scoring category for the three quantifiers in Experiment 3.

Local Noun Phrase Quantifier Type	Response Type			
	Correct	Error	Ambiguous	Miscellaneous
A few	44	21	25	6
Many	55	21	12	8
Several	53	15	17	11

A one-way analysis of variance was conducted on the scores in each of the response categories with the single factor of quantifier type. The fairly even distribution of scores across the three quantifiers in each response category was confirmed statistically. Only the analysis of the ambiguous scores showed that there was a difference. The analysis of the ambiguous scores was significant with participants as a random factor ($F_1(2,26) = 3.12$) but not with items as a random factor ($F_2(2,33) = 1.48$). Post hoc comparisons in the participant analysis with a conservative 95%

confidence interval of 13.36 revealed that only the greater number of ambiguous responses in the condition with a few (25) than in the condition with many (12) was marginally reliable. The analyses of the other three score categories yielded $F_s < 1.77$.

Discussion.

The results of Experiment 3 offered additional support for the interpretation of the findings in the first two experiments. In particular, the results of Experiments 1 and 2 suggest that the singular form of count nouns is grammatically unmarked or unspecified for number. When an unmarked count noun combines with a singular quantifier the resulting noun phrase becomes grammatically specified as singular. The results of Experiment 3 suggest that the quantifier effect is not one of enhancing the specification of a following noun, but rather one of actual specification. If the effect were mere enhancement one would have expected an increase in the number of attraction errors following mismatch preambles that contained both a plural quantifier and a plural local noun relative to mismatch preambles that contained a plural local noun with the determiner the. However, the error results showed that mismatch quantified preambles did not increase the likelihood of attraction errors.

Although the evidence of the first three experiments suggests that the combination of a quantifier with an unmarked noun creates a noun phrase that is grammatically marked or specified for number, it does not mean that the noun itself becomes grammatically specified. It was proposed in the Introduction that the two noun classes that are referred to as mass and count may provide a test of whether a singular noun, itself, may carry explicit singular number specification.

CHAPTER V

Experiment 4

Experiment 4 examined whether mass nouns contain an underlying marked specification of singular number by examining their ability to prevent errors of attraction when they are the subject noun of a subject phrase that contains a plural local noun. A reduction in the incidence of errors for subject phrases that contain mass nouns relative to those that contain count nouns would support the claim that singular count nouns contain an unmarked number specification.

Participants.

Fifty-two participants were recruited in the same manner as described in the previous three experiments.

Materials.

Twenty sets of experimental preambles each containing four preambles were constructed to represent the four conditions. The conditions and examples of the preambles are shown in Table 14.

Table 14. Examples of sentence preambles in Experiment 4.

Local Noun Phrase Number	Sentence Preamble
<u>Singular Count Subject Noun</u>	
Singular (Match)	The eraser for the blackboard
Plural (Mismatch)	The eraser for the blackboards
<u>Singular Mass Subject Noun</u>	
Singular (Match)	The chalk for the blackboard
Plural (Mismatch)	The chalk for the blackboards

As in the previous experiments each preamble consisted of a complex subject noun phrase in which the subject was followed by a prepositional phrase. Each member of a set of preambles was identical except for the subject noun (mass or unmarked count) and the number of the local noun (singular or plural).

The twenty mass nouns were selected from a dictionary of mass terms (Sparkes, 1985). Each mass noun was matched with a count noun that denotes an entity that is related in meaning. For example, the count noun car was matched with the mass noun traffic. Only mass nouns that do not readily undergo a reclassification as a count noun were employed. To enforce this, none of the selected mass nouns had a plural form listed in Francis and Kucera's (1982) word frequency norms. In addition, the mass nouns and their corresponding meaning-related count nouns were subjected to Allan's (1980) tests of countability.

Allan constructed a set of four grammaticality judgment tests that are designed to determine the countability preferences of English nouns. A judgment of "unacceptable" in three of the tests suggests that the noun is not countable, whereas a judgment of

"acceptable" suggests that it is. These three tests include the following environments:

(1) an environment in which a noun takes plural verb and/or pronoun agreement (e.g., *traffic are dangerous, *aren't they? versus cars are dangerous, aren't they?) (2) an environment in which a noun combines with a unit denominator such as "a(n)" or "one" (e.g., *a/*one traffic versus a/one car) and (3) an environment in which a noun combines with a plural quantifier such as "several" or "a few " (e.g., *several traffic versus several cars). The fourth countability test contains an environment in which a judgment of "acceptable" suggests that the noun is not countable, and a judgment of "unacceptable" suggests that it is. The environment is one in which the combination of the noun and the determiner "all" results in a genus-referring noun phrase that is singular (e.g., All traffic is dangerous versus *All car is dangerous).

All twenty of the selected mass nouns were shown to be uncountable by all four of Allan's tests, and all twenty of the corresponding meaning-related count nouns were shown to be countable.

