The Meaning and Use of Zero

An exploration of the semantic interpretation of the number word zero

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Abstract

This study examines the meaning and use of the numeral zero. In the first section the classical neo-Gricean view of number words is discussed, then the type-shifting framework proposed by Geurts (2006) is considered. I then attempt to show that these do not apply to the number zero, and argue that this is because in many cases, ‘zero’ has lost much of its numerical sense, and is instead semantically equivalent to the quantifier ‘not any’ or ‘no’. In the second section, a corpus research is presented. 184 noun phrases with zero are examined and compared to other numerals. The corpus research reveals that the number word zero can quantify mass nouns, which typically cannot be quantified by numerals. It can also take the place of a unit of measurement, and can occur with both singular and plural count nouns. Most of the contexts that zero was found to occur in could be explained by comparing the numeral with ‘not any’ or ‘no’.

Contents

1. Introduction

There are many theories about the meaning of number words in natural language. These make accurate predictions about how number words can be used, but to the best of my knowledge, they never address the number zero. Zero is a unique number because it embodies the concept of nothingness, and it is the only number that is neither positive nor negative (Pogliani, L., Randic, M., & Trinajstić, N. 1998). In this thesis I will attempt to answer the research question: is zero semantically fundamentally different from other number words, and if so, how? I will attempt to apply some existing theories about the meaning of number words to the number zero. In the first section I will discuss the classical neo-Gricean view, then I will consider the type-shifting framework proposed by Geurts (2006). I will then attempt to show that these cannot account for the interpretation of the number zero. I hypothesize that zero is semantically fundamentally different from other number words. I argue that this is because in many cases, 'zero' has lost much of its numerical sense, and is instead semantically equivalent to the quantifier 'not any' or 'no'. I will do this by conducting a corpus research to investigate in what contexts 'zero' is used, and compare this to how other number words are used.

2. Theoretical background

2.1 The neo-Gricean Approach

The neo-Gricean approach was invented by Horn (1972) and is based on the work of Grice (1975). In the neo-Gricean view, numerals have a semantic and a pragmatic component (Spector 2013). The semantic component is the literal meaning of the numbers, and the pragmatic part is an implicature which enriches the literal meaning. Implicature, a term coined by Grice, is the phenomenon that arises when a speaker implies something more or different than what is explicitly said. This is based on the Cooperative Principle (Grice 1975). The Cooperative Principle is a general principle about the expectations of speakers and hearers in conversations. It can be divided into four maxims: Quantity, Quality, Relation and Manner. For current purposes, only the maxim of Quantity is relevant. This maxim states that one's contribution to a conversation should be as informative as required, but not more informative. On the basis of these maxims, a hearer can deduce when a speaker is using implicature. Take for example the following sentence (example from Spector 2013):

(1) Three girls went to the party.

A set X has a distributive property P if and only if for every element x of X it is true that P(x). The sentence in (1) is thus semantically true if and only if there is a set of three individuals, such that for every individual in the set it is true that the individual is a girl and went to the party. It is important to note that this is also true if more than three girls went to the party. This is because a set of three girls is a subset of every set that has more than three girls. For example, the sentence 'Four girls went to the party' logically entails sentence (1). In the neo-Gricean view, therefore, the literal semantic interpretation of (1) is equivalent to (2a) and can be represented as in (2b):

(2)a. At least three girls went to the party.

b. $\exists x[\ \#(x) \geq 3 \wedge \text{girls}(x) \wedge \text{went to the party}(x)]$

'#' is a function that counts the individuals in a group[1], so (2b) is to be read as stating that there is a group consisting of three or more individuals who are girls and went to the party. According to the neo-Gricean view, the interpretation of (1) as 'Exactly three girls went to the party' comes from a scalar implicature. This is the pragmatic component. It is scalar because numerals form a scale, i.e. they are an ordered set. Because 'four' has more logical strength than 'three', if a speaker who utters (1) knows that more than three girls went to the party, it is more informative for him to say that "Four (or more) girls went to the party". Assuming that the speaker follows the maxim of Quantity, the hearer can conclude that the speaker doesn't know that more than three girls went to the party, and that, therefore, exactly three girls went to the party.

