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FOCUS, CONTEXT, AND *MANY* ELEMENTS*

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Abstract

This paper investigates the interpretation of the determiner *many*. Previous literature has pointed out that the interpretation of *many* requires contextual information. Following this idea, some truth conditions for sentences with determiner *many* have been suggested. I will show that the analyses proposed in the previous literature are not sufficient, with some data which these analyses cannot explain. This paper argues that the determiner *many* is focus sensitive, taking a context variable C as its first argument. This context variable provides a set of alternatives for comparison, and predicts a previously unnoticed "list" reading. I will provide a detailed analysis following this idea to explain problematic data for previous analyses, and compare my analysis to the others.

1. Introduction

The goal of this paper is to present an interpretation of the determiner *many* that has not been addressed in previous literature. In the traditional analysis for determiners in which their type is defined as <et, <et, t>>, interpretations of canonical determiners seem to be straightforward; for example, [[every]] = $[\lambda p_{et}\lambda q_{et}.\{x: p(x)\}\subseteq\{x:q(x)\}]$, [[no]] = $[\lambda p_{et}\lambda q_{et}.\{x: p(x)\}\cap\{x:q(x)\}=\emptyset]$, [[some]] = $[\lambda p_{et}\lambda q_{et}.\{x: p(x)\}\cap\{x:q(x)\}\neq\emptyset]$, and so on. The truth conditions of sentences with *many*, however, cannot be defined so easily. An analysis such as [[many]] = $[\lambda p_{et}\lambda q_{et}.|\{x: p(x)\}\cap\{x:q(x)\}|$ is "large"] is too naïve to handle the data, and this denotation needs to be manipulated further. In previous literature, several kinds of analyses for this determiner have been suggested. They are necessary, but do not seem to be sufficient to interpret all the types of sentences with the determiner *many*. In this paper, we will investigate some data that previous works cannot treat, and provide an analysis.

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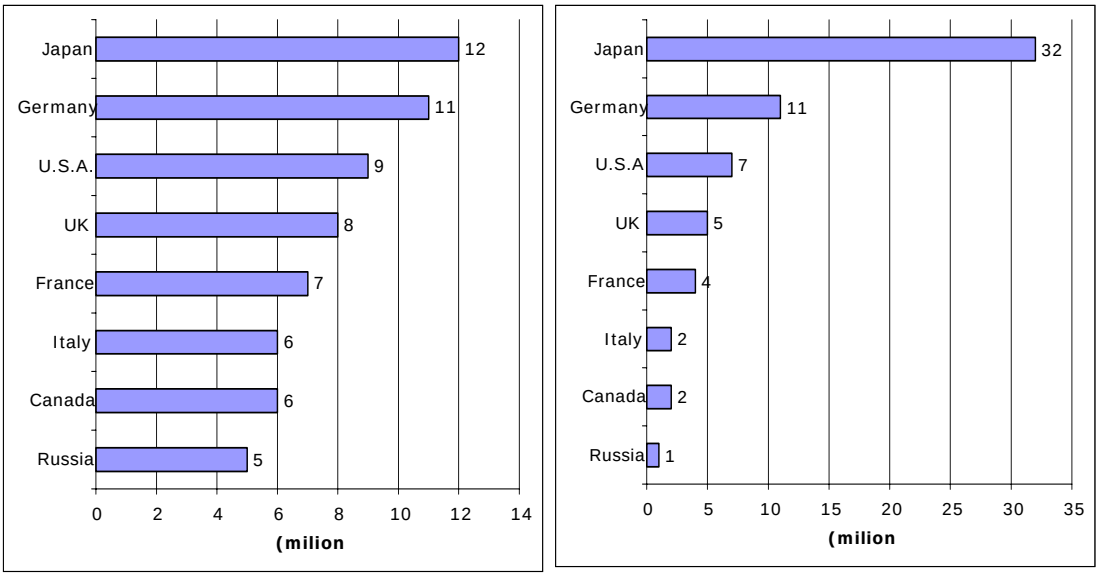
2. Data

In this section I will present the data to be investigated. First, consider the sentence in (1), where the noun *Germans* in the subject NP is focused.