Each of the twenty preamble sets consisted of two preambles that contained a mass subject noun and two that contained the corresponding meaning-related count noun in the singular form. One mass noun preamble and one count noun preamble each represented a mismatch condition. Both mismatch preambles contained a singular subject noun that was followed by a plural local noun. The other mass and count noun preambles represented match control conditions and contained singular subject nouns followed by singular local nouns.

In addition to the experimental preambles, filler items that consisted of simple noun phrases were created. Four lists were constructed with each list containing all the filler items and one preamble from each of the four experimental condition sets. The fillers were designed so that the number of singular and plural items within each list

was equal. Each list contained an equal number of preambles that represented each of the four conditions.

The same Procedure and Scoring categories employed in the first three experiments were also employed in Experiment 4.

Analysis.

An analysis of variance for each of the score categories was performed first with participants as a random factor and then with items as a random factor. Each analysis contained the within participant variables of subject noun phrase type (mass or count) and local noun number (singular or plural).

Results.

Application of the scoring criteria yielded 695 correct agreement responses (67% of all responses), 88 agreement errors (8%), 181 ambiguous responses (17%) and 76 miscellaneous responses (7%). Table 15 contains the numbers of scores in each score category for each preamble condition.

Table 15. Numbers of responses in each scoring category in Experiment 4.

Local Noun Phrase Number	Response Type			
	Correct	Error	Ambiguous	Miscellaneous
<u>Singular Count Subject Noun</u>				
Singular (Match)	200	2	46	12
Plural (Mismatch)	140	51	39	30
<u>Singular Mass Subject Noun</u>				
Singular (Match)	192	6	48	14
Plural (Mismatch)	163	29	48	20

An examination of the numbers of correct responses in Table 15 shows that there were fewer correct agreement responses following mismatch preambles than following match preambles. The table also shows that the distribution of agreement errors was complementary to that of the correct agreement responses; i.e., there were more errors following mismatch preambles than following match preambles.

Figure 4 contains the net error proportions for the two mismatch preamble conditions. The figure clearly shows that the incidence of plural attraction errors was reduced when the preambles contained a mass subject noun relative to when they contained a count subject noun.

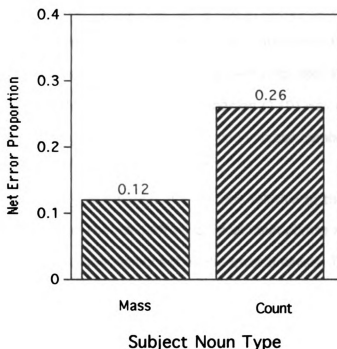


Figure 4. A graph of the net error proportions for the two mismatch conditions. The net error proportions were obtained by subtracting the error proportions of the match conditions from the error proportions of the corresponding mismatch conditions.

An analysis of variance of the correct agreement responses yielded a significant main effect of local noun phrase number in both the participant and item analyses ($F_1(1,51) = 25.67$, $F_2(1,19) = 30.97$). This main effect confirmed that there was a greater number of correct agreement responses in the match control conditions than in the mismatch conditions (392 versus 303, respectively). The main effect of subject noun type (mass or count) was not significant in either analysis ($F_1(1,51) = 1.11$, $F_2(1,19) = .49$), which indicated that the overall number of correct agreement responses following count noun preambles did not differ significantly from the overall number following mass noun preambles (340 versus 355, respectively). However, in the participant analysis, there was a significant interaction between the factors of

subject noun type and local noun phrase number ($F_1(1,51) = 5.11$). Planned pairwise comparisons in the participant analysis with a 95% confidence interval of 19.59 revealed that the greater number of correct agreement responses in the mass mismatch condition (163) than in the count mismatch condition (140) was reliable. The interaction between subject noun type and local noun phrase number was not significant in the item analysis ($F_2(1,19) = 2.04$, $p > .10$).

The complementary distribution of the errors relative to the correct responses was confirmed statistically. The main effect of local noun phrase number ($F_1(1,51) = 34.75$, $F_2(1,19) = 34.98$) was significant in the error analysis. This reflected the greater number of agreement errors in the mismatch conditions than in the match control conditions (80 versus 8, respectively). The main effect of subject noun type was also significant in the participant analysis ($F_1(1,51) = 6.14$) but not in the item analysis ($F_2(1,19) = 2.20$). This effect reflected the greater number of attraction errors following preambles that contained subject count nouns than following preambles that contained subject mass nouns (53 versus 35, respectively).

The interaction between the factors of local noun phrase number and subject noun type was significant in both analyses ($F_1(1,51) = 13.53$, $F_2(1,19) = 4.65$). Planned pairwise comparisons showed that the interaction resulted from the large reduction in the number of attraction errors in the mass mismatch condition (29) relative to the count mismatch condition (51). The difference between these two conditions was reliable in both the participant and item analyses (the 95% confidence intervals were 10.10 and 17.84, respectively).