The neo-Gricean view is not generally accepted, because it is problematic in several respects (see for example Davis 1998). However, it is still interesting to see if it can account for the interpretation of 'zero'. Consider the sentences in (3) and (4).

(3) Zero girls went to the party.

[1] The hash symbol '#' is conventionally used to indicate that a sentence is semantically anomalous or infelicitous. Throughout this paper, a question mark '?' will be used for that purpose, to avoid confusion with the symbol for the counting function.

(4)a. At least zero girls went to the party.

b. $\exists x[\ \#(x)\ \geq 0\ \wedge\ \text{girls}(x)\ \wedge \text{went to the party}(x)]$

According to the neo-Gricean approach, the literal semantic interpretation of (3) should be the sentence in (4). Recall that a set X has a distributive property P if and only if for every element x of X it is true that P(x). (4b) says that there is a set consisting of zero or more individuals and that this is a set of girls that went to the party. The standard view in semantics is that a variable can never refer to the empty set, because the empty set is not in the domain of entities. Variables can only refer to atomic individuals or non-empty groups consisting of atomic individuals (Link 1983). Therefore, if (4) cannot denote the empty set, it is semantically equivalent to (5).

(5)a. At least one girl went to the party.

b. $\exists x[\ \#(x)\ \geq 1\ \wedge\ \text{girls}(x)\ \wedge \text{went to the party}(x)]$

This is clearly problematic, because we want (3) to mean "Exactly zero girls went to the party". It is impossible to get to this meaning from (5) through scalar implicature. Another problem with this approach is entailment. As was stated before, numerals form a scale, and every numeral is entailed by numerals that are higher on the scale. Presumably, zero is the lowest on this scale. Therefore, 'zero' should be entailed by all the other number words. As it turns out, this is not the case. A sentence such as 'Three girls went to the party' does not entail (3). Entailments can be made explicit by using an 'if not' construction. For example, the 'exactly three' implicature in (1) can be cancelled, as was done in (6).

(6) Three girls went to the party, if not more.

When we apply the same technique to (3) we get a sentence that is infelicitous, as is shown in (7).

(7) ?Zero girls went to the party, if not more.

Thus ‘zero’ is not entailed by the other numerals, which renders the neo-Gricean view unsuitable for zero. It seems that zero cannot have an ‘at least’ interpretation[2]. If, however, ‘zero’ is interpreted as a type of negation in (3), that could explain why (7) is infelicitous. After all, (7) is then semantically equivalent to (8), which is also infelicitous:

(8) ?No girls went to the party, if not more.

If this is the case, ‘zero’ is not on the same number scale as the other number words, which explains why scalar implicature does not apply to the number zero.

2.2 The type-shifting framework

Another approach is taken in Geurts (2006), which adopts a type-shifting framework of compositional semantics to analyze theories of number words. It is important to note that the type-shifting framework is not itself a theory about the semantics of number words, but was developed to evaluate theories about numbers. Geurts argues that number words are polysemous and have a predicative sense and a quantifier sense. One of these senses is the primary sense, while the other is derived by type-shifting. Which sense is primary and which is secondary depends on the approach taken. A numeral with a predicative meaning can be seen in a sentence such as (9), while (10) shows a quantifier meaning.

