Sentential Oddities and the Mass-Count Distinction: Do colourful ideas sleep calmly?*

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Abstract This paper compares three potential explanations of sentential anomalies: one that appeals to contradictions and tautologies, another that is rooted in presupposition failure, and a third that employs syntactic features and constraints on subcategorization. In general, the paper argues that there is no a priori way to connect intuitions of sentential deviance to a particular type of explanation, however these different sources of anomaly often make different empirical predictions. The paper both evaluates the general strategies behind each theory and demonstrates how to compare different types of theories (in particular, the presuppositional theory and the syntactic theory) by discussing a detailed case study: namely the distribution of quantifiers with respect to the mass-count distinction. In this case study, the syntactic explanation fairs better than the semantic and pragmatic approaches to the problem. Even thought the syntactic theory ends up providing the best explanation of the facts, it is important to note that the syntactic theory developed in this paper would not have been possible without the insights gained from the attempted pragmatic and semantic explanations. In other words, it is vital to linguistic inquiry to approach problems from multiple perspectives to get a better understanding of the empirical landscape and possible grammatical generalizations.

Keywords: Sentential anomalies, Contradictions, Tautologies, Presupposition failure, Subcategorization, Mass-count Distinction, Quantifier distribution

1 Introduction

In linguistics, an essential part of evaluating theories involves assessing how well they account for speaker intuitions. However, it is not determined a priori how best to frame such an account. For example, consider Chomsky's (1965) discussion of the issue when addressing possible sources of anomaly for sentences like *Sincerity may admire the boy*, *The dog looks barking*, and *John is owning a house*.

> It goes without saying that the same answer may not be appropriate in all of these cases, and that purely semantic or purely syntactic

* I would like to thank ...

> considerations may not provide the answer in some particular case. In fact, it should not be taken for granted, necessarily, that syntactic and semantic considerations can be sharply distinguished. (Chomsky 1965: 77)

The goal of linguistics is to figure out the best possible explanation of an empirical phenomenon and part of this process involves evaluating theories that offer completely different sources of anomaly. This paper reviews three accounts of sentential anomaly: one that appeals to contradiction and tautology, another that introduces a notion of catastrophic presupposition failure and a third that exploits syntactic constraints on sentential derivations. The paper not only discusses these explanations more broadly, but also with respect to a specific case study: namely the distribution of mass and count nouns. In this particular case, a syntactic approach to the problem provides better empirical coverage. However, the take-home message is not just restricted to the domain of the mass-count distinction but rather has two broader theoretical consequences. First, the arguments advanced in this paper describe how semantic, pragmatic and syntactic explanations of the same phenomenon can and should be compared. Second, the paper outlines how syntactic, pragmatic and semantic explanations feed off of one another: in particular, the syntactic theory advanced in this paper would not have been possible without the original observations made in the semantic literature. These observations, in turn, came to light because of semantic and pragmatic theories of the mass-count distinction.

The outline of this paper is as follows. Section 2 presents theories of sentential anomaly anchored in contradiction and tautology. This section reviews three examples where this type of explanation is employed, including the distribution of the mass and count nouns with respect to the plural morpheme. The chapter ends by discussing the main criticism of such approaches, namely that empirically speaking not all tautologies and contradictions are unacceptable. Thus, such a theory is forced into the difficult position of trying to establish a natural divide between acceptable and unacceptable contradictions/tautologies.

Section 3 discusses the idea that sentential anomaly might be due to so-called catastrophic presupposition failure. There are at least two well-known examples where this type of explanation is employed, including an account of the distribution of quantifiers and nouns. There are several virtues of the presuppositional account especially with respect to the feeling that sentential anomaly is gradable (i.e., that the feeling of awkwardness is different for different types of sentences). Critically, the presuppositional account predicts that the anomalous nature of certain sentences should be reduced or completely removed when they are evaluated in atypical contexts and/or when they are evaluated with the addition of atypical

nominal modifiers. Empirically speaking, this prediction does not hold for the case of the distribution of mass and count nouns.

Finally, section 4 outlines the basic strategy behind a syntactic account of sentential anomalies. For the sake of simplicity, the discussion focuses on the distribution of quantifiers with respect to the mass-count distinction. This section argues that the syntactic account can avoid the undesirable empirical predictions made by the presuppositional account. However, to account for the same generalizations, a detailed theory is needed that connects the syntactic features at play to certain types of semantic operations (e.g., join closure).

2 Contradictions and tautologies

Uttering sentences that are either trivially true or false is awkward in almost any type of conversation other than, perhaps, one that happens in an introduction to logic class. Many linguists, mostly semanticists, have tried to exploit the basic principals behind this type of awkwardness to account for sentences that do not seem to be obvious contradictions or tautologies. This section reviews some of these efforts and discusses some of the problems that these types of explanations encounter.

The section begins by outlining the general motivations behind appealing to contradictions and tautologies as a source of sentential anomaly (section 2.1) before discussing examples in the literature where such an explanation plays a significant role (section 2.2). Section 2.3 highlights some of the strengths and weaknesses of this approach.

2.1 Oddity as a violation of informativity

Often semanticists have invoked contradictory or tautological interpretations as a means of accounting for sentential deviance (see Barwise & Cooper 1981, Chierchia 1998, 1984, von Fintel 1993, Gajewski 2002, among others). Linguists and philosophers typically justify this type of account by appealing to Grice's Cooperative Principle. According to Grice (1975), a speaker's message should make a contribution to the conversation and thus in most situations, should convey some information that is not yet part of the common ground (Maxim of Quantity). Tautologies and contradictions can never make any meaningful informational contribution, at least not if they are taken literally. Tautologies are true in every possible context and thus offer no new information, whereas contradictions are false in every possible context and thus cannot possibly be added to the common ground. Hence, uttering these types of sentences would be odd in most contexts.

For example, in most conversational contexts, it would be extremely unusual to utter the tautologies in (1) and perhaps even more odd to utter the contradictions in

(2). (Note, I will use the # symbol to mark sentential deviance in a theory neutral way. As such, the # serves as a cover symbol for #, *, ?, ?? and any other syntactic, pragmatic or semantic marker used in the literature.)

(1) TAUTOLOGIES
   a. # Every number that is less than two is less than two.
   b. # John is as tall as he is.

(2) CONTRADICTIONS
   a. # A number that is greater than two is not greater than two.
   b. # John is taller than he is.

However, as noted by Grice (1975), the status of these types of sentences improves significantly when uttered in a context that permits flouting. For example, contradictions can be used with a sarcastic intonation to imply that the previous statement was false, as shown in (3).

(3) a. **Statement**: Brad will make good on his promises.
   b. **Response**: Sure...and a number that is greater than two is not greater than two. (Said with sarcasm)

The sarcastic intonation indicates that the speaker is flouting cooperative communication and hence can violate informativity with his/her literal utterance in order to implicate that the previous utterance was false. Tautologies can be used in a similar way. Consider the sentence pairs in (4).

(4) a. **Question**: Why does Barack Obama get priority treatment at the airport?
   b. **Response**: Well, the president is the president.

The tautological response in (4b) along with a slight sarcastic intonation indicates that the speaker is flouting informativity in order to implicate that it should be common knowledge that Barack Obama should receive special treatment.

One reason to think that this type of explanation is on the right track is that the oddity of the sentences in (1) completely disappears when they are imbedded in contexts that make them informative, such as when they appear adjacent to *because* as in (5a) or embedded under a propositional attitude as in (5b). (See the discussion in Fauconnier 1994 who presents almost identical sentences.)

(5) a. John is as tall as he is because he eats his vegetables.
   b. I am surprised that John is as tall as he is.

If the source of oddity were grammatical in nature (i.e., if it were a consequence of the rules and constraints that apply during the derivation of the sentence), then one would not expect either *flouting* or sentential embedding to remove the feeling of deviance. If, on the other hand, the oddity were due to informativity (as Grice would maintain), then it it is unsurprising that manipulating informativity can remove the impression of oddness.

2.2 Oddity and informativity in the previous literature

Tautological and contradictory meanings have been invoked to explain a variety of odd sentences that, at least on the surface, are not obviously similar to the sentences in (1) and (2). Such sentences include existential *there* constructions with so-called strong quantifiers (6a), misapplied exceptive phrases (6b), and misapplied plural marking (6c).

(6) a. # There are most boys.
b. # Some students but John insulted the professor.
c. # Several equipments were in the hallway.

At first blush, the sentences in (6) seem distinctly odder than those in (1) and (2), leading many researchers to classify them as ungrammatical (see Diesing 1992, Gillon 1992). I will come back to this point at the end of the section, but first let me outline in more detail how a plausible semantics for these types of sentences can lead to contradictions and tautologies.

2.2.1 Barwise & Cooper 1981

In their discussion of strong and weak quantifiers, Barwise & Cooper (1981) develop a semantic analysis of existential *there* constructions based on (7). (Note that this semantics is for existential *there* and not locative *there*. Marking sentences of the form *there is/are DP* as odd indicates that it is odd under the interpretation of 'DP exist(s)' rather than 'DP is/are in that location.')

(7) $[\![\textit{there is/are } \mathbf{DP}]\!]^M = 1$ iff $D \in [\![DP]\!]^M$, where D is the domain of discourse in the model M.

These truth conditions assert that every member of the domain (in the context of evaluation) is a member of the interpretation of the determiner phrase. For example, if the DP were *no boys* (whose denotation contains all the sets that do not have any boys in them), then *there are no boys* would assert that the current domain does not have any boys in it. In terms of weak quantifiers (e.g., *some students*, *three*

teachers, *several elephants*, etc.), this type of semantics seems to accurately reflect speaker intuitions. However, this type of semantics would be trivially true of strong quantifiers and proper names, such as those in (8).

(8) a. # There is John.
b. # There is every boy.

Since the interpretation of *every boy* contains all the supersets of the denotation of boy and since the interpretation of *John* (when defined) contains all the supersets of the singleton set containing John, it follows analytically that the set of all elements in the domain of discourse will be a member of these DPs since this set by definition is always the largest set in the given context. (The largest set is the superset of all possible subsets in the domain of discourse.) Hence, the sentences in (8), under Barwise & Cooper's (1981) analysis, are tautologies. Given the marked status of these sentences, Barwise & Cooper (1981) appeal to the tautological nature of these sentences as the source of their oddity.

2.2.2 von Fintel 1993

von Fintel (1993) has a similar analysis of exceptive *but* in English, although he appeals to a contradictory meaning rather than a tautological one. von Fintel (1993) argues that a proper treatment of sentences with exceptive phrases, such as those in (9), require two restrictions: first, that a modified version of the sentence is true where the noun phrase has the exception removed from its denotation (so-called domain subtraction criterion); second, that the sentence couldn't be true if the exception were not removed (so-called uniqueness criterion).

(9) a. Every student but John complained.
b. No student but John complained.

For example, the sentence in (9a) is true if and only if 1) every student who is not John complained and 2) for any subset of students that contains John, it is not true that each member of that subset complained (i.e., John is the unique member that didn't complain). Similarly, the sentence in (9b) is true if and only if 1) no student who isn't John complained and 2) for any subset of students that contains John, it is not the case that no member of that subset complained (i.e., John is the unique member that complained). I am phrasing this second criterion a little awkwardly to foreshadow von Fintel's formal representation of the truth conditions. The general outline of these truth conditions is sketched out in (10), where D is the determiner, N is the noun, E is the set of exceptions and VP is the verb phrase.[1]

1 For the sake of simplicity, I only discuss exception sets that contain single members. von Fintel (1993) does not simplify his discussion in this way.

(10) $[\![D\ N\ but\ E\ VP]\!]^M = 1$ iff

a. $[\![VP]\!]^M \in [\![D]\!]^M([\![N]\!]^M - [\![E]\!]^M)$ & [DOMAIN SUBTRACTION]

b. $\cap\{X : [\![VP]\!]^M \in [\![D]\!]^M([\![N]\!]^M - X) = 1\} = [\![E]\!]^M$. [UNIQUENESS]

The truth conditions in (10a) states that quantificational sentence holds for all of the non-exceptions. The truth conditions in (10b) states that it is not possible to assert the quantified statement of a set that contains the exception. The exception must be excluded for the sentence to be true. It is simple to show that the truth conditions in (10), which capture our intuitions about the truth and falsity with respect to the sentences in (9), yield contradictions for other types of quantifiers. For example, consider the sentences in (11).

(11) a. # At least three students but John complained.

b. # Some student but John complained.

According to von Fintel's (1993) analysis, the sentence in (11a) would be true if and only if i) at least three students other than John complained and ii) for any subset of students that includes John, it is not the case that at least three members of that subset complained. However, if i) were true, then the domain must contain three students other than John that complained. This would make the condition in ii) false, since there would exist a subset of students that contains John such that at least three members of that subset complained. Similar consequences follow for (11b). If there exists some student other than John who complained, then it follows that there is a subset of students that contains John such that at least one of the members of that subset complained. von Fintel (1993) hypothesizes that the contradictory nature of these meanings make the sentences in (11) sound odd.