(1) Many [GERMANS]$_F$ like driving a Toyota.

Here, let's suppose Situation A in graph (2a). This graph shows the number of drivers of Toyota in G8 countries. For example, the number of Japanese drivers of Toyota is 12 million, the number of German drivers of Toyota is 11 million, and so on. In this situation, the total number of Toyota drivers in these 8 countries is 64 million.

(2) a. Situation A (total 64 million) b. Situation B (total 64 million)



Intuitively, in situation A the sentence (1) *Many GERMANS like driving a Toyota* can easily be judged as true.

Next, look at situation B in graph (2b). This situation is similar to situation A, but the numbers of drivers in each country are different. The number of Japanese drivers is extremely high. The important point here is that the total number of Toyota drivers in the eight countries is exactly the same as in situation A: 64 million, and so is the number of German Toyota drivers: 11 million. In such a situation, intuitively, sentence (1) is hard to judge as true, in contrast to situation A. It is not easy to say *Many GERMANS like driving a Toyota* in this situation.

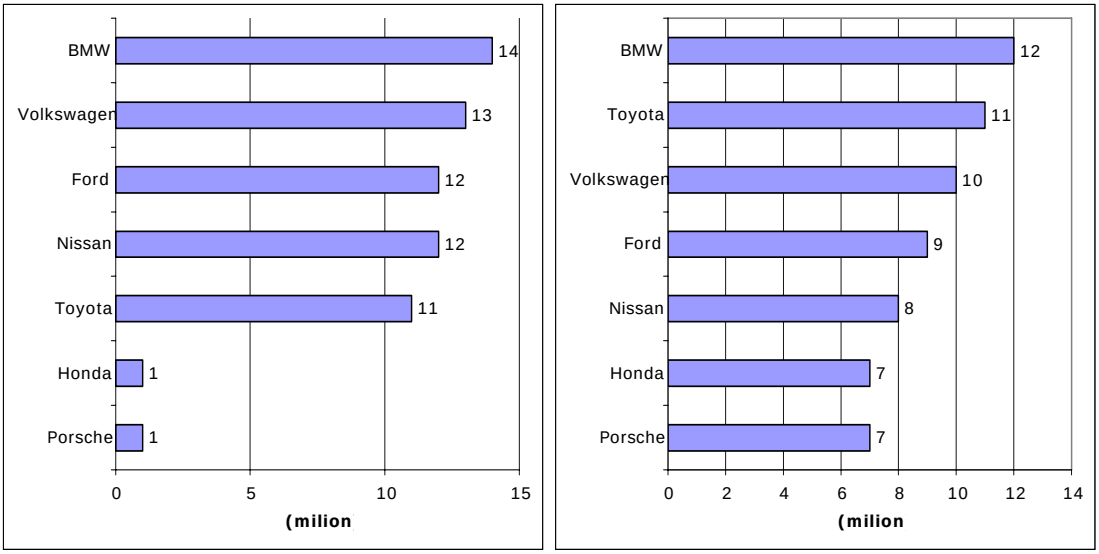
Here is another case. Consider sentence (3).

(3) Many Germans like driving a [TOYOTA]$_F$.

In this sentence, *Toyota*, which is part of the second argument for *many*, is focused. To interpret this sentence, suppose a situation different from A or B. (4a) is situation C under which sentence (3) is interpreted. This graph shows the number of German

drivers according to automobile makers. The total number of German drivers is 64 million. In this situation, BMW is the top car-maker in Germany, selling 14 million automobiles. Volkswagen is the second, Ford is the third, and so on. Toyota, in this case, is not a good car company in Germany, with a position of 5th out of 7 companies. Given this situation, it is hard to judge (3) as true. It is not easy to say *Many Germans like driving a TOYOTA* in this situation.