(9)a. These are five cows.

b. $\#\text{these} = 5 \wedge \text{cow}(\text{these})$

(10)a. Five cows mooed.

b. $\exists x[\#x = 5 \wedge \text{cow}(x) \wedge \text{moo}(x)]$

The difference between these senses is that in (9) ‘five cows’ is a predicate of ‘these’, while in (10) ‘five cows’ acts as an existential quantifier. These two senses of numerals can be derived from each other using type-shifting rules. There are two type-shifting rules, namely ‘Existential Closure’ and ‘Quantifier Lowering’. Suppose for instance that the primary sense of ‘five cows’ is predicative, i.e. $\lambda x[\#x \geq 5 \wedge \text{cow}(x)]$. The quantifier sense can now be derived from this by applying Existential Closure:

[2] However, see (29) on page 15 of this paper for a counterexample.

Existential Closure

$\lambda x[\#x \geq n \wedge cow(x)]$ becomes $\lambda P \exists x[\#x \geq n \wedge cow(x) \wedge P(x)]$

Quantifier Lowering does the opposite of this. To derive a predicate sense from a quantifier sense, the Quantifier Lowering rule can be used as follows:

Quantifier Lowering

$\lambda P \exists x[\#x \geq n \wedge cow(x) \wedge P(x)]$ becomes $\lambda x[\#x \geq n \wedge cow(x)]$

Geurts describes four types of theories, dubbed Vanilla, Strawberry, Caramel and Chocolate. These theories differ in how they interpret number words and in whether the predicate or the quantifier sense is the primary sense. According to the Vanilla theory, both the predicate sense and quantifier sense have an 'at least' meaning. Both senses can be primary. This theory is similar to the neo-Gricean view, and has the same problems when applied to zero. In the Strawberry theory the primary sense is predicative, which has an 'exactly' meaning. In contrast, the quantifier sense has an 'at least' meaning. For the Chocolate theory, the predicate sense has an exact meaning, while the quantifier sense has both an exact and an 'at least' meaning. The primary sense is the quantifier with the 'exactly' meaning. According to the Caramel theory, the predicate and quantifier sense both have exact meanings, and the quantifier sense is primary.

When used in the quantifier sense, a numeral can have an 'at least' meaning. In contrast, when it is used as a predicate it can only have an exact meaning. This can be seen in the following example:

(11)a. Fred took five pills – in fact, he took six.

b. ?These are five pills – in fact, there are six of them.

In (11a) 'five' has an 'at least' interpretation, which is perfectly acceptable. However, when 'five' is replaced by 'zero', the result is unacceptable, as in (12a). An exact reading as in (12b), on the other hand, is allowed:

(12)a. ?Fred took zero pills – in fact, he took one.

b. Fred took zero pills.

This is similar to what was observed earlier in the discussion of the neo-Gricean view. In contrast to other number words, zero does not seem to allow an "at least" reading, only exact meanings. The sentence in (11b) is infelicitous, which suggests that the predicate sense can only have an exact meaning. The Vanilla theory cannot account for this, because it holds that 'at least' meanings are the most basic meaning. Similarly, the Caramel theory wrongly predicts that (11a) and (11b) should be equally acceptable. The Strawberry and Chocolate theories, on the other hand, are able to explain the difference in acceptability between the sentences, because according to them the quantifier sense can have an 'at least' interpretation, while the predicate sense is exact. Following these theories, (9) can only have an exact meaning, which agrees with our intuition. However, when 'five' is replaced by 'zero', the result is infelicitous:

(13) ?These are zero cows

It is infelicitous because 'these' refers to individuals, while 'zero cows' corresponds to the empty set, i.e. a set without any individuals. Thus it seems that, unlike other numerals, 'zero' does not have a predicative sense. It does, however, have a quantifier sense, as is evident from the fact that (12b) is an acceptable sentence. If zero only has a quantifier sense but not a predicative sense, the type-shifting rules cannot be applied to zero. This renders the type-shifting framework unsuitable for evaluating theories about the interpretation of zero.