As evident in Table 15, the numbers of ambiguous responses were fairly evenly distributed across the four conditions. This even distribution was confirmed in the analyses of the ambiguous responses as there were no significant effects or interactions (all $F_s < 1$).

The analysis of the miscellaneous responses resulted in a significant main effect of local noun phrase number ($F_1(1,51) = 7.54$, $F_2(1,19) = 6.14$). There were more miscellaneous responses in the mismatch conditions than in the match control conditions (50 versus 26, respectively). Neither the main effect of subject noun type nor the interaction between subject noun type and local noun phrase number was significant in either the participant or item analysis (all $F_s < 2.33$).

Examples of the miscellaneous responses are given in Appendix B. As in the previous three experiments, the majority (55) were due to preamble repetition failures, with the most frequent failure (30) being a change in the number of the local noun in a presented mismatch preamble from plural to singular. Thus, the significantly greater number of miscellaneous responses in the mismatch conditions than in the match conditions was due to this particular failure. As discussed in the previous experiments, these "number-change" failures may reflect either a perception or a production error.

Verb agreement in the 68 miscellaneous responses containing complex subject phrases was examined. Fifty-two had subject and local nouns that matched in number and 16 had subject and local nouns that had a mismatch in number. The greater representation of match subject phrases in the miscellaneous responses resulted from the frequent number-change repetition failures of the presented mismatch preambles. The verb agreement in these responses was scored with respect to the number of the actually produced subject noun. Table 16 presents the results of this scoring.

Table 16. Numbers of miscellaneous responses containing complex subject phrases in each verb-agreement score category. The percentages given in parentheses are based on a total of 68 responses.

	Agreement Type		
	Correct	Error	Ambiguous
<u>Subject & Local</u>	<u>Match Subject Phrases</u>		
<u>Noun Number</u>	<u>Count Subject Nouns</u>		
Plural Subject & Local	7	2	1
Singular Subject & Local	17	2	6
	<u>Mass Subject Nouns</u>		
Singular Subject & Local	10	2	5
TOTAL	34 (50%)	6 (9%)	12 (17%)
	<u>Mismatch Subject Phrases</u>		
	<u>Count Subject Nouns</u>		
Singular Subject/Plural Local	5	1	
	<u>Mass Subject Nouns</u>		
Singular Subject/Plural Local	7	1	2
TOTAL	12 (17%)	2 (3%)	2 (3%)

Table 16 shows that there were more correct agreement responses following match subject phrases than following mismatch subject phrases, which is consistent with the findings in the main experiment. However, the distribution of errors was not consistent with the main experiment. There were more errors following match subject phrases than following mismatch subject phrases.

Two of the six errors in the match responses resulted in singular-marked verbs that disagreed with a produced plural subject noun. However, since all of the experimental preambles contained singular subject nouns, the singular-marked verbs agreed with the subject nouns of the presented preambles. Because it is impossible to determine whether the produced plural subject noun was a perception error of the presented preamble's subject noun or a production error, the apparent erroneous agreement cannot be confidently attributed to the same processing failures that are proposed to underlie the agreement errors in the main experiment.

Because the remaining four of the six errors in the match subject phrase responses resulted in plural-marked verbs that disagreed with both the presented and produced singular subject nouns, these errors appear to be agreement errors. All four of the subject phrases of these responses resulted in a change in the number of a presented preamble's local noun from plural to singular. Again, it is impossible to determine whether this change is a result of a perception of production error. If the change is due to a production error, then the plural-marked verb may be incorrectly agreeing with an intended plural local noun. In other words, some or all of these four match phrase errors may be attributable to the same processing failures that are assumed to underlie errors of attraction for mismatch phrases. Assuming that the four plural-marked agreement errors are attraction errors, adding them to the errors in the respective singular subject-plural local noun conditions of the mismatch phrases results in a total of three errors following mismatch phrases with subject counts nouns and three following mismatch phrases with subject mass nouns. The equal number of errors for these two mismatch conditions is not consistent with the findings of the main experiment. However, adding these errors to the respective mismatch conditions in the main experiment does not change the error pattern in the main experiment.

Discussion.

The error results of Experiment 4 provide additional evidence for the claim that the singular form of a count noun is grammatically unmarked or unspecified for number. Furthermore, the results suggest that, unlike singular count nouns, mass nouns may contain explicitly specified singular number information. These claims are based on the findings that when the subject noun of a sentence preamble was a singular unmarked count noun followed by a plural local noun, the incidence of attraction errors was significantly greater than when the subject noun of the preamble was a mass noun. Thus, one consequence of the unspecification of number for singular count nouns is the greater likelihood that the grammatical specification of plural number by a following local noun will disrupt the implementation of singular verb agreement. In contrast, the plural specification of a local noun appears to be less disruptive of the use of correct singular verb agreement with subject mass nouns.