2.2.3 Chierchia 1998

Another paper that appeals to tautologies and contradictions to explain why certain sentences sound odd is Chierchia 1998. In this paper, Chierchia proposes a semantic analysis of the plural morpheme based on Link 1983, as represented in (12).

(12) In all models M, $[\![\text{-}s]\!]^M = \lambda P.\ P^* - P$, where * maps any set to its join closure (i.e., For all P, $P \subseteq P^*$, $P^* = (P^*)^*$, and $\forall x, y \in P^*.\ x \sqcup y \in P^*$)

Although some scholars have recently argued against this type of meaning for the plural morpheme (e.g., Croft 1990, 2nd ed. 2003, Krifka 1989, Sauerland 2003, 2008, Sauerland et al. 2005, Spector 2003, 2007, Bale et al. 2011b, among others), it still largely aligns with speaker intuitions, at least with respect to common count

nouns.[2] For example, intuitively speaking, a word like *cats* can be used to refer to any group of two or more cats, whereas *cat* can only be used to refer to a singular cat. This intuition is reflected in Chierchia's and Link's semantics.

(13) a. In a context where there are only three cats (a, b and c), $[\![cat]\!]^M = \{a, b, c\}$

b. In the same context, $[\![cats]\!]^M = [\![\text{-}s]\!]^M([\![cat]\!]^M)$
$= {}^*\{a, b, c\} - \{a, b, c\}$
$= \{a, b, c, ab, ac, bc, abc\} - \{a, b, c\} = \{ab, ac, bc, abc\}$

More relevant to the present discussion, this same operator, at least as it is formally defined by Chierchia, has a different effect on mass nouns. Intuitively speaking, the word *equipment* can be used to refer not only to any singular item of equipment but also any group of items. For example, the sentence in (14) can be used to talk about a hockey neck guard or it can be used to talk about the group of equipment consisting of the neck guard, shoulder pads, elbow pads and shin pads.

(14) That equipment will protect you.

Based on these intuitions, Chierchia (1998) assigns mass nouns like *equipment* a broad interpretation that includes both individuals and groups of individuals (see also Bunt 1985, Gillon 1992).

(15) In a context where there are only three pieces of equipment (a, b and c), $[\![equipment]\!]^M = \{a, b, c, ab, ac, bc, abc\}$

However, if this were the denotation of *equipment*, then the application of the plural morpheme to this mass noun (or any other mass noun for that matter) would result in an empty denotation.

(16) $[\![equipments]\!]^M = [\![\text{-}s]\!]^M([\![equipment]\!]^M)$
$= {}^*\{a, b, c, ab, ac, bc, abc\} - \{a, b, c, ab, ac, bc, abc\}$
$= \{a, b, c, ab, ac, bc, abc\} - \{a, b, c, ab, ac, bc, abc\} = \emptyset$

Such an empty denotation would render sentences like the one in (17) analytically false (i.e., a contradiction). Since the denotation of the nominal complement is empty, it is impossible that several members of the denotation could have been used to protect John. Chierchia (1998) suggests that the contradictory nature of this sentence could account for its oddity.

(17) # Several equipments are being used to protect John.

2 Chierchia himself abandons this semantic denotation for plural nouns in Chierchia 2010.

Not only does this type of semantic analysis derive contradictions with respect to existential quantifiers like *several*, it also derives tautologies for other types of quantifiers. For example, since the denotation of *equipments* is empty, it follows analytically that both the sentences in (18) are true.

(18) a. # No equipments are in the hockey bag. (cf., No equipment is in the hockey bag.)

b. # All equipments are used to protect the players. (cf., All equipment is used to protect the players.)

The intersection of the empty set with any set will always be empty, hence the tautological nature of (18a). Furthermore, the empty set is a subset of every other set, hence the tautological nature of (18b).

2.3 Summary and Criticism

In each of the papers discussed above, the authors appeal to the general truth conditions needed to account for acceptable sentences to derive the oddity of the unacceptable ones. Hence, there is no need to invoke extra grammatical mechanisms or superfluous semantic conditions to distinguish the odd from the acceptable. However, there are some weaknesses that challenge the explanatory adequacy of this type of account. This section focuses on one of the major weaknesses, namely the inability for this type of account to separate slightly odd examples of contradictions/tautologies from very odd examples, at least not without introducing an arbitrary stipulation.

2.3.1 Some sentences are odder than others

Probably the most accessible weakness of this type of account is the empirical observation that the sentences discussed in section 2.2 are distinctly odder than prototypical contradictions and tautologies. Furthermore, unlike their prototypical counterparts, the sentences in section 2.2 cannot be used in circumstances where flouting is permitted. For example, the responses in (19b-d), unlike (19a), do not imply that the statement in (19) is false.

(19) **Context**: Everyone but the speaker seems to know that Bob is in love with Professor Smith and would never complain about her.
Statement: Perhaps it was Bob who complained to the administration about Professor Smith.

a. **Response**: Sure, and I am taller than myself.

b. # **Response**: Sure, and some student but Bob hates Professor Smith.

c. # **Response**: Sure, and the local sports store sold several equipments today.

d. # **Response**: Sure, and it is not the case that there are most students.

In addition, sentences similar to the ones in section 2.2 remain unacceptable when embedded under intensional verbs despite the fact that prototypical contradictions and tautologies are acceptable in the same context, as shown by the contrast between (20) and (21).

(20) a. Bob said that every number less than two is less than two.

b. Bob said that a number that is less than two isn't less than two.

(21) a. # Bob said that some student but Mary complained about the class.

b. # Bob said that there are most students.

c. # Bob said that several computer equipments are stored in the janitor's closet.

In summary, the following generalization holds: the sentences which sound odder out of the blue are also those that cannot be used in flouting or in embedded contexts. An adequate theory should be able to connect these two observations.

However, as von Fintel (1993) points out, such criticisms are not a valid reason for rejecting outright a theory that explains unacceptability through contradictions and tautologies. Rejection should be based on the preference for one theory over another rather than the simple fact that the current theory cannot explain all the facts. Although von Fintel (1993) admits that his theory cannot explain the differences between the sentences in section 2.2 and more prototypical tautologies and contradictions, he also notes that there is no other theory that can, at least not without simply re-stipulating the empirical facts. Hence, von Fintel (1993) concludes "While the final word has not been said, there is nothing better on the market at this time."

It is worth emphasizing this point since many researchers unfairly reject explanations involving contradictions and tautologies due to this observation alone. The fact that sentences vary in terms of their degree of acceptability is a well-known empirical fact (for example, see the discussion in Chomsky 1965 and Chomsky 1986). Often, linguists will mark this fact with various symbols. For example, sentences marked with '*' are less acceptable than those marked with '??' which in turn are less acceptable than those marked with '?.' However, rarely do grammatical theories distinguish between the various levels of acceptability (notable exceptions are Chomsky 1965, 1986). Thus, if one is willing to reject outright any explanation of oddity in terms of contradictions and tautologies simply because they cannot

explain the contrast in acceptability between (22) and (23), then one should be prepared to reject any syntactic theory that cannot explain the fact that (25c) sounds much worse than (25b) which in turn sounds much worse than (25a).

(22) # John is taller than he is.

(23) a. # There are most boys.
b. # Some boys but John ate all the cookies.

(24) Who did John paint a picture of?

(25) a. # Who did John give a picture of to Mary?
b. # Who did John paint a picture of Paul and?
c. # Who did John give a picture of Paul and to Mary?

In practice, theories are not rejected because they are incomplete. A syntactic theory that makes a division between (24) and (25) is much better than a theory that does not make any distinctions. Similarly, a semantic theory that can explain why one set of sentences is acceptable while another sounds odd is much better than a theory that cannot even make this basic division.

2.3.2 An aside about Gajewski 2002

It should be noted that Gajewski (2002) does attempt to provide an explanation for the difference between prototypical tautologies/contradictions and the sentences in section 2.2. He endeavours to divide analytically false/true sentences into those that are "logically" analytic and those that are not. A discussion of Gajewski 2002 brings us a little off topic and is not directly relevant to the thesis at hand. However, given the discussion so far and the main criticism levied against this type of approach, it is worth considering attempts to refine the theories that appeal to contradictions and tautologies. Ultimately, I do not think Gajewski's refinement offers a significant improvement over simply stipulating that there are two types of contradictions/tautologies.

The basic strategy behind Gajewski's explanation involves separating words into two groups: those whose interpretation is permutation invariant and those whose interpretation is not, where permutation invariance is defined in van Benthem 1989.

(26) **Definition of a Permutation**: A permutation is a function that maps each individual in a domain to a unique substitute, where it is possible that an entity could serve as its own substitute. The set of permutations for a domain D are all possible functions of type $<e,e>$ that are bijective on D.

A permutation that applies to individuals can be extended to sets and functions by permuting the individuals involved in the extension of those sets and functions, as defined in the recursive definition below.

(27) For all permutations π,
   a. $\pi(1) = 1$ and $\pi(0) = 0$
   b. For all sets $\{x_1, x_2, \ldots x_n\}$, $\pi(\{x_1, x_2, \ldots x_n\}) = \{\pi(x_1), \pi(x_2), \ldots \pi(x_n)\}$
   c. For all functions $f_{<a,b>}$, $\pi(f) = \{\langle \pi(x_a), \pi(y_b)\rangle : \langle x_a, y_b\rangle \in f\}$

With this idea of an extended permutation in mind, we can define permutation invariance technically as follows: a function or denotation f is permutation invariant if and only if for all models M with a domain D and all possible permutations π defined on D, $\pi(f) = f$. In practice, the permutation invariant words tend to be quantifiers, connectives, and other closed class items. In contrast, the non-invariant words tend to be proper names, common nouns, verbs, adjectives and other open class items.

It should be kept in mind that the key notion in Gajewski's system is not permutation invariance per se, but rather a definition of logical analyticity that relies on replacing words that are not permutation invariant. Gajewski (2002) defines a sentence as being *logically analytic* if it remains analytically true or false under all possible variable assignments even when each instance of a non-invariant word (i.e., a proper name, noun, verb or adjective) is replaced by a variable of the same type. In other words, a sentence is logically analytic if each instance of a noun, verb or adjective can vary arbitrarily in interpretation without affecting the truth or falsity of the sentence. Critically, two different instances of the same noun, verb or adjective within the same sentence can be assigned different interpretations.

This concept is best understood through an example. Consider the sentence *The president is the president*. Although this sentence is analytically true, its truth is based on the two instances of noun *president* having the same interpretation. However, under Gajewski's definition, this sentence is not logically analytic. To assess so-called logical analyticity, each instance of the noun *president* is replaced with a different variable of type $<e,t>$. For every variable assignment where these variables are mapped to two different sets, the sentence is no longer true. For example, consider the variable assignment g that maps α to $\{a\}$ and β to $\{b\}$. With this variable assignment, the expression $[\![\textit{The } \alpha_{<e,t>} \textit{ is the } \beta_{<e,t>}]\!]^{M,g}$ would be false. This holds despite the fact that for all models M where $[\![\textit{The president is the president}]\!]^{M}$ is defined, the sentence is true, independent of the variable assignment.

(28) a. For all models M and variable assignments g, $[\![\textit{The president is the president}]\!]^{M,g}$ is either undefined or equal to 1.

b. There is some model M and some variable assignment g, such that $[\![\textit{The } \alpha_{<e,t>} \textit{ is the } \beta_{<e,t>}]\!]^{M,g} = 0$.

What this shows is that the analytic nature of the sentence is partly dependent on the repetition of the noun.

These facts contrast with so-called logically analytic sentences like *There are most boys*. If we replace *boys* by a variable of the same type, such as $\alpha_{<e,t>}$, there would not be any model M or variable assignment g that would render $[\![\textit{There are most } \alpha_{<e,t>}]\!]^{M,g}$ false.

(29) a. For all models M and variable assignments g, $[\![\textit{There are most boys}]\!]^{M,g}$ is either undefined or equal to 1.

b. For all models M and variable assignments g, $[\![\textit{There are most } \alpha_{<e,t>}]\!]^{M,g}$ is either undefined or equal to 1.

Hence, the analytic nature of the sentence clearly rests on the semantics of *most* and the existential *there*-construction, independent of the noun.

With this division of the analytic expressions into the "logical" and "non-logical" in mind, Gajewski (2002) makes the following claim. (Note, I have modified it slightly to remove reference to logical form.)

(30) A sentence is ungrammatical if it contains a logically analytic constituent.

It is important to note that Gajewski's strategy works well in distinguishing prototypical tautologies and contradictions from the type of expressions discussed in von Fintel 1993 and Barwise & Cooper 1981, but it does not work so well for the ungrammatical plurals discussed in Chierchia 1998. Chierchia's explanation critically relies on the semantics of the nominal expression to derive the contradictory or tautological nature of the unacceptable sentences. If one were to depend on Gajewski's (2002) explanation for the distinctly odder nature of the sentences discussed in section 2.2, one would still need a separate account of the unacceptable plurals or at least be a little more nuanced in the separation of "logical" and "non-logical" grammatical items.