(4) a. Situation C (total 64mil.) b. Situation D (total 64mil.)



Finally, look at the fourth graph, situation D, in (4b). This graph also shows the number of German drivers according to car-makers. The total number of German drivers is 64 million as well. In this situation, however, Toyota is a much better company than in situation C. It is ranked second here. In this situation, sentence (3) is easily judged as true.

Compare all the situations A, B, C, D. In all these situations, the number of German drivers of Toyota is the same, 11 million. The total number of elements in each situation is also the same: 64 million. This means the ratio of the number of German drivers of Toyota out of the number of all individuals involved in these situations is the same in all four situations: 11 million out of 64 million. The truth values, however, are totally different for some reason. The question we have arrived at is "why?"

From now on, we will call such readings the "List Reading" of *many*. In the following section, I will provide an analysis of this reading.

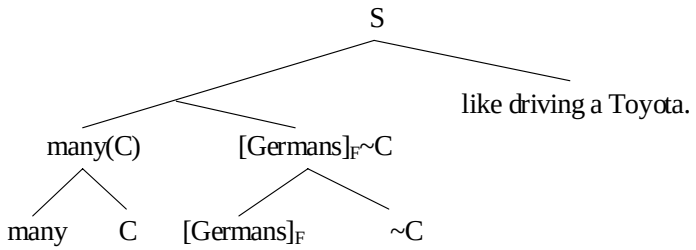
3. Analysis

In this section I will provide an analysis to account for the List reading of *many*. First off, we notice the characteristic point in (1) and (3). In both cases, focus is involved. To explain the data we need to assume (5) (see also Herburger 1997; 2000).

(5) The determiner *many* is focus sensitive.

Now, we will consider the focus structure of (1) and (3), following the analysis by Rooth (1985; 1992).

(6)



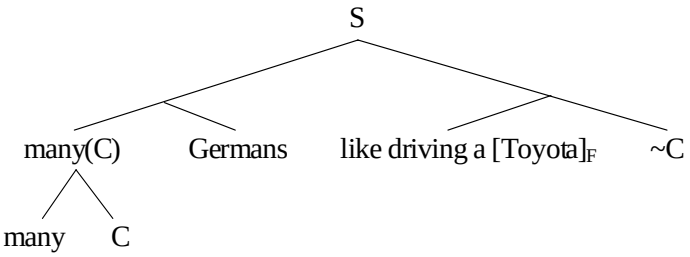
(6) is the syntactic structure of (1), where *Germans* is focused. Here we assume that *many* takes three arguments: a context variable C; the first <e, t> type argument, *Germans*; and the second <e, t> type argument, *like driving a Toyota.* If the first <e, t> type argument, *Germans* here, is focused, the alternatives to Germans (as in (7)) are available for interpretation by the context variable C.

(7) $C \subseteq$ ALT(Germans) = {Japanese, Germans, American, Englishmen, Frenchmen, Italian, Canadian, Russian}

If *Germans* is focused in this sentence, the only context available is one with several countries, not car makers. Compare the bar-graphs for situations A, B, and situations C, D. When *Germans* is focused, situations C, D are not available for interpretation, because these situations do not include an alternative set of nationalities. Therefore, situations A and B, which have alternatives with respect to nationality, are appropriate situations for sentence (1).

Next, look at (8). In this case, *Toyota* is focused.

(8)



When *Toyota* is focused, the sentence *Many Germans like driving a Toyota* implies that Germans liking a Toyota is contrasted with Germans liking other car brands. This is why the set of alternatives will be (9), which includes alternative car-makers.

(9) $C \subseteq$ ALT(like driving Toyota)
= {like driving a BMW, like driving a Toyota, like driving a Volkswagen, like driving a Ford, like driving a Nissan, like driving a Honda, like driving a Porsche}

Following this focus structure, I'll suggest the truth conditions in (10) (for the list reading of *many*).