CHAPTER V

General Discussion

The results of all four experiments support the proposal that there is a markedness relation in the underlying specification of grammatical number for singular and plural count nouns. Singular nouns appear to be unmarked or unspecified for number whereas plural nouns appear to be marked or explicitly specified. This difference in the underlying markings of grammatical number is manifested in the asymmetric distribution of attraction errors. The asymmetry, which shows a greater incidence of agreement errors following subject phrases with a singular subject-plural local noun number pattern than following subject phrases with the reverse number pattern, appears to arise from the marked specification of a plural local noun dominating or overshadowing the unmarked specification of a singular subject noun. Experiment 1 showed that the dominance of plural number specification on a local noun can be significantly weakened by a subject noun phrase that is grammatically marked or specified as singular by an overt singular morpheme, i.e., a quantifier.

In addition, the results of Experiment 2 demonstrated that when a local noun phrase is grammatically marked as singular by a quantifier, this explicit specification is able to overshadow the contrasting grammatical specification of plural number on a subject noun phrase, thereby increasing the likelihood of a singular attraction error relative to when there is no singular marking on a local noun phrase. Experiment 3 offered evidence that singular quantifiers do not merely enhance a weak specification or marking of singular number, but rather they mark an otherwise unspecification.

Finally, the results of Experiment 4 showed that mass nouns, unlike singular count nouns, appear to contain an underlying grammatical specification that is equivalent to a marked specification of singular number.

Although the overall results demonstrate that singular number on a subject noun phrase can become grammatically marked or specified and therefore reduce the likelihood of an attraction error by a plural marked local noun, there is still an indication that plural number marking is more attractive or dominant than singular number marking. This indication comes from a comparison of the incidence of singular versus plural attraction errors following mismatch preambles that had contrasting number marking on the subject and local noun phrases. Experiment 2 was the only one to employ mismatch preambles in which the subject noun phrases were marked as plural and the local noun phrases were marked as singular (by a quantifier). The incidence of singular attraction errors, i.e., the net error proportion for this condition, was .02 (see Figure 2). Both Experiments 1 and 4 employed mismatch preambles in which the subject noun phrases were marked as singular (by either a quantifier or a mass noun) and the local noun phrases were marked as plural. The incidence of plural attraction errors, i.e., the net error proportions for these conditions, was .20 in Experiment 1 (see Figure 1) and .12 in Experiment 4 (see Figure 4). This comparison suggests that plural marking is more capable of overshadowing singular marking than the reverse.

The difference in attractiveness may be attributable to the nature of the marking of singular versus plural number. In Experiments 1 and 2, singular noun phrases were grammatically marked by the unbound morphemes each, every, and one. In contrast, plural noun phrases were grammatically marked by the bound morpheme -s. Thus, plural noun phrases received their number specification from their head nouns, whereas singular noun phrases received their number specification from a non-head

constituent, i.e., the quantifier. Therefore, in these cases, plural specification may be more attractive than singular specification (or less prone to being overshadowed) because the specification of plural number was at both the level of the noun phrase and the level of the head subject noun. In contrast, the specification of singular number was only at the level of the noun phrase.

Unlike noun phrases specified as singular by quantifiers, noun phrases specified as singular by mass nouns should receive their specification from the head subject noun, itself. Thus given the above analysis, the specification on the subject noun should be more effective at reducing the incidence of attraction errors by plural local nouns. This appears to be the case in a post hoc comparison of the net error proportion for the mismatch condition with quantified subject noun phrases in Experiment 1 (.20) versus the net error proportion for the mismatch condition with mass subject noun phrases in Experiment 4 (.12). However because there are many differences between these two experiments this comparison should be treated cautiously. It is up to future research to examine this issue in a more controlled manner as well as to examine whether local noun phrases specified as singular by mass nouns are as effective at eliciting attraction errors as local noun phrases specified as plural by plural count nouns.

Along related lines, the results of Experiments 1 and 2 indicated that there is a difference in the effectiveness of the three quantifiers each, every, and one to mark singular number. In Experiment 1, the results indicated that the singular quantifier one was more effective than the other two at reducing the incidence of attraction errors by a plural local noun. In Experiment 2, the results indicated that the quantifier one was more effective than the other two at attracting erroneous verb agreement. Because all three quantifiers obligatorily require singular verb agreement (the consistent use of this agreement was verified by the results of a validation test in Experiment 1) the difference does not appear to arise at the level of grammatical number specification.

However there is a level at which the quantifier one differs from the quantifiers each and every, namely the semantic level. As previously discussed, the combination of a noun with either the quantifiers each or every results in a noun phrase whose referent set presupposes *more than one* entity. The combination of the quantifier one with a noun, however, not only explicitly specifies number as singular at the grammatical level but it also explicitly specifies number as singular at the semantic level. The duality in the usage of the unmarked meaning of singular number was illustrated in the Introduction with the phrases one man and man is an animal where it was argued that the singular meaning of the first phrase reflects the specific opposite of the plural meaning of a phrase such as many men. The meaning in the second phrase was argued to reflect a neutral unmarked meaning of singular number.