There are both strengths and weaknesses to connecting logical analyticity to ungrammaticality. The strength is that such a proposal is able to account for why some analytic expressions not only sound distinctly odder, but also cannot be embedded under intensional verbs and cannot be used in flouting. The weakness is that the oddness of analytic expressions no longer follows from well-known principles of Gricean reasoning. Rather, the new grammatical principle in (30) is a necessary stipulation. Recall, one of the most appealing aspects of this type of explanation is that the oddness of sentences followed from Gricean reasoning in combination with the semantics that was independently needed to account for the truth conditions of

acceptable sentences. The principle in (30) does not follow from other well-known properties of semantics or pragmatics.

2.3.3 Summary

In summary, there are at least two advantages to a theory that equates sentential anomalies with contradictions and tautologies. First, such a theory can appeal to well-known pragmatic principles to account for unacceptability judgments. Second, the semantics that is independently motivated by acceptable sentences is the same semantics that derives contradictions and tautologies in other sentences. In other words, there is independent evidence supporting the hypothesis that the unacceptable sentences might indeed be analytically false and true.

The main weakness of such a system is that it is unable to explain why there is an empirical contrast between two groups of contradictions and tautologies. One group of sentences sounds distinctly odder than the other. That same group also sounds acceptable when they are used in contexts where the speaker is flouting the Maxim of Quantity and when they are embedded under certain types of propositional attitude verbs. The unacceptable nature of the second group persists even in these types of environments. Overall, any theory that can naturally account for the contrast between these two groups of sentences would be empirically more adequate than the theories reviewed in this section.

3 Presupposition Failure

Another potential explanation for why a sentence sounds odd has its roots in presupposition. For ease of exposition, I will define presuppositions along the lines of Stalnaker (1973): presuppositions are the propositions entailed by the common ground, where the *common ground* is what is known, and known to be known, by both the speaker and hearer. In a slight abuse of terminology, I will sometimes characterize a sentence S as "presupposing" a proposition p if a precondition for interpreting S is that it be evaluated in a context where the common ground entails p. Often linguists and philosophers hypothesize that these *preconditions* are a result of partial functions or truth value gaps (see Frege 1892, Strawson 1952, van Fraassen 1966, 1968, among others). I will follow this tradition in my representation of truth conditions in this section, although nothing I say depends on this theoretical choice.

Technically speaking, sentences do not "presuppose" anything, only people do. However, it is well-known that certain phrases and words signal that the people engaged in a conversation have a certain type of common ground, as shown with the adverb *again* in (31a), the verb *know* in (31b) and the cleft construction in (31c).

(31) a. Hilary Clinton is campaigning to be president again.

b. My mother knows that Bertrand Russell co-wrote Principia Mathematica.

c. It was Oswald who shot John F. Kennedy.

In normal circumstances, even if one denies the statements in (31) or simply doubts their veracity, one still implicitly accepts that it is common ground that Hilary Clinton campaigned to be president sometime in the past, that Bertrand Russell co-wrote Principia Mathematica, and that somebody shot John F. Kennedy.

The rest of this section discusses the interaction between presupposition failure and accommodation. In particular, it reviews theories that account for sentential anomalies by appealing to a hearer's inability or unwillingness to accommodate the speaker. There are two advantages to this approach. First, similar to the previous approach, feelings of unacceptability are grounded in well-established pragmatic generalizations. Second, since sentential anomaly is related to a hearer's willingness to accommodate a presupposition, this account can provide an explanation of why unacceptability is a gradable intuition.

3.1 Oddity and Accommodation

A potential source of oddity arises when a sentence S with the presupposition p is uttered in a context where the common ground does not entail p. I say "potential" since, as discussed by Stalnaker (1973) among others (e.g., von Fintel 2008, Heim 1990, 1983, Karttunen 1974, etc.), the oddness of a sentence can often be mitigated through a process that Lewis (1979) called *accommodation*. Accommodation can be characterized as follows: If a statement is uttered and it has the presupposition p, but the current common ground does not entail p, then the hearer will often accommodate the speaker by updating the common ground so that it entails p before evaluating the statement.

As Stalnaker (1973) argued, this type of update is a natural extension of Gricean requirements on cooperation. According to the Cooperative Principle, the hearer assumes that the speaker's statement will be appropriately informative (MAXIM OF QUANTITY). However, if a sentence has a presupposition that is not entailed by the common ground, then that sentence would be completely uninformative (since it would be undefined and thus lack a meaning). To rescue the assumption that the speaker is being cooperative, the hearer needs to update the common ground. As Karttunen (1974) characterized the process...

> ...a sentence is always taken to be an increment to a context that satisfies its presuppositions. If the current conversational context does not suffice, the listener is entitled and expected to extend it as required...

The mental gymnastics that the hearer is expected to go through is not so different from the type of reasoning a hearer engages in when computing quantity implicatures. For example, upon hearing *some of the students failed my semantics class*, the hearer assumes that the speaker is being cooperative and hence communicating a message that is appropriately informative. If all of the students failed, then the speaker's statement would have been under-informative. By assuming that not all of the students failed (i.e., by adding this proposition to the common ground), the hearer can interpret the speaker's overall message as being appropriately informative.

There are some important differences between these two types of processes, however such differences are orthogonal to our main point here, namely that accommodation is an expected consequence of Gricean reasoning.[3] Critically, speakers can plan their speech acts with the assumption that hearers will accommodate (within reason), much like they can assume that hearers will compute quantity implicatures. As Stalnaker (1973) characterized this process...

> ...as soon as there are established and mutually recognized rules relating what is said to the presumed common beliefs, it becomes possible to exploit those rules by acting as if the shared beliefs were different than they in fact are known to be...

In fact, blocking accommodation, theoretically speaking, would require either some extra grammatical principles or a careful redefinition of the MAXIM OF QUANTITY.

The pragmatic nature of accommodation might be helpful when trying to explain degrees of oddity. I will not spell out a detailed theory here but I can sketch out the basic outline of what such a theory should look like. The fundamental intuition is that the harder it is to accommodate a sentence, the more odd it sounds. For example, suppose I am engaged in a conversation with my friend John about a dinner he had on the previous night with our mutual acquaintance Mary. It would be completely acceptable for John to say the sentence in (32).

(32) I will have dinner with Mary again tomorrow night.

However, the exact same sentence would sound slightly odd if I had no idea whether or not John had dinner with Mary on the previous night and he knew I had no idea.

3 The main differences between accommodation and quantity implicatures are two-fold. i) With accommodation, the ordering of the added information is critical—the common ground must be updated before the statement can be informative. This is not true with respect to quantity implicatures. The implied information can be added before or after the information contained in the literal meaning of the statement. ii) Quantity implicatures are derived through competition with alternative statements whereas accommodation is derived by calculating the truth conditions of a single sentence.

Still, it would not be completely unacceptable since I could update my conception of the common ground to incorporate that he had dinner with Mary sometime in the past. In fact, the same sentence improves dramatically in the same type of context if the speaker makes explicit his expectation for me to accommodate, as in (33).

(33) a. **Me**: What did you do last night?
b. **John**: Let me put it this way. I will have dinner with Mary again tomorrow night.

This response is still not perfect, but it is much better than making the statement in (32) out of the blue.

Note also, that the sentence in (32) becomes quite a bit odder if John had previously uttered the sentence in (34).

(34) I have never had dinner with Mary.

Once the sentence in (34) has been integrated into the common ground, then I am no longer willing to accommodate the presuppositions introduced by (32). It is important to note, it is not that I could not see how to accommodate the sentence (I simply need to remove the proposition that John never had dinner with Mary before and then add the contrary proposition to my conception of the common ground), however this would require reanalyzing previous steps in our conversation. Although in principle it is not difficult for me to conceptualize how the sentence could be informative or to imagine a different conversation where the sentence would not sound odd, in practice my willingness to accommodate has limits.

If the inability or unwillingness to accommodate a sentence's presuppositions leads to a greater sense of oddity, then one could image that it might be possible for a sentence to have presuppositions that noone would be willing to accommodate into the common ground, no matter what context the sentence is uttered in. Following others, I will label this *catastrophic presupposition failure* and in the sections below I will assess whether this failure is a viable way to account for the oddity of certain types of sentences.

3.2 Catastrophic Presupposition Failure

From one perspective, an account of sentential oddities via presupposition failure is more natural than an account due to contradiction. First, the pragmatic nature of accommodation can potentially provide an explanation for why certain sentences sound odder than others. Second, there is no need to appeal to an arbitrary principle that classifies certain sentences (e.g., logically analytic sentences) as ungrammatical. However, despite this advantage, there are only a few accounts that appeal

to presupposition failure as the source of oddity. In what follows, I first discuss prototypical examples of catastrophic presupposition failure, such as *Truth burned up* before turning my attention to Chierchia's (1998) account of the distribution of quantifiers and plural marking.

3.2.1 The Truth Burns?

As discussed in Chomsky (1957, 1965), Katz & Fodor (1963), Katz (1964, 1971), among others, there are certain types of sentences which are not fully acceptable but which appear to have no obvious violation in terms of constituency structure. I list some of the more classic examples in (35) below.

(35) a. Golf plays John. (Chomsky 1965)
b. The boy may frighten sincerity. (Chomsky 1965)
c. Is his insecticide a spinster? (Katz 1964)
d. Truth burned up. (Katz 1964)

Chomsky (1965), Katz & Fodor (1963), and Katz (1964, 1971) all accounted for the deviance of these types of sentences by making a distinction between subcategorization rules and selectional restrictions. Subcategorization accounted for why certain lexical items were allowed to appear in certain phrase structure environments and yet were prohibited in others. For example, in Chomsky's system the word *eat* was subcategorized with features that allowed it to appear in both transitive and intransitive environments ([+__NP, +__#]) whereas *devour* was subcategorized only for transitive environments ([+__NP]). In contrast, selectional restrictions accounted for the sensitivity of lexical items to finer grained distinctions among the major categories, such as [± ANIMATE], [± HUMAN], [± ABSTRACT], etc. For example, in Chomsky's system the lexical item *believes* selects for a [+ANIMATE] subject.

One of the main reasons to distinguish between selectional restrictions versus subcategorization was a sense that violations of subcategorization were significantly more deviant than violations of selection, as demonstrated in (62).

(36) a. John devoured that Mary was sick.
b. The rock believed that Mary was sick.

It is claimed that there is a marked difference between sentences like (62a) which violate a phrase structure constraint (e.g., the requirement that *devour* have an NP object), and sentences like (62b) which violate a selectional constraint (e.g., *believe* selects for a [+ANIMATE] subject but instead has an inanimate noun). I will talk more thoroughly about Chomsky's account in section 4.

What is important for the present purposes is that the division between selectional restrictions and subcategorization can be recast as a division between syntactic versus semantic/pragmatic violations. This re-casting of Chomsky's distinctions, discussed by Chomsky himself although ultimately rejected, was foreshowed in a series of papers by Katz (1964, 1971), who described selectional restrictions in terms of concept coherence. According to Katz (1964, 1971), some concepts impose preconditions that get implemented during semantic composition. For example, the concept RED, when used as a modifier, requires that the concept it modifies have the feature [−ABSTRACT]. Since the concept IDEA had no such feature (it is clearly an abstract concept), the result of composing RED and IDEA into the concept RED IDEA is incoherent (i.e., non-metaphorical readings are impossible).

Although Katz (1964, 1971) was quite insistent on specifying these preconditions for concept formation in terms of features, it is not difficult to mimic his discussion by employing partial functions. For example, consider the interpretations for the words *play*, *frighten*, *spinster* and *burn-up* outlined in (37).

(37) a. $(\lambda y.\lambda x.\lambda e.\ \textsc{play}(x,y,e))(z)$ is defined only if z is a type of game, song or instrument. When defined,
$(\lambda y.\lambda x.\lambda e.\ \textsc{play}(x,y,e))(z) = \lambda x.\lambda e.\ \textsc{play}(x,z,e)$.

b. $(\lambda y.\lambda x.\lambda e.\ \textsc{frighten}(x,y,e))(z)$ is defined only if z is a type of thing that can hold an intentional state. When defined,
$(\lambda y.\lambda x.\lambda e.\ \textsc{frighten}(x,y,e))(z) = \lambda x.\lambda e.\ \textsc{frighten}(x,z,e)$.

c. $(\lambda x.\ \textsc{spinster}(x))(z)$ is defined only if z is human. When defined,
$(\lambda x.\ \textsc{spinster}(x))(z) = (\textsc{spinster}(z))$.

d. $(\lambda x.\ \textsc{burn-up}(x))(z)$ is defined only if z is a concrete, physical object or substance. When defined,
$(\lambda x.\ \textsc{burn-up}(x))(z) = (\textsc{burn-up}(z))$.

I will take (37d) as a prototypical example, although the following points hold for any of the interpretations in (37). The interpretation in (37d) specifies that *burned-up* is interpreted as a partial function from concrete, physical objects or substances to truth-values. Abstract objects like those in the denotation of *truth* are not in the domain of the function.