(10) a. **many**$_{\textbf{list}}$(C, ψ, ϕ) is defined only if ψ∈C or$_{\text{exclusive}}$ ϕ∈C.
b. When defined, **many**$_{\textbf{list}}$(C, ψ, ϕ) = True iff
(i) |{x∈C: |x ∩ β | > |α ∩ β |}| is "small," and
(ii) For all x∈C s.t. x ≠α, |x ∩ β| - |α ∩ β| is "small,"
where α∈{ψ, ϕ} and α∈C, and β∈{ψ, ϕ} and β∉C

(10a) states a presupposition which predicts that (1) is not appropriate in situations C and D, and that (3) is not appropriate in situations A and B. ψ is the first <e, t> type argument, and ϕ is the second <e, t> type argument of *many*. In our examples (1) and (3), ψ is *Germans*, and ϕ is *like driving Toyota*. The presuppositions of *many* are satisfied only if ψ or ϕ is in the relevant set of alternatives exclusively. In other words, if ψ is in the relevant set of alternatives, ϕ is not. If ϕ is in the relevant set of alternatives, ψ is not. And, at least one of them must be in the relevant set of alternatives. (10) means that α is an <e, t> type argument which is in the set of alternatives, and β is the other <e, t> type argument which is not in the set of alternatives, following the focus structure. In (1), a focused element *GERMANS* is the argument which is in the set of alternatives as can be seen in (7). Therefore it is our α, and the other argument, *like driving a Toyota* is our β in (1). On the other hand, in (3), the non-focused element *Germans* is the argument which is not in the set of alternatives as can be seen in (9), therefore it is our β following the definition in (10). The other argument, *like driving a TOYOTA*, is our α because it is in the set of alternatives in this case.

(10b) is divided into two parts. Both of them should be satisfied for sentences with *many* to be judged as true. First, (10b)-(i) means that the number of elements in the set of alternatives that are superior to α, should be "small." In other words, this condition prohibits that α be in a low position in the alternative list. It should be in a higher position in the ranking. Second, look at (10b)-(ii). This condition prohibits that there be some extremely outstanding alternative superior to α.

Now, let's see how these truth conditions work. First of all, let's see the interpretation of sentence (1) in situation A.

(11) Many [GERMANS]$_F$ like driving a Toyota. (=(1))

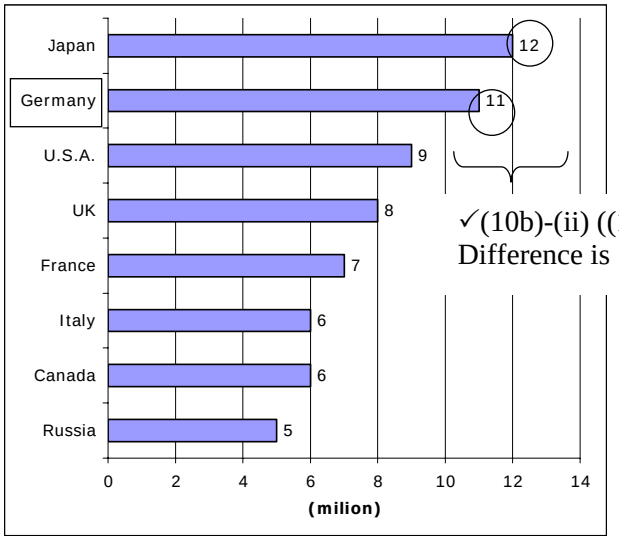
ψ = α = *GERMANS*
ϕ = β = *like driving a Toyota*

Here, the first <e, t> type argument ψ is focused, and we get a set of alternatives (7) by the context variable C. This argument is our α, because it is in the set of alternatives. The second <e, t> type argument ϕ, *like driving a Toyota*, which does not contain a focused element and is therefore not in the set of alternatives, is our β. Condition (10a) is satisfied because one of two <e, t> type arguments is in the set of alternatives exclusively.