Thus, the apparent greater effectiveness of the quantifier one to mark singular number may be due to its consistent marking of number at both the semantic and grammatical levels. This suggests that the notional markings of number may have some influence on the verb agreement process. This might appear to be inconsistent with the evidence from previous investigations of attraction errors which has shown that verb agreement is more sensitive to grammatical number than semantic or notional number (Bock and Miller, 1991; Bock and Eberhard 1993). However, the claims proposed here as well as previously do not assert that the verb agreement processes are completely blind to notional number. In fact recent evidence by Bock, Eberhard, and Cutting (1992) shows that the notional plurality of singular collective subject nouns (e.g., The choir at the mass) can affect the implementation of verb agreement. Thus, the claim is that when there is a conflict between notional number and grammatical number the verb agreement process appears to favor grammatical number (Bock and Eberhard, 1993). In the case of noun phrases with the quantifier one the consistent marking of number

information at both the semantic and grammatical level may result in more secure retrieval of an agreeing verb.

The issue of "security" was also raised in the Introduction where it was argued that the unspecification of singular nouns should show evidence of less secure verb agreement even under circumstances where there is no plural specification to disrupt the agreement process. This is because the agreement mechanism is assumed to retrieve a singular agreeing verb form by default rather than on the basis of explicit number information. The match control conditions of Experiments 1 and 4 permit an examination of this issue. Both Experiments employed two match conditions. In all four conditions the subject and local noun phrases were singular; however, in two of the four conditions the subject noun phrases were marked as singular by either a quantifier (Experiment 1) or a mass subject noun (Experiment 4). The prediction, therefore, is that the match conditions that contained singular number specification on the subject noun phrases should show evidence of more secure verb agreement than those that contained unspecified subject noun phrases. Neither Experiment, however, offers support for this prediction. In Experiment 1, there were more correct agreement responses and fewer agreement errors following match preambles that had unmarked subject nouns than following match preambles that had subject nouns marked as singular by a quantifier. Similarly in Experiment 4, there were more correct agreement responses and fewer agreement errors following match preambles that had singular subject count nouns than following match preambles that had mass subject nouns. Although the pattern of agreement is opposite to the predictions based on the security of marking, it should be noted that the pattern arises from small differences in small numbers, none of which were significant.

In contrast to the small number of errors in the match condition, there were large numbers of agreement errors in the mismatch conditions in these four experiments. In fact, the overall error rates (total number of agreement errors divided by total number of number-inflected responses) in Experiments 1, 3, and 4 were somewhat larger than the overall error rates for previously reported experiments. The overall error rates in the experiments reported by Bock and Miller (1991) range from .04 to .08. Bock and Cutting's (1992) experiments had overall error rates ranging from .03 to .05, and Bock and Eberhard (1993) have slightly higher overall error rates ranging from .04 to .14. In comparison, the overall error rates for Experiments 1, 3, and 4 reported here are .15, .20 and .13, respectively. One possible reason for the larger error rates in these experiments may be the small number of experimental preambles that contained animate nouns. Bock and Miller (1991) found that the copula to be is used more often when subject nouns are inanimate than when they are animate. Because this irregular verb inflects for number both in the present and past tenses there are more opportunities for agreement errors to occur. None of the subject nouns in any of the four experiments reported here were animate and very few of the local nouns were. Thus the predominance of inanimate nouns in these experiments may have elicited the greater use of to be as a copula or auxiliary which led to an increase in the error rates.

Although the vast majority of number-inflected responses, both correct and incorrect, were forms of the irregular verb to be, there were responses that involved number-inflected regular verb forms. The error rate for the regular verb forms did not differ dramatically from the error rate for the irregular verb forms. This is consistent with previous investigations (Bock and Eberhard, 1993; Bock and Miller, 1991) and suggests that the verb agreement patterns are not particular to the retrieval of irregular verb forms. Across the four experiments there were 214 responses that

had number inflected regular verb forms. Of these responses 25 were errors (12%). In comparison, there were 4,374 responses that had number inflected irregular verb forms, 351 of which were errors (8%). Similar examinations by Bock and Eberhard and Bock and Miller found error rates for regular verb forms to be 19% and 5%, respectively, and error rates for irregular verb forms to be 9% and 8% ,respectively. Thus, the error rates for irregular verbs are quite consistent across these independent studies, and the error rate for regular verbs in this study is the average of the rates found in Bock and Eberhard's and Bock and Miller's studies.