As further confirmation that these types of predicates behave like other presuppositions, consider the sentences in (38) with the nonce term *flimmick*.

(38) a. The flimmick burned up.

b. It isn't true that the flimmick burned up.

c. If the flimmick burned up, then I will be in trouble.

d. If a flimmick is a concrete physical object, then John's flimmick likely burned up.

Upon hearing the sentence in (38a), a hearer will assume that flimmicks are concrete physical objects, even if the hearer doubts whether the assertion is true or not. In other words, the mere assertion of (38a) implies critical information about the nature of flimmicks. This presupposition projects when embedded under negation (38b) and in the antecedent of a conditional (38c): a typical characteristic of presuppositions. Furthermore, this implication is blocked when the antecedent of a conditional asserts that flimmick's are concrete physical objects, as in (38d). Once again, another typical pattern of presuppositions.

With this presuppositional account of *burned-up* in mind, let's reconsider the sentence in (35d), repeated below.

(35d) Truth burned up.

If the presuppositional account is on the right track, then upon encountering a sentence like (35d), the hearer should reason that the speaker is being cooperative. If the speaker is being cooperative, then the speaker's statement should provide the appropriate amount of information and hence must have a truth value. In order to have a truth value, either the denotation of *truth* would have to be a concrete physical entity or the interpretation of *burned up* would have to be different than what it is in (37d). In other words, accommodating the speaker would require re-writing lexical interpretations or imagining a context where truth was a concrete thing. It is reasonable to suspect that this type of accommodation is too demanding in most if not all circumstances: either the hearer cannot even fathom how truth could be concrete and physical or the hearer cannot fathom how burning up can apply to abstract, non-physical entities. There is an option of interpreting the statement metaphorically, however such interpretations usual run parallel to a literal meaning. What is interesting about (35d) is that there is no such thing as a literal meaning.

Note that this type of explanation can explain the contrast between sentences like (39) and (35d), repeated below.

(39) The king of France is bald.

(35d) Truth burned up.

By most judgments, (35d) is distinctly odder than (39) even though most speakers are unwilling to accommodate the preconditions of either utterance. However, unlike (35d), one can easily imagine how such a sentence could be accommodated: one just needs to add to their common ground the proposition that there exists a king of France. Adding such a proposition is far easier to accommodate than adding the proposition that truth is a physical entity. In other words, even if a hearer is unwilling to accommodate (39), they can image the steps and contexts that would lead to a coherent sentence. This is not possible with (35d).

3.2.2 Chierchia 1998

Chierchia (1998) hypothesizes that the distribution of quantifiers among mass nouns, singular count nouns and plural nouns is determined by denotational preconditions imposed by the quantifiers themselves. This proposal runs directly contrary to a more syntactic approach, such as the one offered by Chomsky (1965), where lexical items are subcategorized to appear in certain types of phrase structure environments. I will talk about the syntactic alternative in more detail in section 4.

The basis of Chierchia's presuppositional account of the mass-count distinction relies on the denotational categories he associates with mass nouns, singular count nouns and plural count nouns (discussed briefly in section 2.2). Chierchia (1998) adopts the fairly standard assumption that the denotation of singular count nouns is a set of atoms (i.e., singular entities that have no subparts). This assumption is supported by how speakers use demonstrative phrases and nominal predicates such as *that couch* and *is a couch*. Such demonstratives and predicates are only used to pick out singular entities and are only true of singular entities, respectively. In contrast, demonstrative phrases with plural count nouns (such as *those couches*) are generally used to pick out groups of two or more entities and similarly, nominal predicates with plural count nouns (such as *are couches*) are generally only true of groups of two or more. Based on evidence like this, and following Link (1983), Chierchia (1998) analyses plural count nouns as denoting a set of groups, where each group consists of more than one individual. In contrast to plural and singular count nouns, demonstrative phrases with mass nouns (such as *that furniture*) can be used to refer to either singular entities (e.g., a single couch) or groups of entities (e.g., several couches). Similarly, predicates with mass nouns (such as *is/are furniture*) can be true of both groups and individuals. To account for these facts, Chierchia assigns mass nouns a denotation that is true of both groups and individuals. The division between singular count, plural count and mass nouns is represented in the graph in Figure 1.

To account for the distributional characteristics of quantifiers, Chierchia (1998) hypothesizes that most quantifiers specify certain preconditions that must be satisfied before the quantifier can coherently combine with its nominal complement. These preconditions critically rely on the denotational difference outlined in Figure 1. As Chierchia observes, in mass-count languages, there are four major categories of quantifiers:

i. **Singular Quantifiers**: Quantifiers like *every* require that the complement noun have a singular denotation;

ii. **Plural Quantifiers**: Quantifiers like *several* require that the complement noun have a plural denotation;

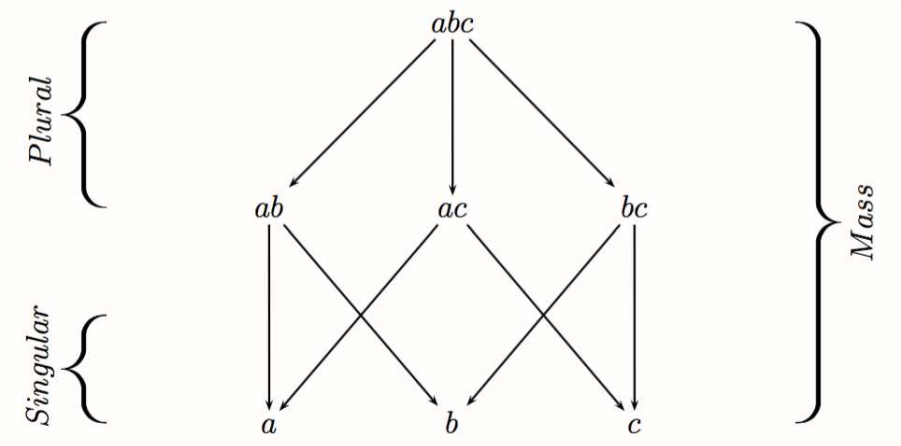


Figure 1 **A visual representation of the denotational restrictions.** The interpretation of singular nouns are restricted to sets of singular entities and the interpretation of plural nouns to sets of groups, while the interpretation of mass nouns is much broader. For example, if a, b and c are couches, and there are no other pieces of furniture in the domain other than these couches, then $[\![couch]\!] = \{a, b, c\}$, $[\![couches]\!] = \{ab, ac, bc, abc\}$, and $[\![furniture]\!] = \{a, b, c, ab, ac, bc, abc\}$.

iii. **Non-Singular Quantifiers**: Quantifiers like *all* require that the complement noun have a non-singular denotation;

iv. **General Quantifiers**: Quantifiers like *no* impose no requirements.

To capture these facts, Chierchia (1998) proposes three different types of denotational checking functions, as outlined in (40).

(40) Let all potential domains D be closed under join, such that if * is the join closure operation, then $D = {}^*D$. Also, let D be generated by the set of atoms in D (i.e., if ATOM is the set of atoms in D, then $D = {}^*\text{ATOM}$).

a. **Singular Check**: Let S be a function from subsets of D to truth values such that for any set X, $S(X) = 1$ iff $X \subseteq \text{ATOM}$.

b. **Plural Check**: Let P be a function from subsets of D to truth values such that for any set X, $P(X) = 1$ iff there is a subset Z of ATOM such that $({}^*Z - Z) = X$ (i.e., elements in X are all the plural entities generated from a set of singulars, but X does not contain any of the singulars).

c. **Non-singular Check**: Let CL be a function from subsets of D to truth values such that for any set X, $CL(X) = 1$ iff ${}^*X = X$. (Note, CL stands for *closed* as in "X is closed under join.")

The function S is only true of singular count noun denotations. The function P is only true of plural count noun denotations. The function CL is only true of plural count noun and mass noun denotations. With these functions in mind, the preconditions on quantifiers can be defined as follows.

(41) PRECONDITIONS ON QS

a. **Example of a Singular Q**: For any subset Z of the domain D, $[\![every]\!]^M(Z)$ is defined only if $S(Z) = 1$.

b. **Example of a Plural Q**: For any subset Z of the domain D, $[\![several]\!]^M(Z)$ is defined only if $P(Z) = 1$.

c. **Example of a Non-Singular Q**: For any subset Z of the domain D, $[\![all]\!]^M(Z)$ is defined only if $CL(Z) = 1$.

d. **Example of a General Q**: For any subset Z of the domain D, $[\![no]\!]^M(Z)$ is always defined.

Deliberately absent from these quantifier types is the contrast between *many* vs. *much*, *little* vs. *few*, and *less* vs. *fewer*. On the surface, *many*, *few* and *fewer* pattern like *several* in that they only appear with plural count nouns. However, *much*, *little*

and *less* do not pattern like any of the quantifiers mentioned above. Descriptively, all three quantifiers only seem to combine with mass noun complements.

Theoretically speaking, it is possible to specify a third denotational checking function that can account for this distribution, as specified in (42).

(42) A POSSIBLE MASS NOUN PRECONDITION: For any subset Z of the domain D, $[\![much]\!]^M(Z)$ is defined only if $CL(Z) = 1$ and $\neg(PL(Z))$.

However, there are two reasons why we might not want to have this fourth possible precondition. First, the existence of quantifiers that only appear next to mass nouns is rare cross-linguistically. Second, in languages that seem to have such quantifiers on the surface, there always exists a related quantifier that has the same meaning but exclusively applies to plural nouns. Given these facts, it seems more reasonable to hypothesize that *much* and *many* are allomorphic variations of the same underlying quantifier. Likewise for *little* and *few*, and *less* and *fewer*. In other words, the root quantifier applies to both plural and mass nouns much like *most* however the variation in form is triggered by other factors in the syntactic environment. For example, the quantifier underlying *many/much* appears with both plural and mass nouns, but surfaces as *many* when appearing next to plurals (see Wellwood 2014 for a detailed analysis of *many* as an allomorph of *much*). For the rest of this paper, I will assume that this account of the quantifier distribution is on the right track and hence that there is no quantifier that has a mass-noun checking mechanism as a precondition. I will also spell out the allomorphic mechanism in more detail in section 4.

Chierchia's (1998) account of the distribution of quantifiers fits perfectly with the general theme of catastrophic presupposition failure. For example, consider the distinctly odd sentences in (43).

(43) a. # All man will eventually be alone.
b. # Every men will eventually be alone.

The quantifier *all* signals to the hearer that they should implicitly assume that $[\![man]\!]^M$ is closed under join. Otherwise the sentence would not have an interpretation. Similarly, the quantifier *every* signals to the hearer that they should implicitly assume that $[\![men]\!]^M$ is a subset of the atoms in the domain. However, in most contexts, these preconditions are not accommodatable. The noun *man* is singular and if there is more than one man in the context, it is impossible to interpret the noun as being closed under join. In contrast, the noun *men* is plural and if there is more than one man in the context, it is impossible to interpret the noun as being a subset of the set of atoms. Hence why, according to Chierchia, the sentences sound so odd.

There are several advantages to Chierchia's (1998) system. First, due to catastrophic presupposition failure, there is a fairly comprehensive explanation of both the acceptable and unacceptable judgments of all the sentences in (44).

(44) a. Every couch/*couches/*furniture will be stored in the warehouse.
b. Several couches/*couch/*furniture will be stored in the warehouse.
c. All couches/furniture/*couch will be stored in the warehouse.
d. Shakers used local American woods such as pine and cherry, but for most Shaker furniture/chairs/*chair, maple was the wood of choice.
e. No men/man/furniture will ever please Mrs. Donaldson.

For the sentences to be interpretable, *every* must combine with a singular denotation, *several* must combine with a plural denotation, and finally *all/most* must combine with denotations that are closed under join. In contrast, *no* can combine with any type of denotation. Presuppositional accommodation would either require the hearer to hypothesize that the speaker has a non-conventional meaning assigned to the quantifier or that certain nouns are assigned to different semantic types than the grammatical rules dictate. Accommodations of this kind are not pragmatically reasonable in most contexts.

Second, this theory also accounts for certain distributional gaps. If the three denotational checking functions defined above are the only possible preconditions available to quantifiers, then it falls out as a consequence that there cannot be a quantifier that appears with both singular count and mass nouns to the exclusion of plural nouns. Similarly, it follows that there cannot be a quantifier that appears with both singular and plural count nouns to the exclusion of mass nouns.

(45) CROSS LINGUISTIC GENERALIZATIONS
a. There is no known quantifier that applies exclusively to singular count and mass nouns to the exclusion plural nouns.
b. There is no known quantifier that applies exclusively to singular count and plural nouns to the exclusion of mass nouns.

Cross-linguistically, there are no clear examples of quantifiers that violate these predictions.[4]

In summary, Chierchia's (1998) system of preconditions accounts not only for the distribution of quantifiers but also for certain cross-linguistic distributional gaps. His system is able to do this without appealing to separate syntactic subcategories. Rather, the distributional characteristics of quantifiers and the cross-linguistic variations amongst quantifiers stem from catastrophic presupposition failures.