3. The current study

As was shown in the previous section, the current theories about number words cannot adequately account for the interpretation of zero. I suspect that this is because zero is different from the other numerals, in that it is equivalent to 'not any'. If this is the case, then zero should be able to occur in contexts where other numerals cannot. Furthermore, zero can only in exceptional cases have an "at least" interpretation. To test this, I conducted a corpus research to examine how zero is used, compared to other number words. I hypothesized that zero is often used in contexts where other numerals cannot be used. Secondly, I predicted that many of the phrases in which zero is used are semantically (though maybe not pragmatically) equivalent to phrases with a negation instead of the number word.

3.1 Method

I used the Corpus of Contemporary American English (COCA), which is freely available at corpus.byu.edu/coca (Davies 2008). This corpus contains more than 520 million words from fiction, newspapers, academic texts, popular magazines, and transcribed spoken texts. The corpus was searched using the search term "zero [nn*]". This matches all phrases with the word zero followed by a noun. From this search, the 200 most frequent noun phrases were taken and analyzed. Sixteen phrases were excluded from analysis, in four cases because the word was wrongly tagged as a noun, and in the other cases because 'zero' was (part of) a proper noun. For example, "zero memorial" was part of "Ground Zero memorial". Therefore, the final analysis examined 184 noun phrases. The phrases were then compared to noun phrases with other number words, by taking the noun that was found to occur with zero, and then searching the corpus for that noun paired with any other number. For instance, if the phrase "zero hours" was found in the first search, I would then use the search term "[mc*] hours". This matches phrases with any (cardinal) numeral followed by "hours". These findings were then compared, as explained below, to the phrases containing 'zero'.

3.2 Results and Analysis

Of the 184 examined noun phrases, 107 were phrases with uncountable or mass nouns, while 77 were phrases with count nouns. However, it was not always clear whether a word was a mass noun or a count noun, because sometimes a count noun was used in a mass sense, or vice versa. Of the count nouns, 48 were plural, 27 were singular, and 2 were ambiguous between plural and singular. The mass nouns and count nouns can be found in Appendix A and B respectively.

3.2.1 Mass nouns

The large amount of mass nouns that occur with 'zero' is noteworthy, because mass nouns typically cannot be quantified by numerals (e.g. *five water). It seems that 'zero' is an exception to this, which is exactly what would be expected if its interpretation is not necessarily numerical. In most cases, the mass noun was a word that does not typically have a unit of measurement associated with it (as opposed to physical quantities that are typically expressed in units of measurement, which will be discussed later). Some examples of this that were found in the corpus are:

(14)a. He has *zero confidence* in me.

b. When the smoke clears we see there has been *zero damage*.

c. I received *zero leadership* from above.

d. (…) you discover there was *zero evidence*, absolutely no evidence.

e. (…) but right now, he gets no help, *zero help*.

In these phrases, ‘zero’ seems to have lost its numerical meaning and have become a negation, because it denotes a lack of something. This is especially evident in (14d) and (14e), where the noun phrase is conjoined with an explicit negation of the same noun. These phrases could be paraphrased by replacing ‘zero’ with ‘not any’ or ‘no’, as was done in (15).

(15)a. He does *not* have *any confidence* in me.

b. When the smoke clears we see there has *not* been *any damage*.

c. I did *not* receive *any leadership* from above.

d. (…) you discover there was *not any evidence*, absolutely no evidence.

e. (…) but right now, he gets no help, *not any help*.

Another possibility is that ‘zero’ is a mass quantifier. While mass nouns cannot be quantified by numerals, they can be quantified by mass quantifiers, like “little confidence”, “much confidence”. With this interpretation, ‘zero’ is the lowest point on the scale of mass quantifiers: “zero”, “little”, “much”. These constructions with mass nouns were not found to occur with any other numbers, indicating that it is a property specifically of the number zero. In some other cases the noun was a physical quantity taking the place of a unit of measurement. Some examples of this phenomenon are:

(16)a. I felt as if I had *zero weight*.

b. Since there is no such thing as a gas with *zero volume*, (…)

c. Stop signs may not show a *zero speed*, as speed is recorded only every five seconds.

d. A universe of *zero size*, the Big Bang singularity, is not the beginning of spacetime.

e. (…) a state that has no net magnetization at *zero temperature*.