The less consistent error rate of the regular verb forms is likely due to the smaller numbers that determine the rate. Nevertheless, in both Bock and Eberhard's study and the one reported here the error rate for regular verbs appears to be slightly higher than the error rate for irregular verbs. The higher rate may be reflective of not only agreement errors but also of the regular verb form's proclivity to bound morpheme loss errors; i.e., the dropping of the third-person-present singular inflection. Stemberger (1984) has found that loss errors are much more likely than addition errors and he attributes their greater likelihood to a failure at the level of assembling the verb form. Specifically, he suggests that loss errors result when the higher frequency-less complex verb form (the plural form) is substituted for the lower frequency inflected form (the singular form). In three of the four experiments reported here and in three of the four experiments reported by Bock and Eberhard, all of the experimental preambles had singular subject noun phrases. Therefore, in both studies the correct form of the verb for the majority of the experimental preambles was singular and this means that there is a greater likelihood that some of the regular verb errors are actually bound morpheme loss errors. Although this type of error may have inflated the overall agreement error rate for regular verb forms, it should nonetheless

be equally distributed across the control and experimental conditions since both conditions contained singular subject nouns.

Other difficulties in processing bound morphemes surfaced in the failures to correctly repeat the preambles in these experiments. In all four experiments the most common repetition failure resulted in a change in the number of one or both of the nouns of the presented experimental preambles. Across the four experiments 191 failures changed a plural noun in a presented preamble to a singular noun and 88 changed a singular noun to a plural noun. Although on the surface these failures appear to be production errors, i.e., bound morpheme loss and addition errors, it is very unlikely that all the failures are attributable to one or the same stage of processing. This is because the nature of the task minimally involved the perception, comprehension, elaboration, and production of the preambles. At any stage of processing the loss or addition of the plural morpheme may have occurred. Because it is impossible to determine when these errors occurred, the interpretation of the agreement patterns that follow these responses is speculative at best. It should be noted that a similar problem plagues the interpretation of the results of memory studies that have investigated the recall of marked versus unmarked lexical items (e.g., Clark and Stafford, 1969; Clark and Card, 1969; Lapointe and Dell, 1989). The consistent findings of a systematic simplification of the marked form to the unmarked form in recall errors may be reflective of the difficulty of perceiving, comprehending, recalling, or producing the marked forms.

Despite the uncertainty as to what stage(s) the difficulty in processing the marked form occurs, the results of the agreement experiments here suggest that grammatical marking aids the processes underlying verb agreement.

Conclusion.

The view of semantic markedness relations typically holds that the meaning of unmarked lexical expressions is simpler or less specific than the meaning of opposing marked lexical expressions which suggests that the processing of the unmarked is in some sense easier or more secure. However, the investigations of the markedness relations of number at the grammatical level reported here show that when singular noun phrases are marked for number, implementing correct verb agreement during production is less likely to be disrupted by conflicting number marking in the clause than when singular noun phrases are unmarked for number. These findings are consistent with the view of language processing that although there is a correlation between properties of lexical expressions at the various levels of linguistic representation, the representations within each level, as well as the processes that operate on them, are somewhat distinct. The systematic manipulation of the grammatical property of number in the investigations of subject-verb agreement in production has offered a glimpse into both the nature of the processes at the syntactic level and the representations that they operate on.

FOOTNOTES

¹The table contains 12 of the 22 English consonants. The features that are listed in the table are from Jakobson and Halle (1956). The two features consonantal and vocalic have been omitted since they do not define any of the oppositions among the phonemes listed in the simplified table.

²Jakobson and Halle (1956) defined each feature acoustically and "genetically", i.e., in articulatory terms. The articulatory descriptions for each feature is as follows: Nasal refers to the stopping of the passage of air through the oral cavity by opening the velic to allow the air to pass through the nasal cavity. Compact refers to a place of articulation, namely the articulation in a dorsal location of the oral cavity. Continuant refers to the constriction of a location in the vocal tract that does not stop the passage of air, but is sufficient to cause a friction. Strident refers to the "high-intensity" noise from the passage of air that is caused by an obstruction at the point of articulation. Voiced refers to the periodic vibration of the vocal cords. Grave, like compact, refers to a place of articulation and includes both frontal and dorsal locations.

APPENDIX A

Experimental preambles from Experiment 1:

Match and Mismatch "the"

The boat for the expedition(s)
The check from the stockbroker(s)
The donation to the charity(ies)
The door to the office(s)
The museum near the hotel(s)
The order for the cook(s)
The bridge to the island(s)
The invitation to the party(ies)
The memo from the accountant(s)
The road from the mountain(s)
The shipment from the warehouse(s)
The warning from the expert(s)
The appointment with the doctor(s)
The entrance to the laboratory(ies)
The key to the cabinet(s)
The letter from the lawyer(s)
The result of the survey(s)
The song for the performer(s)
The cover on the book(s)
The stamp on the envelope(s)
The name on the sign(s)
The movie in the theater(s)
The mistake in the program(s)
The star on the flag(s)
The slogan on the poster(s)
The picture on the postcard(s)
The crime in the city(ies)
The prize in the cereal box(es)
The advertisement in the magazine(s)
The uniform for the employee(s)
The chemical in the product(s)
The label on the bottle(s)
The date on the application(s)
The defect in the car(s)
The tag on the suitcase(s)
The problem in the school(s)