4 The closest violation is the fact that numerals in Western Armenian can modify either nouns with plural marking or nouns without (see Borer 2005, Bale et al. 2011a,b, Bale & Khanjian 2014, 2009). However, as discussed in Bale et al. 2011a,b, Bale & Khanjian 2014, 2009, non-plural nouns in Western Armenian do not have a singular interpretation.

3.3 Summary and Criticisms

There are many aspects of presupposition failure that are promising with respect to grammatical anomalies. First and foremost, it provides a natural explanation of why anomalous sentences might vary in their degree of unacceptability: certain presuppositions are more difficult to accommodate than others. Second, insofar as the presuppositions can be independently motivated (e.g., through projection), the presuppositional account appeals to aspects of meaning that are needed independent of anomaly.

Despite its advantages, there is one significant potential flaw, especially with respect to nominal subcategories. The basic problem comes from the fact that sometimes nouns have an empty denotation. For example, suppose we are in a context where there is no furniture. In such a context, the nouns *chair*, *chairs* and *furniture* would have the exact same denotation, namely the empty set. This is a perfectly suitable denotation for such nouns. It can be used to evaluate certain sentences as true, such as those in (46), and others as false, such as those in (47).

(46) a. There is no furniture here.
b. There are no chairs here.
c. There is no chair here.

(47) a. There is too much furniture here.
b. There are several chairs here.
c. There is a chair here.

Because this is a suitable denotation, the checking functions, *P*, *S* and *CL*, should be satisfied by the empty set. However, a problem arises when considering atypical combinations of quantifiers and nouns.

(48) Suppose we are in a context where there is no furniture and hence $[\![furniture]\!] = [\![chair]\!] = [\![chairs]\!] = \emptyset$.
a. # There are several furniture here.
b. # There are several chair here.
c. # There is a chairs here.
d. # There is a furniture here.

If the anomalous nature of the phrases like *several furniture* were due to the fact that *furniture* has a different kind of denotation than *chairs*, then the anomaly should disappear when *furniture* and *chairs* have the same type of denotation, namely the empty set. The same holds for the distributional differences between *chair* and *chairs*, as well as those between *furniture* and *chair*. However, as demonstrated

in (48) the distributional differences persist even when the denotations of the nouns are equivalent.

The empty denotation is not the only way that the denotation of different types of nouns could be equivalent. For example, another potential problem arises in a context where the only piece of furniture is a single chair. In this context, the denotation of *furniture* and *chair* would once again be equivalent, consisting of the singleton set containing the single chair. However, there is still a contrast between the sentences in (49).

(49) Suppose we are in a context where $[\![furniture]\!] = [\![chair]\!] = \{c\}$, where c is the only chair and the only piece of furniture.

a. There is a chair in the room.

b. There is less furniture in the room than I thought.

c. # There is a furniture in the room.

d. # There is less chair in the room than I thought.

Chierchia (1998) recognized this potential problem and proposed that the presuppositional functions *P*, *S*, and *CL* would have to hold across all possible contexts in order to account for the distribution of nouns in contexts where the extensional denotations are equivalent. In other words, the checking functions would need to hold intensionally even though the nominal denotation itself is only interpreted with respect to the present world/context. Let's reconsider the definitions of the presuppositional functions above with this kind of intensional definition spelled out in more detail. For the sake of simplicity, I will use world variables w to represent possible contexts and assume that models M consist of a domain of contexts and a lexical assignment function that is relative to a world/context.

(50) INTENSIONAL PRECONDITIONS ON QS: Let the denotation of any nominal predicate P be a function from worlds/contexts to sets that are a subset of the domain of w (i.e., functions of type $\langle s, \langle e,t\rangle\rangle$). Let generalized quantifiers be functions from nominal denotations to functions from worlds to truth values (i.e., functions of type $\langle\langle s, \langle e,t\rangle\rangle, \langle s,t\rangle\rangle$). For example, for all models M, $[\![boy]\!]^M = \lambda w.\{x : x \text{ is a boy in } w\}$ and $[\![no\ boy]\!]^M = \lambda P.\lambda w.(\{x : x \text{ is a boy in } w\} \cap (P(w)) = \emptyset)$.

a. **Example of a Singular Q**: For any nominal denotation Z, $[\![every]\!]^M(Z)$ is defined only if $\forall w.\ S(Z(w)) = 1$.

b. **Example of a Plural Q**: For any nominal denotation Z, $[\![several]\!]^M(Z)$ is defined only if $\forall w.\ P(Z(w)) = 1$.

c. **Example of a Non-Singular Q**: For any nominal denotation Z, $[\![all]\!]^M(Z)$ is defined only if $\forall w.\ CL(Z(w)) = 1$.

d. **Example of a General Q**: For any nominal denotation Z, $[\![no]\!]^M(Z)$ is always defined.

The intensional version of the checking functions avoid the problem of contexts where plural, singular and mass denotations happen to be the same. However, there is something vaguely uncomfortable with the idea that the presuppotional checking functions exploit the intensional nature of the nouns even when the entire sentence is only evaluated in the present context. Fortunately, vaguely uncomfortable feelings do not have much scientific weight when it comes to evaluating theories.

Perhaps less fortunately, there are two main arguments why these intensionalized versions of the checking functions are still off the mark. First, in this type of explanation, there is an implicit assumption that *furniture* and *chair* will consistently map to the right kind of denotations across all worlds/context in any model. In other words, in all Models M and worlds w, $[\![chair]\!]^M(w)$ will always be a subset of the set of atoms in the domain associated with w, and similarly $[\![furniture]\!]^M(w)$ will always be a subset of the domain associated with w that is closed under group formation. The question becomes, how can/does our system implement the consistent behaviour of these lexical items? In other words, what prevents the possibility of a world w' where $[\![furniture]\!]^M(w')$ is mapped to an atomic set (for instance a set of chairs in w') and what prevents the possibility of a world w'' where $[\![chair]\!]^M(w'')$ is mapped to a set that not only contains all the chairs in w'' but also all groups that can be formed consisting of those chairs?

The standard answer to this question in model theoretic semantics is that *furniture* and *chair* belong to different types and that the lexical interpretation respects the restriction on types in all models and in all worlds within those models (see the discussion in Gillon 2012a, Carpenter 1997, Klein & Sag 1985). However, typing restrictions require that the lexical items be marked in some way so that the interpretation function has the proper information about which type-category the lexical item belongs to. If the interpretation function is a map from syntactic objects (lexical items and phrases) to semantic denotations, then the standard treatment of typing requires that the syntactic object be marked in some way so that, for example, *furniture* is consistently mapped to closed sets and *chair* is consistently mapped to atomic sets. Hence, underpinning an intensional semantic category is a distinction among syntactic items: *furniture* and *chair* are marked as belonging to different types. However, this begs the question: If *furniture* and *chair* require some kind of syntactic distinction, why not provide a syntactic explanation for their different distributions?

The other problem with the intensional version of the checking functions has to do with contradictory nominal predicates: i.e., predicates that can never be satisfied by any referential subject. Although the intensional implementation of S, P and CL

in (50) avoids problematic cases where mass nouns, singular count nouns and plural nouns happen to have the same empty denotation, they are still problematic when considering nominal predicates that denote the empty set in all possible worlds in any given model. Such predicates are listed in (51).

(51) a. furniture that is not furniture
b. chairs that are not chairs
c. chair that is not a chair

These phrases support a metaphorical meaning, but under a literal interpretation the predicates can never be satisfied. I am assuming here that metaphorical interpretations are not in the domain of the semantic interpretation function, however even if one weakens this assumption, the phrases in (51) could be re-stated in ways that avoid metaphorical interpretations. For example, *furniture that is not furniture* can be re-stated as *actual furniture that is not actually furniture*. The points made below hold for all types of rephrasing that resist metaphorical interpretations.

Perhaps unsurprisingly, these intensionally empty predicates pattern exactly like their non-intensionally counterparts. There is one minor difference: the intensionally empty predicates often yield contradictory or tautological statements, although critically these statements are not of the extremely unacceptable variety discussed in section 2. However, independent of this one difference, all such predicates are acceptable when they appear with certain quantifiers, as shown in (52) and (53), yet distinctly odd in other contexts, as shown in (54).

(52) a. There is no furniture that is not furniture here (or anywhere else).
b. There are no chairs that are not chairs here (or anywhere else).
c. There is no chair that is not a chair here (or anywhere else).

(53) a. There is too much furniture that is not furniture here.
b. There are several chairs that are not chairs here.
c. There is a chair that is not a chair here.

(54) a. # There are several furniture that is not furniture here.
b. # There are several chair that is not a chair here.
c. # There is a chairs that are not chairs here.
d. # There is a furniture that is not furniture here.

As shown in (54), the nominal predicates [*furniture that is not furniture*] and [*chair that is not a chair*] sound much odder as complements of *several* than the nominal predicate [*chairs that are not chairs*]. Similarly, [*chairs that are not chairs*] and

[*furniture that is not furniture*] sound much odder as complements of the indefinite determiner than [*chair that is not a chair*].

It is important to note that Chierchia 2010 employs a different semantic system than Chierchia 1998. This updated system does not explicitly address the distribution of quantifiers so it is difficult to compare the two theories in this respect, however Chierchia (2010) does imply that such a distribution will still follow from the presuppositional nature of the quantifiers. In the updated system, Chierchia adopts the same type of denotation for singular count nouns but changes the denotational types for plural count nouns and mass nouns: (i) plural count nouns denote sets that contain singular atoms and all the groups generated from those singulars and (ii) mass nouns denote a property that is only true of maximal elements in some join semi-lattice.[5] For example, suppose that a, b and c are all chairs and the only pieces of furniture in a given context. According to Chierchia (2010), in this context the singular noun *chair* would denote the set $\{a,b,c\}$, the plural noun *chairs* would denote the set $\{a,b,c,ab,ac,bc,abc\}$, while the mass noun *furniture* would denote the singleton set $\{abc\}$. Whatever the preconditions are on the quantifiers, the same problems arise in this new system. In contexts where there is no furniture, or in contexts where the only piece of furniture is a single chair, the denotations of the three types of nouns will be identical.

As discussed in the next section, the problem with these types of systems lies not with the semantic characterization of the different categories, nor with the nature of the presuppositional checking functions, but with the fact that quantifier distribution boils down to a syntactic and not semantic distinction.

4 Syntactic Violations

The syntactic explanation of sentential oddities seeks to account for some of the unacceptability judgments through violations of syntactic rules and/or constraints. To simplify the discussion, I concentrate on violations due to subcategorization rather than those due to restrictions on movement and binding.

Even in the earliest versions of phrase structure grammar (Harris 1946, Wells 1947 among others), the distributional characteristics of words was one of the central descriptive data-points that linguistic theory sought to account for. At the heart of these data-points was not only the observed distribution, but the feeling of oddness or ungrammaticality, and the lack thereof, when novel word combinations were

5 For now, I will side-step the issue of vagueness, which, although is central to Chierchia's motivation for switching from one system to another, is orthogonal to the issue at hand in this section. Also, for simplicity, I will ignore kind denotations. Like Chierchia (1998, 2010), I will assume that the semantic system has operations that can freely coerce mass and plural denotations into kind denotations and vice versa.

presented to native speakers. Let's consider the difference between transitive and intransitive verbs as our prototypical example, as exhibited by the verbs *eat* and *devour* in (55).

(55) a. The furniture monster already ate our couch.
b. The furniture monster already ate.
c. The furniture monster already devoured our couch.
d. # The furniture monster already devoured.

Although *eat* is acceptable in both a transitive and intransitive environments, *devour* is limited to transitive environments. As argued by Chomsky (1965), the fact that near synonyms pattern so differently make it unlikely that this kind of distribution can be directly attributed to the meaning of the verbs. Furthermore, the fact that the contrast between *devour* and *eat* persists even when novel (and unlikely) word combinations are used, as in (55), provides evidence against any account that appeals to familiarity or statistical probabilities. Chomsky (1965) argues that a much more likely explanation is that *eat* and *devour* have syntactic features which only allow the verbs to appear in certain syntactic environments: *devour* happens to be much more restrictive than *eat*.

There are many ways that theories have accounted for subcategorization facts like these, but almost all versions involve marking lexical items with some kind of syntactic feature that either selects for or limits the number of syntactic environments it can appear in. For the sake of clarity, I will review two options: one based on the notation used in Chomsky 1965 and another based on the notation used in Chomsky 2000.

In Chomsky's (1965) system, lexical items contain a list of syntactic environments that they can be used in. The syntactic structure is grammatical as long as the environment the lexical item appears in satisfies at least one member of this list. Syntactic environments are symbolized using the underscore symbol plus the relevant syntactic category or feature the lexical item is expected to be adjacent to at the point of insertion. For example, to symbolize that *eat* can appear in either transitive or intransitive environments, it would contain the list $\{\_DP, \_\#\}$, where # encodes the absence of a verbal complement. In contrast, *devour*'s list would only contain the transitive environment ($\{\_DP\}$). By assumption, the appearance of a lexical item in an improper environment would lead to a feeling of unacceptability.