For this set of alternatives, situations A and B are appropriate. Neither situation C nor D is appropriate for this sentence because these situations do not have appropriate alternatives in terms of nationality. "x" in (10b) is an arbitrary element in these alternatives, that is, in this situation, Japanese, American, Frenchmen, or anything else. Condition (10b)-(i) and (10b)-(ii) is represented as bar-graph (12).

(12) Interpretation of (1) in situation A

✓(10b)-(i) ((13))
The number of superior elements (Japan) is 1, which is "small"



✓(10b)-(ii) ((14))
Difference is 1, which is "small"

< Truth condition (10)b-(i) for (1) in situation A>

(13) a. |{x∈ALT(German): |Toyota drivers in country x| > |Toyota Drivers in Germany|}| is "small"

b. |{x: x is in a superior position to GERMAN }| = |{Japan}| = 1, which is relatively "small"

< Truth condition (10)b-(ii) for (1) in situation A >

(14) a. |Toyota drivers in country x| - |Toyota Drivers in Germany| is "small"

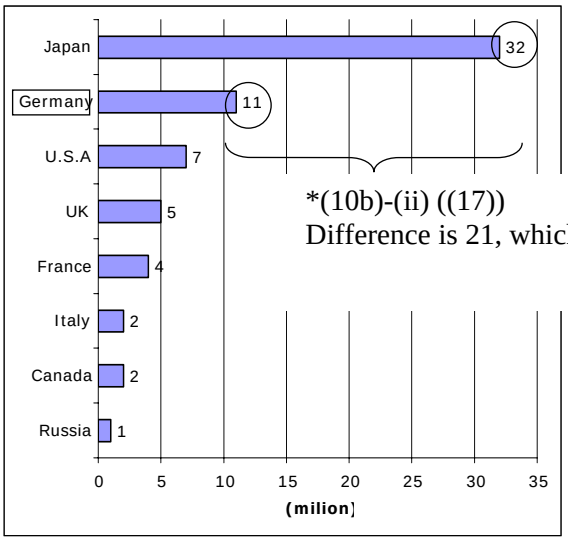
b. |Japanese Toyota Drivers| - |German Toyota Drivers| = 1milion, which is relatively "small"

(13a) says the number of superior elements to the focused element (*GERMAN*) should be "small". It is the condition following (10b)-(i), and it is satisfied as can be seen in a bar-graph (12) and (13b). The only alternative which is superior to Germany is Japan. (14)a is another condition following (10b)-(ii), which says, the difference between the number of individuals in the outstanding group (the number of Japanese drivers of Toyota, in this case) and the focused one (*GERMAN* Toyota drivers) is "small." It is shown in a graph (12) and (14b). In both conditions, the numbers are relatively small, so these two conditions are satisfied. This is why sentence (1) is easily judged true in Situation A.

Next, let's look at the interpretation of sentence (1) in situation B. In this case, condition (10a) is satisfied as well, because one of the two <e, t> type expressions is in the alternative set, exclusively. Conditions (10b)-(i) and (10b)-(ii) are represented in bar-graph (15).

(15) Interpretation of (1) in situation B

✓(10b)-(1) ((16))
The number of superior element (Japan) is 1, which is “small”



*(10b)-(ii) ((17))
Difference is 21, which is NOT “small”.

< Truth condition (10)b-(i) for (1) in situation B >

(16) a. |{x∈ALT(German): |Toyota drivers in country x| > |Toyota Drivers in Germany|}| is “small”

b. |{x: x is in a superior position to GERMAN }| = |{Japan}| = 1, which is “small”

< Truth condition (10)b-(ii) for (1) in situation B >

(17) a. |Toyota drivers in country x| - |Toyota Drivers in Germany| is “small”

b. |Japanese Toyota Drivers| - |German Toyota Drivers| = 21, which is NOT “small”

These conditions are represented as (16a) and (17a) in detail. Here, condition (10b)-(ii) is not satisfied. (17b) shows that the difference between the number of *GERMAN* Toyota drivers and the number of individuals in the superior group (the number of Japanese Toyota drivers) is 21 million, which is not “small.” This is why the sentence (1) in situation B is hard to judge true.