In (16a) the noun ‘weight’ is used instead of a unit of measurement associated with weight, such as ‘kilograms’ or ‘pounds’. Similarly, in the other examples the physical quantity is used instead of a unit of measurement. The interpretation of ‘zero’ as negation is plausible for

(16a), (b) and (c), but cannot account for (16d) and (e). After all, how can something physical have no size, or no temperature? It is possible that these phrases are abbreviated forms of constructions with the form "a [Physical quantity] of zero [unit]". If this is the case, then the sentences in (16) could be paraphrased as in (17). In these sentences, the numerical aspect of 'zero' is more pronounced than in the non-measurement-type mass nouns discussed above, because the word could easily be substituted with another numeral.

(17)a. I felt as if I had *a weight of zero kilograms/ pounds/ etc*.

b. Since there is no such thing as a gas with *a volume of zero liters/ cubic meters*/ etc., (…).

c. Stop signs may not show a *speed of zero kilometers/ miles per hour/ etc.*, as speed is recorded only every five seconds.

d. A universe of *a size of zero light-years*, the Big Bang singularity, is not the beginning of spacetime.

e. (…) a state that has no net magnetization at *a temperature of zero degrees Celsius/ Fahrenheit/ Kelvin*.

However, if this is a correct interpretation of these measurement-type constructions, I see no reason why the phrases in (16) should not be able to occur with other numbers as well. These measurement-type constructions never occurred with other numerals, at least not with the noun in a mass sense[3], suggesting that it is a unique property of the number zero. Further research should be done to determine whether this is a correct interpretation of these types of phrases.

3.2.2 Singular count nouns

Another noteworthy finding is the occurrence of singular count nouns with 'zero', because as we will see later, count nouns following 'zero' usually take plural form. Upon further investigation, some of these were in fact compounds consisting of two nouns. In a few cases this was trivial, as 'zero' modified the second noun, as is shown in (18). Here the second noun should be taken to determine the interpretation of the numeral. For (18), since 'growth' is a mass noun, the entire noun phrase should be analyzed as a mass noun, in the way that was

[3] "One size fits all" would be an example of a physical quantity where the noun has a count sense.

discussed above. In other phrases, however, ‘zero’ modified the first noun. Instances of these constructions are shown in (19).

(18) (…) has seen *zero job growth* since the 2001-02 recession.

(19)a. Politics is a *zero sum game*.
b. A *zero bedroom dwelling* is any dwelling where (…).
c. This is the *zero line*.
d. This return to absence signifies a return to the *zero point.*

The use of ‘zero’ with a singular count noun that modifies another noun, like the examples in (19), seems to be limited to collocations. Although the singular noun ‘bedroom’ was also found with other number words (e.g. “three bedroom house”), ‘sum’ was not. In the phrases (19c) and (19d), ‘zero’ functions as a label for a neutral or starting point.

Lastly, there were count nouns in singular form that were not part of a compound. Some examples of these are:

(20)a. Even if something is sold for a *zero price*, (…).
b. But there’s *zero margin* for error.
c. I have *zero problem* eating a huge bowl by myself all in one sitting.

In (20a), (20b) and (20c), the nouns that are quantified by ‘zero’ are count nouns, but they have a mass-like interpretation. The interpretation of these is similar to the mass nouns discussed above. (20a) is similar to the physical quantities that are typically expressed in a unit of measurement, in that it could be paraphrased as “Even if something is sold for a price of zero Euros/Dollars/etc. (…)”. (20b) and (20c) are similar to the earlier discussed phrases with mass nouns in that their interpretation of ‘zero’ appears to have lost its numerical value and instead seems to have the meaning of a negation. With this interpretation, (20b) for example could be paraphrased as “But there’s *no margin* for error” and (20c) as “I have *no problem* eating a huge bowl by myself all in one sitting”.