In Chomsky's (2000) system (see also Adger 2003 for a detailed introduction), lexical items contain uninterpretable features which can be deleted once the appropriate complement is selected. For example, a verb like *devour* would have an uninterpretable uD feature which can be "checked" by the introduction of a D complement (i.e., a determiner phrase). A key aspect of this type of theory is that so-called uninterpretable features must be deleted before the end of the derivation (i.e.,

before the syntactic structure is shipped to the cognitive-intensional interface). In essence, this system ends up being quite similar to the systems of subcategories developed in early phrase structure grammars (e.g., Wells 1947, Harris 1946) and in early versions of the Lambek Calculus (Lambek 1958) and other types of Categorial Grammars. It also inherits the problems that such systems have in trying to account for the fact that certain lexical items (but not all) appear in more than one syntactic environment, as exhibited by *eat* in the examples above. In a selectional system, for *eat* to be transitive and intransitive, either *eat* must be ambiguous or the transitive and intransitive environments must be sub-environments of a broader distributional category. However, as noted by Gillon (2012a), a selectional system can be developed to handle this type of underspecification.

In the rest of this section, I discuss how traditional mass-count features fail to provide a better account of the distribution of quantifiers than Chierchia (1998). I then develop a better feature system for the mass-count distinction, one that is based on the empirical observations made in Chierchia 1998. This system is able to account for the distributional characteristics of quantifiers without encountering any problems with empty denotations. Overall, the new feature system provides a better account of the mass-count distinction than the purely presuppositional account.

4.1 The mass-count distinction and why traditional features fail

Given the weaknesses of the presuppositional account of the distribution of quantifiers, it seems prudent to explore an account based on syntactic subcategorization rather than catastrophic presupposition failure. However, it is important to first note that a straightforward syntactic account does not fair better than the presuppositional account offered by Chierchia (1998). In this section, I discuss a naive syntactic theory of the mass-count distinction before presenting a revised theory in section 4.2.

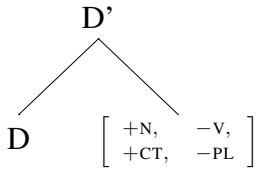
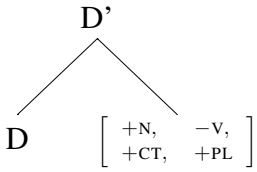
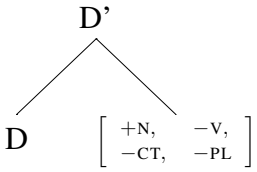
As hypothesized by Chomsky (1965), and discussed in detail by Gillon (1999), one way to represent the mass, count, and plural distinction is to use two binary features, [±CT] and [±PL]. In this type of theory, singular count nouns would contain the features [+CT, −PL], plural count nouns would contain the features [+CT, +PL], and prototypical mass nouns would contain the features [−CT, −PL]. As noted by Gillon (1999), there is even some evidence for a category of nouns with the features [−CT , +PL]. Nouns like *groceries*, *brains*, *remains* and *fireworks* (just to name a few) have overt plural morphology and trigger plural agreement but otherwise pattern like mass nouns.

With these features in place, the distribution of quantifiers can be characterized in terms of a set of subcategorization features. For example, quantifiers that only combine with singular count nouns like *every* could have the subcategoriza-

tion set {_[+CT, −PL]} whereas quantifiers that only combine with plural count nouns like *several* could have the subcategorization set {_[+CT, +PL]}. In contrast, quantifiers that combine with either plural count nouns or mass nouns, like *most*, could have the subcategorization set {_[+CT, +PL], _[−CT]}. Finally quantifiers that combine with any noun, such as *no*, could have the subcategorization set {_[+N,−V]}, or if we did not want to appeal to general nominal features, then equivalently {_[+PL], _[−PL]}.

These features give a list of possible quantificational complements that can appear to the right of the quantifier. Basically, there are three main environments as outlined in (56), (for now we will leave aside plural mass nouns, although our feature system here is compatible with such nouns).

(56)

Singular Count Environment	**Plural Count Environment**	**Mass Noun Environment**
		

A quantifier can appear in the slot marked by D only if one of members of the quantifier's subcategorization set is consistent with the features in the complement. Hence, a quantifier with the subcategorization set {_[+CT, −PL]} can only appear in the singular count environment whereas one with the subcategorization set {_[+CT, +PL]} can only appear in the plural count environment. In contrast, a quantifier with the subcategorization set {_[+CT, +PL], _[−CT]} can appear in either the plural count environment or the mass noun environment. As the reader can verify, these features (with the appropriate subcategorization frames) correctly account for the distribution of known quantifiers.

However there is a problem. Recall that Chierchia's system was able to account for two cross-linguistic generalizations, given in (45) and repeated below.

(45) CROSS-LINGUISTIC GENERALIZATIONS

a. There is no known quantifier that applies exclusively to singular count and mass nouns to the exclusion plural nouns.

b. There is no known quantifier that applies exclusively to singular count and plural nouns to the exclusion of mass nouns.

With the features ±CT and ±PL, this distributional gap would be coincidental. It would be easy to specify a subcategorization set that would characterize a quantifier that only attaches to singular and plural count nouns, namely {_[+CT]}. Similarly,

it would be easy to specify a set that would characterize a quantifier that only attaches to singular nouns independent of whether they are mass or count, namely {_[−PL]}. In other words, there is no principled explanation in this theory of why certain distributional gaps exist cross-linguistically.

The situation does not improve if we move to a representation of subcategorization using selectional features. In this type of theory, quantifiers have uninterpretable features that determine the type of complements they take. The range of uninterpretable features are as follows: {*u*[+CT], u[−CT], u[+PL], u[−PL]}. A lexical item would have a subset of these uninterpretable features. General determiners, like *no*, would not require any of these features but rather would just select for any noun (i.e., they would have a uN feature). In contrast, singular count-noun determiners, like *every*, would need the features *u*[+CT] and u[−PL] whereas the plural count noun determiners, like *several*, would need the features *u*[+CT] and u[+PL]. A problem arrises with when it comes to determiners like *all* that select for either plural nouns or mass nouns. These two categories have no features in common and hence there is no single uninterpretable feature or set of such features that could yield the correct distribution.

Not only do selectional features have problems accounting for fact that plural nouns and mass nouns seem to form a natural class, they also over-generate much like the previous theory. For example, if a determiner only had the uninterpretable feature *u*[+CT], then it would select for singular and plural count nouns to the exclusion of mass nouns. Similarly, if a determiner only had the uninterpretable feature *u*[−PL], then it would select for singular count and mass nouns to the exclusion of plural count nouns. Neither type of quantifier is attested cross-linguistically.

4.2 An updated version of the mass-count contrast

An alternative account of the mass-count distribution takes advantage of Chierchia's distributional observations by employing four monovalent features: *n*, SG, PL and CL which represent the intuitive idea of *noun*, *singular*, *plural* and *closed* respectively. There are two main advantages of this syntactic system. First, unlike the system proposed in section 4.1, this theory can explain why there are certain distributional gaps cross-linguistically. Second, by accounting for the mass-count distinction syntactically, the system avoids problems where nouns share the same denotation but yet have a different distribution. This is beneficial not only with respect to empty denotations, but also with respect to evidence that plural denotations have atomic minimal parts (and thus are sometimes not distinguishable from mass nouns).

4.2.1 Monovalent features and the distribution of quantifiers

Before discussing the interaction between monovalent syntactic features and semantic interpretations, it is important to fully spell out how the features *n*, SG, PL and CL can characterize the mass-count distinction and also how these features interact with subcategorization processes. This section explores the syntactic details of using these four monovalent features. It first outlines how singular count nouns, mass nouns and plural count nouns are featurally encoded before discussing the range of possible quantifiers in terms of subcategorization.

Building off of Chierchia's (1998) observations, a distinction between singular count nouns, plural count nouns and mass nouns can be represented as follows (note, I leave a discussion of plural mass nouns to section 4.2.4):

- singular count nouns have the features [*n*, SG],
- plural count nouns have the features [*n*, PL, CL] and
- mass nouns have the features [*n*, CL].

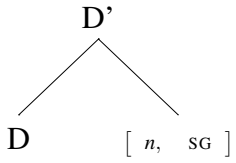
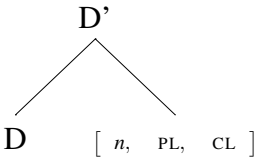
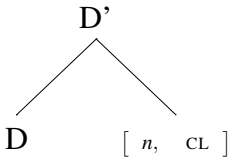
An important aspect of this feature system is that the plural feature cannot appear independently of the CL feature. Semantically speaking, this simply states that plural denotations are closed under join. However, to capture the syntactic relationship between these two features, I will assume that the following redundancy rule holds:

(57) PL $\rightarrow$ CL

In other words, the presence of PL implies the presence of CL.

This type of feature system yields three environments for determiners, as outlined in (58).

(58)

Singular Count Environment	**Plural Count Environment**	**Mass Noun Environment**
		

Given these environments, there is only a limited range of possibilities with respect to subcategorization. In what follows, I discuss these limitations both in terms of feature selection and constraints on grammatical environments

Let's first consider an account of subcategorization that appeals to constraints, as outlined in Chomsky 1965. Recall that within this theory, each lexical item has

a set of environments, a subcategorization set, that delineates all possible syntactic complements. The simplest type of subcategorization set is a singleton set. For example, {_*n*}, {_SG}, {_PL}, or {_CL} are all potential subcategorization sets, where the *blank* represents the insertion site (i.e., the D-head) and the elements to the right of the blank represent a required feature of the complement. These sets characterize the following distributions:

- Quantifiers with the singleton set {_*n*} are compatible with any noun (i.e., the distributional characteristics of *no*).
- Quantifiers with the singleton set {_SG} are only compatible with singular count nouns (i.e., the distributional characteristics of *every*).
- Quantifiers with the singleton set {_PL} are only compatible with plural nouns (i.e., the distributional characteristics of *several*).
- Quantifiers with the singleton set {_CL} are compatible with both plural and mass nouns, but not singular count nouns (i.e., the distributional characteristics of *all*).

Hence, the singleton sets alone account for the distribution of English quantifiers.

More interestingly, there is no subset of features that would limit the distribution of a quantifier to singular count and mass nouns. The closest possible subcategorization set would be {_SG, _CL} which states that a quantifier is compatible with a complement that has the feature SG **or** the feature CL. However, both mass and plural nouns have the feature CL. Hence, the subcategorization set {_SG, _CL} is equivalent to the singleton set {_*n*}. This limitation of the feature system could help explain why there are no languages with quantifiers that take singular count noun and mass noun complements to the exclusion of plural count nouns.

Although there are some advantages to this feature system, it still does not account for all of cross-linguistic generalizations mentioned in Chierchia 1998. For example, the subcategorization set {_SG, _PL} would yield a quantifier that, in principle, would be compatible with singular and plural count nouns. As mentioned earlier, such a quantifier is unattested. However, if we move to a subcategorization system that specifies featural selections rather than sets of compatible environments, we can capture this cross-linguistic generalization as well.

With the features *n*, SG, PL and CL, there are four basic selectional features, namely u*n*, uSG, uPL, and uCL. Determiners that have one or more of these selectional features would have the following distributions:

- Quantifiers that only have the selectional feature u*n* would select for any noun, whether it be mass, count, singular or plural (i.e., the distributional characteristics of *no*).

- Quantifiers that only have the selectional feature uSG would select for any singular count nouns (i.e., the distributional characteristics of *every*). Note, having the selectional feature u*n* in addition to uSG would not alter the distribution. In contrast, having either the feature uPL or uCL in addition to uSG would yield an unusable quantifier.
- Quantifiers that only have the selectional feature uPL would select for any plural noun (i.e., the distributional characteristics of *several*). Note, having the selectional feature u*n* and/or uCL in addition to uPL would not alter the distribution.
- Quantifiers that only have the selectional feature uCL would select for any singular count nouns (i.e., the distributional characteristics of *all*). Note, having the selectional feature u*n* in addition to uCL would not alter the distribution.

Not only does this feature system capture all of the possible distributions of English quantifiers, it also explains why there can never be a quantifier that either (i) selects for singular mass and count nouns to the exclusion of plural nouns, or (ii) selects for singular and plural count nouns to the exclusion of mass nouns. For example, the only feature shared by singular mass and count nouns, is the general nominal feature, namely *n*. The only feature shared by singular and plural count nouns is this same general nominal feature. Thus, any quantifier that selects for singular and plural count nouns will automatically select for mass nouns too. Similarly, any quantifier that selects for singular mass and count nouns will automatically select for plural count nouns.

In summary, the revised monovalent feature system is able to account for the distribution of quantifiers while also restricting the range of possible quantifiers. As we will see, the advantage of this system is that it is purely syntactic and thus will avoid many of the problems encountered by Chierchia's (1998) theory.