Match and Mismatch Quantified

Each boat for the expedition(s)
Each check from the stockbroker(s)
Each donation to the charity(ies)
Each door to the office(s)
Each museum near the hotel(s)
Each order for the cook(s)
Every bridge to the island(s)
Every invitation to the party(ies)
Every memo from the accountant(s)
Every road from the mountain(s)
Every shipment from the warehouse(s)
Every warning from the expert(s)
One appointment with the doctor(s)
One entrance to the laboratory(ies)
One key to the cabinet(s)
One letter from the lawyer(s)
One result of the survey(s)
One song for the performer(s)
Each cover on the book(s)
Each stamp on the envelope(s)
Each name on the sign(s)
Each movie in the theater(s)
Each mistake in the program(s)
Each star on the flag(s)
Every slogan on the poster(s)
Every picture on the postcard(s)
Every crime in the city(ies)
Every prize in the cereal box(es)
Every advertisement in the magazine(s)
Every uniform for the employee(s)
One chemical in the product(s)
One label on the bottle(s)
One date on the application(s)
One defect in the car(s)
One tag on the suitcase(s)
One problem in the school(s)

Experimental preambles from Experiment 2:Match and Mismatch "the"

The boats for the expedition(s)
 The checks from the stockbroker(s)
 The donations to the charity(ies)
 The doors to the office(s)
 The museums near the hotel(s)
 The orders for the cook(s)
 The bridges to the island(s)
 The invitations to the party(ies)
 The memos from the accountant(s)
 The roads from the mountain(s)
 The shipments from the warehouse(s)
 The warnings from the expert(s)
 The appointments with the doctor(s)
 The entrances to the laboratory(ies)
 The keys to the cabinet(s)
 The letters from the lawyer(s)
 The results of the survey(s)
 The songs for the performer(s)
 The covers on the book(s)
 The stamps on the envelope(s)
 The names on the sign(s)
 The movies in the theater(s)
 The mistakes in the program(s)
 The stars on the flag(s)
 The slogans on the poster(s)
 The pictures on the postcard(s)
 The crimes in the city(ies)
 The prizes in the cereal box(es)
 The advertisements in the magazine(s)
 The uniforms for the employee(s)
 The chemicals in the product(s)
 The labels on the bottle(s)
 The dates on the application(s)
 The defects in the car(s)
 The tags on the suitcase(s)
 The problems in the school(s)

Mismatch Quantified

The boats for each expedition
 The checks from each stockbroker
 The donations to each charity
 The doors to each office
 The museums near each hotel
 The orders for each cook
 The bridges to every island
 The invitations to every party
 The memos from every accountant
 The roads from every mountain
 The shipments from every warehouse
 The warnings from every expert
 The appointments with one doctor
 The entrances to one laboratory
 The keys to one cabinet
 The letters from one lawyer
 The results of one survey
 The songs for one performer
 The covers on each book
 The stamps on each envelope
 The names on each sign
 The movies in each theater
 The mistakes in each program
 The stars on each flag
 The slogans on every poster
 The pictures on every postcard
 The crimes in every city
 The prizes in every cereal box
 The advertisements in every magazine
 The uniforms for every employee
 The chemicals in one product
 The labels on one bottle
 The dates on one application
 The defects in one car
 The tags on one suitcase
 The problems in one school

Experimental preambles from Experiment 3:Match and Mismatch "the"

The boat for the expedition(s)
 The check from the stockbroker(s)
 The donation to the charit(y)ies
 The door to the office(s)
 The museum near the hotel(s)
 The order for the cook(s)
 The bridge to the island(s)
 The invitation to the party(ies)
 The memo from the accountant(s)
 The road from the mountain(s)
 The shipment from the warehouse(s)
 The warning from the expert(s)
 The appointment with the doctor(s)
 The entrance to the laboratory(ies)
 The key to the cabinet(s)
 The letter from the lawyer(s)
 The result of the survey(s)
 The song for the performer(s)
 The cover on the book(s)
 The stamp on the envelope(s)
 The name on the sign(s)
 The movie in the theater(s)
 The mistake in the program(s)
 The star on the flag(s)
 The slogan on the poster(s)
 The picture on the postcard(s)
 The crime in the city(ies)
 The prize in the cereal box(es)
 The advertisement in the magazine(s)
 The uniform for the employee(s)
 The chemical in the product(s)
 The label on the bottle(s)
 The date on the application(s)
 The defect in the car(s)
 The tag on the suitcase(s)
 The problem in the school(s)