3.2.3 Plural count nouns

The phrases where ‘zero’ occurred together with plural count nouns are the most easily comparable to phrases with other numerals. Some examples of these phrases are:

(21)a. (…) bring us ever closer to the impossible goal of *zero accidents.*
b. I was only five and had roughly, well, *zero dollars* in my savings.
c. If the site didn't exist, *zero people* would get help.
d. Diplomacy without force produced *zero results* in Bosnia.

All plural count nouns except ‘balances’ and ‘tariffs’ also occurred in the corpus with other numerals. Some examples are:

(22)a. Denver traffic records show he caused *two accidents* during his time as a Medicaid driver, (…)
b. It costs you *five dollars* worth of electricity the entire season to use this.
c. *Four people* died when the car sped out of control.
d. *Two results* of his review are particularly important.

In (21), ‘zero’ again has the meaning of ‘not any’ or ‘no’, which can be shown when it is compared to (22). The first part of (22c), for instance, can be represented as in (23) and when four is replaced by zero, the result is (24):

(23)a. Four people died.
b. $\exists x[\#x = 4 \wedge \text{people}(x) \wedge \text{died}(x)]$

(24) Zero people died.

The sentence in (24) cannot have an interpretation similar to (23b), because (24) is true if and only if there is a set of zero people who died. In this case X is the empty set, and as was mentioned earlier, a variable cannot refer to an empty set. Therefore, there is no such set, and an interpretation of (24) such as in (25) is incorrect.

(25) ? $\exists x[\#x = 0 \wedge \text{people}(x) \wedge \text{died}(x)]$

What (25) says is that there is a non-empty set consisting of zero individuals, which is a contradiction. Now consider the sentence in (26):

(26)a. No people died.

b. $\neg\exists x[\text{people}(x) \wedge \text{died}(x)]$

(24) and (26) have the same truth conditions, because (26) is also true if and only if the amount of people that died is zero. Similarly, the phrases in (21) are equivalent to (27):

(27)a. (…) bring us ever closer to the impossible goal of *no accidents*.

b. I was only five and had roughly, well, *no dollars* in my savings.

c. If the site didn't exist, *no people* would get help.

d. Diplomacy without force did *not* produce *any results* in Bosnia.

An exceptional case is the use of zero in a phrase like (28):

(28) (…) molecules of water crystallized into solid ice at *zero degrees* Celsius.

In this phrase, zero does not mean 'not any'. "Zero degrees Celsius" is not a quantity of degrees Celsius, but rather a label for a certain temperature. Furthermore, this is one of the very few cases in which zero can have an 'at least' or an 'at most' interpretation. Consider for example the sentence in (29), which one could imagine being uttered on an exceptionally warm day.

(29) It was *zero degrees* on the North Pole today, if not more.

For an example of an 'at most' meaning of zero, consider the sentence in (30):

(30) You have to wear gloves when it is *zero degrees* outside.

Here 'zero degrees' is understood to mean 'zero degrees or lower' through pragmatic inference. Because gloves are usually worn when the temperature is low, it is unlikely that (30) could mean that gloves should be worn at exactly zero degrees, but not when it is -1

degrees. The most likely interpretation is that gloves should be worn when it is zero degrees or lower.

3.3 Discussion

The results show that zero can be used in many different ways. Most importantly, it can quantify mass nouns. This is a significant finding, because mass nouns typically cannot be quantified by numerals, suggesting that zero is fundamentally different from other numerals. It can also take the place of a unit of measurement when it occurs with a physical quantity, and it can occur with both singular and plural count nouns. These properties are, again, unique to the number zero. I proposed that zero is semantically similar to ‘not any’. With this interpretation, many of the unique properties of zero can be explained. This theory can account for the occurrence with mass nouns, and most occurrences with singular and plural count nouns. However, it cannot account for the occurrence as a unit of measurement, nor for its function as a label. It seems therefore that zero is polysemous between a type of negation, a unit of measurement and a label. The analysis mostly did not take into account the pragmatic component of zero. If zero is semantically similar to negation, as I propose, there is most likely a pragmatic component that distinguishes it from ‘not any’ or ‘no’. Further research should be done to examine this pragmatic component. All in all, the current study only scratched the surface of the meaning and use of zero, and future research should be done to test the validity of the proposed theory of zero as a type of negation.