4.2.2 Two potential objections

Before discussing the semantic advantages of this system, I would like to address two potential objections. One potential objection is that the system outlined above does not have a feature associated with count nouns. Some might consider this problematic since, intuitively, the morphological distinction between *much* and *many* correlates with the mass-count distinction. If it is assumed that *much* and *many* are allomorphs of a single morpheme (which seems likely), then one might suspect that a count feature would trigger this variation. However, as more thoroughly discussed in Wellwood 2014, since *many* is restricted to plural count nouns, this allomorphic

distinction can be characterized using a plural feature rather than a count feature. In other words, the quantifier surfaces as *many* when appearing next to a plural and surfaces as *much* elsewhere, as outlined by the vocabulary insertion rules in (59).

(59) Where MUCH is the underlying morpheme for both *much* and *many*:
MUCH ⇔ /mɛni/ / _PL
MUCH ⇔ /mʌtʃ/ elsewhere

Another potential objection is that, in this system, singular mass and count nouns do not share any features independent of plural nouns. However, in terms of verbal agreement, singular mass and count nouns pattern together to the exclusion of plural nouns. For example, both require third person singular copulas and both trigger third person singular agreement in the present tense.

(60) a. Every chair is/*are in the back room.
b. All the furniture is/*are in the back room.
c. The furniture stays/*stay in the back room.
d. Every chair stays/*stay in the back room.

One might object that this evidence demonstrates that singular mass and count nouns share a feature. However, such data does not necessitate any type of feature sharing between the two categories.

First of all, in most languages other than English (and German), such an agreement pattern would not be problematic due to the fact that a contrast between singular and plural agreement only requires the plural feature. In other words, plural morphology could be due to agreement with a plural feature, whereas so-called singular morphology could just be the result of a default/elsewhere form of the morpheme. However, the English example is particularly problematic since the plural form appears to be the same as the default/elsewhere realization of the morpheme. For example, the plural form *are* is the same as the form used with second person singular subjects (e.g., *you are in the back room*). Similarly, the plural form *stay* is the same as the form used with first and second person singular subjects (e.g., *you stay in the back room*). Thus, the 3rd person singular realization of the morphemes, *is* and *stays*, must somehow be distinguished featurally from the plural forms without appealing to the plural feature.

Fortunately for the theory advanced in this section, it is more likely that the 3rd person feature is at play than a feature associated with being singular. Although the 3rd person feature is shared by all nouns (mass, count, singular and plural), there is evidence in English that this feature might be deleted from the verbal agreement morpheme when there is a plural subject. As argued by Harley (2008) and Bobaljik (2001), the lack of certain distinctions across paradigms indicates that an impoverishment rule might be active in the grammar, i.e., a rule that deletes certain features

after the point of interpretation but before vocabulary insertion, essentially making the morphological system blind to certain features in certain environments. In English, plural agreement markers on verbs and plural forms of irregular verbs systematically lack any person distinctions, this despite the fact that person distinctions exist in the so-called singular forms. Such a systematic lack of a distinction suggests that all person features in the agreement morpheme are deleted when co-occurring with plural features before the point of vocabulary insertion (see also the discussion in Bale et al. 2011b).

(61) **Impoverishment Rule**: In verbal (agreement) heads, person features are deleted in the environment of PL. (Bale et al. 2011b)

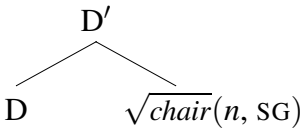
Given the evidence for this type of imporverishment rule, it is likely that plural agreement morphemes lack any person features and hence the so-called third-person singular forms could more accurately be described as third-person forms (absent the singular distinction). In other words, what mass nouns and singular count nouns share is that they are both third person rather than both singular.

4.2.3 Feature interpretations

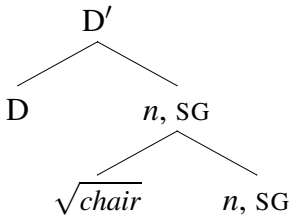
With the features *n*, SG, PL and CL, we do not need to rely on differences in the semantic types associated with singular, plural and mass nouns to characterize the distribution of quantifiers. For example, *several* cannot combine with *furniture* or *chair* because *several* requires its complement to have the PL feature. Similarly, *all* and *most* cannot combine with *chair* because *all* and *most* require their complements to have the CL feature. Finally, *every* and *each* cannot combine with either *chairs* or *furniture* because *every* and *each* require their complements to have the SG feature. These subcategorization restrictions apply even when *furniture*, *chair* and *chairs* have equivalent denotations (e.g., when their denotations are empty or singleton sets). However, even though the distribution of quantifiers is determined syntactically, this does not mean that the syntactic features cannot affect the semantic nature of the nouns. This section discusses how these nominal features might influence the denotational characteristics of nominal expressions.

Let's begin with the feature SG. There are at least two possible ways of treating this feature. One possibility assumes that some lexical items have SG as a lexical feature. The other assumes that root nouns are stored without lexical features and that features like SG are introduced syntactically, perhaps as part of some nominalizing head. The contrast between these two theories can be visually represented by the D′-phrases in (62), where $\sqrt{chair}$ is the label for the lexical entry for *chair* and D is a placeholder for the head determiner.

(62) a.



b.



In (62a), the lexical entry for *chair* enters the syntax with two lexical features. In (62b), the lexical entry has no syntactic features: the nominal features are introduced by a separate head.[6]

No matter which theory is adopted,[7] a semantic system can be developed that ensures that singular nouns are mapped to singular denotations. Let's suppose that SG is a lexical feature. If this were the case, then this feature could be encoded in the semantic system as a marker for the semantic type of the lexical item. In other words, in all possible models, lexical items with the SG feature would necessarily map to a subset of the atoms in the domain. In contrast, let's suppose that SG is introduce as part of a nominalizing head. If this were the case, then this feature could be associated with a function that maps the denotation of lexical items to the atoms contained within that denotation.

(63) For all models M, let i symbolize the lexical interpretation function in M and let ATOM be the set of all atoms in the domain of M.
   a. If SG is a lexical feature, then for all lexical items x with the feature SG, $i(x)$ maps to a subset of ATOM.
   b. If SG is a syntactic feature, then $[\![\text{SG}]\!]^M = f_{sg}$, where f_{sg} maps any subset X of the domain to $X \cap \text{ATOM}$.

In the latter theory, we could assume that each lexical item is associated with a semi-lattice and that for all models M, $[\![n]\!]^M$ is the identity function on sets (i.e.,

6 The lexical item could have subcategorization information which, for the sake of simplicity, is not represented in the trees in this section.

7 As thoroughly discussed in Bale & Barner (2009), there is very little evidence that can help distinguish a lexicalist theory from a non-lexicalist one. The primary data to consider is the limited flexibility of nouns in certain languages, especially in languages like English. For example, in English some nouns can be used as either mass or count, some are mostly used as mass but have a "coerced" count usage, some are mostly used as count but have a "coerced" mass usage, and still others demonstrate no flexibility whatsoever. Furthermore, this type of restricted flexibility is productive in the sense that novel nouns learned as belonging to one category can be spontaneously used in the other category. To account for this flexibility, a lexicalist theory would need to have a restricted function that converts mass nouns to count nouns and vice versa. A non-lexicalist theory would have to explain why certain roots cannot be used in certain syntactic environments. Both theories would need to make similar stipulations to both account for the productivity of the conversions but yet explain the restrictions.

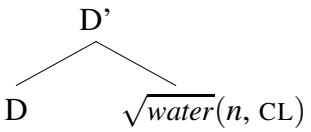
for all $Y \subseteq D$, $[\![n]\!]^M(Y) = Y$). The combination of two features in a head could then be interpreted through functional composition: i.e., $[\![n,\ \text{SG}]\!]^M = [\![n]\!]^M \circ [\![\text{SG}]\!]^M = \text{ID} \circ f_{sg} = f_{sg}$. In other words, the nominal feature *n* does not have any affect on the interpretation. The choice of theory is not important. What is important is that all singular nouns by definition denote a subset of the atoms in the domain.

With respect to mass nouns, the feature CL can also have a lexical or a syntactic interpretation. However unlike SG, the CL feature is associated with the join-closure operation.

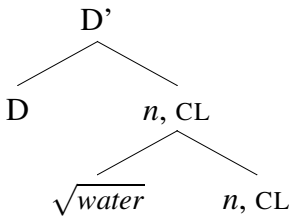
(64) For all models M, let i symbolize the lexical interpretation function in M and let * be the join-closure operation on sets.
   a. If CL is a lexical feature, then for all lexical items x with the feature CL, $i(x)$ maps to a set Z such that Z is subset of D and $^*Z = Z$.
   b. If CL is a syntactic feature, then $[\![\text{CL}]\!]^M = {}^*$.

Similar to the syntactic trees associated with the singular feature, the difference between the lexical and syntactic approach for mass nouns can be represented with the trees in (65).

(65) a.



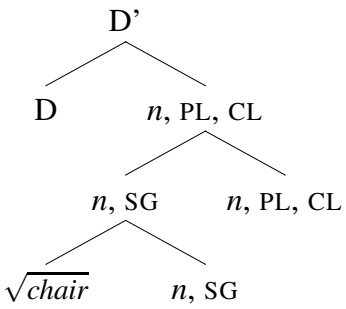
b.



As before, if we assume that two syntactic features are interpreted via functional composition and that the interpretation of *n* is simply the identity function, then $[\![n,\ \text{CL}]\!]^M$ is equivalent to $\text{ID} \circ {}^*$ which in turn is equivalent to *. As a result, in either theory all possible denotations for mass nouns are closed under the join closure operation.

Unlike either SG or CL, it is unlikely that there are two options associated with the interpretation of the plural feature, at least not in its regular use as a morpheme that attaches to singular nouns. In this case, the syntactic interpretation is much more likely since the features associated with the plural are part of their own separate morpheme. As a consequence, not only is the syntactic interpretation more likely with respect to the PL feature, but also with respect to the CL feature associated with the plural. Let's begin by considering a syntactic representation of the plural morpheme, under the assumption that the plural morpheme is the phonological realization of a feature bundle containing *n*, PL and CL.

(66)



With this kind of structure, we can assume that (i) the interpretation of CL is the join closure function, as discussed above, (ii) the interpretation of *n* is the identity function and (iii) the interpretation of PL is also the identity function. The nuances of the plural feature is discussed in more detail in section 4.2.4. Putting this issue aside for now, the important point in the current context is that for all models M, $[\![n,\ \text{PL},\ \text{CL}]\!]^M$ is equivalent to $[\![\text{CL}]\!]^M$, which is the join closure operator *.

A consequence of this semantic system is that the denotation of plural nouns do not exclude atomic parts. For example, in (66), if we assume that $[\![(\sqrt{chair},\ n,\ \text{SG})]\!]^M$ is the set $\{a,b,c\}$, then the interpretation of the plural noun *chairs* would be equivalent to the join closure operation applied to $\{a,b,c\}$, i.e. $\{a,b,c,ab,ac,bc,abc\}$. This denotation contains the atomic parts *a*, *b* and *c*. Both Link (1983) and Chierchia (1998) assumed that plural denotations only contained plural entities, e.g. $[\![chairs]\!]^M = \{ab,ac,bc,abc\}$. This assumption is based on the fact that demonstrative phrases like *those chairs* can only pick out plural objects and plural predicates such as *are chairs* are only true of plural objects.

However, as thoroughly discussed in a variety of different papers (see Croft 1990, 2nd ed. 2003, Krifka 1989, Sauerland 2003, 2008, Sauerland et al. 2005, Spector 2003, 2007, Bale et al. 2011b, among others), the "strict plural" nature of plurals seems to be due to competition with singular counterparts rather than true denotational restrictions. There are at least two sources of evidence supporting this analysis. First, plural nouns that do not have singular counterparts, e.g. pluralia tantum nouns such as *scissors*, are not restricted to plural entities in either their demonstrative or predicative instantiations. For example, *those scissors* can be used to pick out a singular entity (i.e., one pair) and *Those are scissors* can be a statement about the existence of a singular object. (Note, The fact that one pair of scissors counts as a singular object can be demonstrated by the fact that the phrase *two scissors* is used to pick out two pairs.) Second, restrictions on plural denotations are weakened in certain types of downward entailing environments. For example, although the statement *John has children* implies that John has more than one child, the antecedent of the conditional *if John has children, then he will get a tax break* is satisfied even when John only has one child. Weakening of restrictions in downward

entailing contexts is often a sign that such restrictions are due to competition rather than semantic limitations.

An important aspect of the current theory is that whether or not plurals are restricted to non-singular denotations is completely independent of the distribution of quantifiers. It could very well be that in a given context, the denotations of *furniture* and *chairs* is identical, especially if the only pieces of furniture in the context are chairs. However, this coincidental identity does not affect what types of quantifiers a speaker can use with either *furniture* or *chairs*. The distribution of the quantifiers is determined by the syntactic features alone. In Chierchia's (1998) system, it is critical that mass nouns and plural nouns are distinct in terms of their denotations since quantifier distribution is based on denotational differences.