Mismatch Quantified

The boat for many expeditions
 The check from many stockbrokers
 The donation to many charities
 The door to many offices
 The museum near many hotels
 The order for many cooks
 The bridge to several islands
 The invitation to several parties
 The memo from several accountants
 The road from several mountains
 The shipment from several warehouses
 The warning from several experts
 The appointment with a few doctors
 The entrance to a few laboratories
 The key to a few cabinets
 The letter from a few lawyers
 The result of a few surveys
 The song for a few performers
 The cover on many books
 The stamp on many envelopes
 The name on many signs
 The movie in many theaters
 The mistake in many programs
 The star on many flags
 The slogan on several posters
 The picture on several postcards
 The crime in several cities
 The prize in several cereal boxes
 The advertisement in several magazines
 The uniform for several employees
 The chemical in a few products
 The label on a few bottles
 The date on a few applications
 The defect in a few cars
 The tag on a few suitcases
 The problem in a few schools

Experimental preambles from Experiment 4 :Match and Mismatch Count Subject Nouns

The garage behind the building(s)
 The crime at the soccer match(es)
 The shield for the soldier(s)
 The crop in the field(s)
 The fork on the napkin(s)
 The stain on the rug(s)
 The suggestion from the worker(s)
 The song for the performer(s)
 The tractor behind the fence(s)
 The ovation after the announcement(s)
 The cigarette in the tobacco
 advertisement(s)
 The glass for the bartender(s)
 The suitcase for the trip(s)
 The eraser for the blackboard(s)
 The shirt beside the dryer(s)
 The pass from the teacher(s)
 The car near the exit ramp(s)
 The assignment for the student(s)
 The couch near the window(s)
 The instruction in the computer
 program(s)

Match and Mismatch Mass Subject Nouns

The parking behind the building(s)
 The violence at the soccer match(es)
 The armor for the soldier(s)
 The rice in the field(s)
 The silverware on the napkin(s)
 The mud on the rug(s)
 The advice from the worker(s)
 The music for the performer(s)
 The equipment behind the fence(s)
 The applause after the announcement(s)
 The smoking in the tobacco
 advertisement(s)
 The ice for the bartender(s)
 The luggage for the trip(s)
 The chalk for the blackboard(s)
 The laundry beside the dryer(s)
 The permission from the teacher(s)
 The traffic near the exit ramp(s)
 The homework for the student(s)
 The furniture near the window(s)
 The information in the computer
 program(s)

APPENDIX B

Summary of miscellaneous responses in all four experiments.

Breakdown of miscellaneous responses in Experiment 1:

101 total miscellaneous responses

1. 76 preamble repetition failures:

a) 64 Change in number of head or local noun

The appointment with the doctors--> The appointment with the doctor

The appointment with the doctors--> The appointments with the doctors

Each order for the cooks--> Each orders for the cooks

The appointment with the doctor--> The appointment with the doctors

b) 12 change in a word of the preamble

The memo from the accountants--> The memo for the accountant

The stamp on the envelope--> A stamp on the envelope

The label on the bottle--> The label on the bottom

2. 10 multiple repetitions before completion

3. 9 verb did not immediately follow preamble

The shipment from the warehouse never arrived

The mistake in the program...um...I don't know...was my fault

4. 1 omitted verb

5. 5 responses no longer had preamble as subject phrase

One appointment with the doctor--> One appointment with the doctor and you're scared

Breakdown of miscellaneous responses in Experiment 2:

278 total miscellaneous scores

1. 223 preamble repetition failures

a) 151 change in number of head or local noun

The dates on the applications--> The dates on the application

The boats for the expeditions--> The boat for the expeditions

The stamps on the envelope--> The stamps on the envelopes

The donations to the charity--> The donation to the charity

The names on each sign--> The name on each sign

The advertisements in every magazine--> The advertisements in every magazines

b) 59 change in a word of the preamble

The shipments from the warehouse--> The shipments to the warehouse

The movies in the theater--> The movies in a theater

The boats for the expedition--> The boats for the exposition

c) 13 added words to preamble

The uniforms for the employees--> The uniforms were for the employees

2. 20 multiple repetitions
3. 30 verb did not immediately follow preamble
4. 5 no verb or imperceptible

Breakdown of miscellaneous responses in Experiment 3:

62 total miscellaneous scores

1. 51 preamble repetition failures
 - a) 31 change in number of either head or local noun
 The entrance to the laboratories--> The entrance to the laboratory
 The stamp on the envelopes--> The stamps on the envelopes
 The boat for many expeditions--> The boat for many expedition
 The memo from several accountants--> The memos from several accountants
 - b) 15 change in word of the preamble
 - c) 5 words added to preamble
2. 6 multiple repetitions
3. 5 verb did not immediately follow preamble

Breakdown miscellaneous responses in Experiment 4:

76 total miscellaneous scores

1. 55 preamble repetition failures
 - a) 33 change in number of either the head or local noun
 The applause after the announcements--> The applause after the announcement
 The song for the performers--> The song for the performer
 The ovation after the announcements--> The ovations after the announcements
 The homework for the students--> The homework for the student
 - b) 3 words added to the preamble
 - c) 19 change in words of the preamble
2. 11 multiple repetitions
3. 3 verb did not immediately follow preamble
4. 2 verb was omitted
5. 5 responses no longer had preamble as subject phrase

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