4. Conclusion

The corpus research revealed that the number word zero can occur in many contexts where other numerals cannot. Most notably, it can quantify mass nouns, which typically cannot be quantified by numerals. It can also take the place of a unit of measurement, and can occur with both singular and plural count nouns. The semantic and pragmatic theories about numerals that were discussed only took into account plural count nouns. Therefore, they cannot explain the other uses of zero. Furthermore, the neo-Gricean view is unsuitable for zero because zero is not entailed by the other numerals. This approach maintains that the semantic meaning of a number word is an ‘at least’ meaning, but zero only very rarely means anything other than ‘exactly zero’. The type-shifting framework is based on the assumption that numerals have a predicative and a quantifying sense. This again is an unsuitable approach for zero, because zero was found not to have a predicative sense. Since the existing

approaches are not satisfactory, a new theory for the interpretation of zero is required. Most of the contexts that zero was found to occur in could be explained by comparing the numeral with ‘not any’ or ‘no’. Therefore, a new theory of the semantics and pragmatics of zero should present zero as a number word that is simultaneously a negation.

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Appendix A: Mass nouns found to occur with ‘zero’

ability
activity
alignment
attention
backlash
balance
business
capital
carbon
cash
chance
change
charisma
chlorine
cholesterol
condensation
confidence
configuration
contact
control
correlation
cost
credibility
credit
damage
debt
deficit
degree
design
desire
discharge
displacement
effect
effort
emission
energy
evidence
experience
exposure
fat
flexibility
focalization
frequency
g
gain
gee
gravity
growth
help
home
hunger
immigration
impact
income
inflation
intelligence
interest
knowledge
leadership
leakage
liability
longitude
magnitude
maintenance
measure
meridian
money
mortality
movement
oil
order
patience
policy
pollution
population
position
power
privacy
probability
profit
progress
protection
rating
recognition
relationship
resistance
respect
revenue
risk
sense
size
sleep
speed
sugar
support
tax
temperature
texture
time
tolerance
value
variance
visibility
volume
waste
water
weight

Appendix B: Count nouns found to occur with zero

Noun	Grammatical number
accidents	plural
arrests	plural
balances	plural
baseline	singular
bedroom	singular
budget	singular
byte	singular
calories	plural
coupon	singular
crossings	plural
crowds	plural
day	singular
days	plural
defect	singular
defects	plural
degrees	plural
dollars	plural
draft	singular
emissions	plural
expectations	plural
field	singular
fighters	plural
games	plural
hours	plural
house	singular
interceptions	plural
job	singular
level	singular
levels	plural
line	singular
lot	singular
margin	singular
means	ambiguous
messages	plural
miles	plural
minutes	plural
mistakes	plural
offers	plural
option	singular
people	plural
percent	ambiguous

Noun	Grammatical number
photons	plural
point	singular
points	plural
possibility	singular
price	singular
problem	singular
problems	plural
rate	singular
rates	plural
receptions	plural
response	singular
results	plural
risks	plural
savings	plural
scores	plural
series	plural
signifiers	plural
stack	singular
stage	singular
stares	plural
stars	plural
sum	singular
tariffs	plural
taxes	plural
taxpayer	singular
temperatures	plural
times	plural
touchdowns	plural
turnovers	plural
values	plural
volts	plural
votes	plural
week	singular
wins	plural
women	plural
yards	plural