In summary, although the distributional characteristics of quantifiers is completely determined by syntactic features and subcategorization constraints, the interpretation of these features still account for the denotational characteristics of mass, count and plural nouns. Not only can it capture many of the semantic generalizations observed in the mass-count literature, it does so while permitting denotational overlap in contexts where this over-lap is empirically justified.

4.2.4 Pluralia Tantum

The previous section outlined a semantics for plural nouns that was almost identical to the semantics for mass nouns. In particular, like mass nouns, the semantic system does not specify whether the nominal denotation of a plural noun has atomic minimal parts or not. Such a specification is not necessary when the plural noun is formed by combining a plural morpheme with a singular noun. The semantics of singular complements ensures that non-empty plural denotations have atomic minimal parts. A more interesting puzzle arises when considering nouns that do not have an obvious singular counterpart and therefore are not necessarily formed by combining the plural morpheme with a singular denotation: i.e., pluralia tantum nouns. In this section, I discuss the empirical landscape of pluralia tantum nouns in more detail, however I do not have any firm theoretical proposals about how best to account for their distribution with respect to quantifiers. Note that many of the empirical observations in this section are taken from Gillon 2012b, 1999 and Quirk et al. 1972.

Not all pluralia tantum nouns are the same. There are those that pattern exactly like other types of plural nouns and those whose distribution is hard to pin down empirically. The ones that pattern like regular plurals can appear as the complement of *many*, can combine with numerals and vague numeral-like quantifiers, can combine with plural-mass quantifiers like *most* and *all*, and can appear with general nominal quantifiers like *no* and *some*.

(67) Distribution of pluralia tantum nouns like scissors, trousers, pants.
   a. There are no scissors, trousers, or pants in this drawer.
   b. All scissors are dangerous. All trousers are uncomfortable.
   c. There are too many scissors/pants in this drawer.
   d. #There are too much scissors/pants in this drawer.
   e. Several pants that you bought have holes in them.
   f. Those four scissors are too dull to be useful.

These nouns are easy to integrate into the current system since they can be treated the same as regular plurals. For example, the noun *scissors* involves a singular noun *scissor* in combination with a plural morpheme *-s*. The fact that the denotation has minimal parts that can be counted is due to the underlying singular denotation. The fact that it has the same distribution as regular plural nouns is due to the presence of the PL and CL features. The only difference between this type of noun and regular plurals is that the root (e.g., *scissor*) can only be used with either a plural morpheme or as part of a compound (e.g., *scissor-kick*).

Another type of pluralia tantum noun that is not too difficult to explain are those that can be used with *many* but sound awkward when coupled with numerals and quasi-numerals. For example, consider the distribution of *dues* and *valuables*.

(68) Distribution of pluralia tantum nouns like *suds*, *dues*, *leftovers*, *groceries*, *clothes* and *valuables*.
   a. There are no valuables in this drawer. I pay no dues.
   b. All valuables are ephemeral. All dues must be paid.
   c. I pay too many dues. I have too many valuable.
   d. #I pay too much dues. #I have too much valuables.
   e. #Several valuables were stolen from my house.
   f. #Those four valuables were in my safe.

For such nouns, it is plausible that despite having PL and CL features, their denotations might not have well defined atomic minimal parts (and hence cannot be composed of a singular noun). Thus, although it might be syntactically coherent to combine these nouns with numerals and other quantifiers that depend on atomic minimal parts, it is not semantically coherent.

A third category of puralia tantum nouns is not so easy to characterize within the current system. These nouns are generally used either as bare nouns or with a definite determiner, and sound slightly odd or coerced when used in other types of constructions. However, the appearance of these nouns with general quantifiers like *no* and plural-mass quantifiers like *all* generally sounds better than when they appear with *many*, *much*, *several* and numerals like *four*.

(69) Distribution of pluralia tantum nouns like *dregs*, *annals*, *amends*, *earnings*, *fireworks* and *odds*.

a. I don't want to eat the dregs of your leftovers. The odds are against you. Odds are that she will not make amends. In the annals of history, few people have left a positive imprint on the world.

b. There are no dregs in my bowl. No annals of history record the deeds of the insignificant people. All fireworks need to be approved by the fire marshal.

c. #There are too much/many dregs in my bowl. #There are too much/many fireworks this evening.

d. #Several amends were made.

e. #Those four dregs were suppose to be mine.

The problem with these nouns is that they often trigger plural agreement on verbs and auxiliaries. This agreement suggests that they must have a plural feature but their distribution suggests that they are lacking such a feature. For now, I do not have anything useful to say about these nouns other than a suggestion that they might be fixed expressions, much like idioms. If they are fixed expressions, it is possible that their distribution is limited for reasons that lie beyond their featural make-up.

In summary, two of the three types of *pluralia tantum* nouns can be easily integrated into the current semantic system. Critically, this integration requires that plural nouns be underspecified with respect to whether their denotations have atomic minimal parts or not. A third category of pluralia tantums nouns remains somewhat mysterious, although it is possible that their idiosyncratic behaviour might be related to the fact that they are generally used in fixed expressions like idioms. As a side note, the distribution of pluralia tantum nouns calls into question whether our theory needs to restrict the syntactic complement of the plural morpheme to singular nouns (as suggested in Chierchia 1998 and elsewhere). Such a restriction would be easy to specify (e.g., the plural morpheme could be listed as having the subcategorization feature uSG, or alternatively the subcategorization set {_SG}), however such a specification would force one to hypothesize two plural morphemes: one that can productively combine with any singular noun and another that is more restricted and idiosyncratic. For now, I will leave this as an open issue.

4.3 Selectional Restrictions revisited

Before moving on from this section, I would like to revisit Chomsky's account of selectional features in *Aspects of the theory of syntax* (Chomsky 1965). Some people misleadingly cite Chomsky 1965 as demonstrating a separation between syntax

and semantics with sentences like *Colorless green ideas sleep furiously*. I say this is misleading since (i) the term *semantics* within linguistics had a different meaning back then than it does post Montague 1974 (and hence Chomsky's discussion of a separation between syntactic and semantic considerations does not apply to the way the field understands this contrast today) and (ii) Chomsky developed a feature-system to account for this type of anomaly that is similar to the feature system developed in this paper under the label *syntactic approach* (e.g. *Truth burned up* is deviant because *burn up* has selectional features that require its subject to have the feature [−ABSTRACT]). In fact, Chomsky (1965) argued that violations of so-called semantic features sometimes result in grammatical deviances that are similar in feel to subcategorization violations.[8]

Slightly lost in the legacy of Chomsky's book is the fact that it also outlined a theory of why intuitions of sentential deviance are gradable. This account not only relies on features, but also on the idea that the more "syntactic" subcategorization features stand in a hierarchical relationship to the more "semantic" selectional features. For example, Chomsky noted that the expressions in (70) differ in terms of their degree of deviance. The expression in (70a) is more deviant than the one in (70b) which in turn is more deviant than the one in (70c). (For the sake of clarity, I used repeated instances of the # symbol to signal gradable intuitions of oddity.)

(70) a. ### Sincerity may virtue the boy.
b. ## Sincerity may elapse the boy.
c. # Sincerity may admire the boy.
d. Sincerity may frighten the boy.

In (70a) there is a category violation: the noun *virtue* appears as the head of a verb phrase. In (70b) there is a subcategorization violation: the intransitive verb *elapse* appears with a DP object complement. In (70c) there is a selectional restriction violation: the transitive verb *admire* requires an animate subject but appears with an abstract subject.

8 According to Chomsky (1965), the sentence in (1a) demonstrates that the relative pronoun *who* requires the head noun to be [+HUMAN] whereas the sentence in (1b) demonstrates that gradable adjectival gerunds require that the underlying verb permit abstract subjects in combination with animate objects.

(1) a. #The book who you read was a best seller. (c.f., The man who you insulted was an idiot.)
b. #a very walking/hitting person (c.f., a very frightening/amusing/charming person)

Chomsky noted that the level of deviance in these sentences does not seem significantly different from prototypical examples of subcategorization violations. This deviance is equivalent despite the fact that the violations in (1) are directly related to "semantic" features.

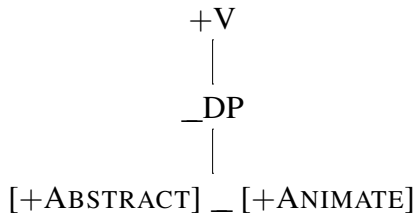
Chomsky (1965) argued that these types of features form a natural hierarchy. Any lexical item that has the feature which indicates that it is a transitive verb (i.e., the feature _DP) also has the feature which indicates that it is a verb. Similarly, any lexical item that has the feature which indicates that it selects for abstract subjects in combination with animate objects (i.e., the feature [+ABSTRACT] _ [+ANIMATE]) also has the feature which indicates that it is a transitive verb.

(71) **Feature Entailments (a.k.a., Redundancy Rules)**

a. _DP → +V

b. [+ABSTRACT] _ [+ANIMATE] → _DP

(72) **FEATURE HIERARCHY**



According to Chomsky, syntactic violations caused by features higher up in the hierarchy result in a greater sense of deviance than those caused by features on the lower end. (Or to put it another way, violations with respect to a feature higher on the hierarchy automatically entails the violation of all the features it dominates. Hence, sentential deviance can be measures by counting featural violations.)

This account of the gradability of speaker intuitions challenges the account of selectional restrictions offered in section 3 in terms of presupposition failure. Generally speaking, a theory that can explain why some odd sentences sound more deviant than others clearly has an advantage over any theory that offers no such explanation. As discussed in section 3, a presuppositional theory does offer a possible explanation of gradability, but this explanation rest on the notion of *ease of accommodation* (i.e., if the presupposition violations in a sentence **A** are easier to accommodate than the violations in another sentence **B**, then **A** will be more odd than **B**). It is not obvious whether accommodating the fact that *admire* has an abstract subject should be easier than accommodating that *elapse* has an object.

However, all is not lost with respect to the presuppositional theory. It remains to be established whether Chomsky's intuitions with respect to a hierarchy of deviance is empirically well founded across a variety of different speakers. Although I agree with Chomsky's characterization of the data-points he discusses, one has to be careful how to determine what are the relevant factors involved in creating a sense of deviance. A variety of different stimuli needs to be assessed and other pos-

sible sources of deviance need to be carefully controlled (such as word familiarity and coercive syntactic contexts).

5 Conclusion

This paper argued that feelings of sentential deviance cannot be a priori connected to a certain source. As a result, different theories of deviance, whether semantic, pragmatic or syntactic, need to be carefully assessed and compared. Each theory makes slightly different predictions on what factors should influence intuitions and how such intuition might be mitigated in certain types of contexts. Each theory also has different strengths and weaknesses.

Both the presuppositional theory and the theory based on contradictions/tautologies are grounded in well-established pragmatic principles. Both also offer explanations that can be independently supported by facts that do not depend on sentential deviance (e.g., one can test whether certain sentences do indeed have the hypothesized presuppositions and one can test whether certain expressions do indeed have the semantic interpretations that derive the contractions/tautologies). However, both theories also have some inherent weaknesses. The theory based on contradictions and tautologies does not have a good explanation of why certain contradictions and tautologies sound more deviant than others. The theory based on presupposition failure predicts that semantic denotations alone should determine feelings of deviance.

The biggest weakness of the syntactic theory is that it is not well grounded in well-known pragmatic principles. Rather, the syntactic distinctions are arbitrarily introduced to create a system that separates the odd from the acceptable. However, this theory has the advantage that it is not dependent on semantic denotations nor on pragmatic expectations. Thus, feelings of oddness cannot be mitigated by assessing sentences in different types of contexts.

It is important to note that in the broad sense, the weaknesses and advantages of each theory cannot be compared without considering a specific data-set. For example, a data-set where feelings of deviance disappear when the sentential context is altered is probably best explained by the more semantically and pragmatically oriented theories. Furthermore, the choice between the presuppositional theory and the non-presuppositional theory depends on whether the hypothesized presuppositions can be independently established.

In contrast, a data-set where feelings of deviance are not mitigated by context is probably best suited to a syntactic explanation (if such an explanation is syntactically plausible). We saw an example of this with respect to the distribution of quantifiers. Note, however, that a critical aspect of the syntactic theory developed in section 4 is that it relied on the observations and generalizations that were established in the presuppositional account. In other words, some generalizations

are easier to establish through a semantic and pragmatic perspective than they are through a syntactic one. However, this does not mean that such generalizations are best suited to a semantic or pragmatic explanation. For example, the denotational similarities of mass and plural nouns (the fact that they are both closed under join) supports the syntactic hypothesis that these types of nouns share a syntactic feature. In contrast, the denotational dissimilarities between mass and singular count nouns (the fact that one is closed under join and that the other is always a set of atoms) supports the syntactic hypothesis that these types of nouns do not share any syntactic features. This type of evidence would be difficult to discover if one focused narrowly on the distribution of words alone.

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