Next, let's look at the interpretation of sentence (3) (repeated as (18) for convenience) in situation C.

(18) Many Germans like driving a $[\text{TOYOTA}]_F$. (=(3))

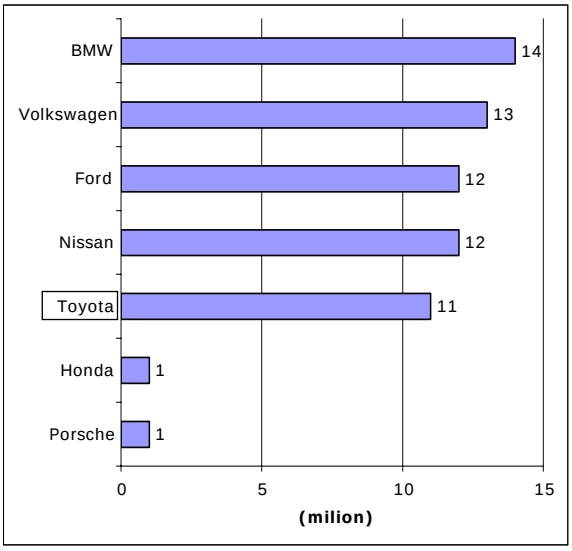
$\phi = \alpha$ = *like driving a TOYOTA*
$\psi = \beta$ = *Germans*

In this case, the second <e, t> type argument *like driving a Toyota*, is in the set of alternatives, because *Toyota* is focused, and we get a set of alternatives (9) by means of the context variable C. Therefore, this is our α. *Germans*, which is not focused, is our β

here. One of the two arguments of *many* is in the relevant set of alternatives exclusively, and condition (10a) is satisfied in situations C and D. Here again, "x" in condition (10b)-(ii) is an arbitrary element in these alternatives.

(19) Interpretation of (3) in situation C

*(10b)-(i) ((20))
The number of superior elements is 4, which is NOT "small".



Condition (10b)-(i) is shown in bar-graph (19). In this case, condition (10b)-(i) is not satisfied, as shown in (20b).

< Truth condition (10b)-(i) for (3) in situation C >

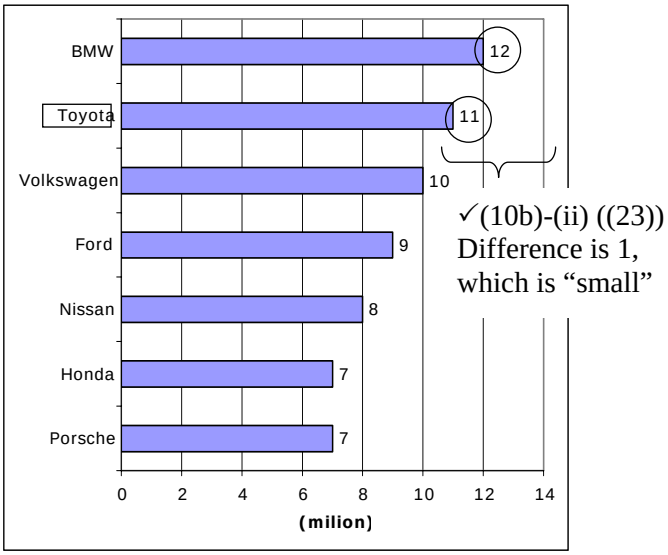
(20) a. |{x∈ALT(like driving TOYOTA):
| drivers of Toyota in Germany| > |drivers of x in Germany|}|

b. |{x: x is on superior position to TOYOTA}|
= |{BMW, Volkswagen, Ford, Nissan}|
= 4 (out of 7 elements), which is relatively NOT "small"

There are 4 alternatives which are superior to TOYOTA (BMW, Volkswagen, Ford, and Nissan). 4 out of 7 is not "small", and condition (10b)-(i) is not satisfied. This is why the sentence (3) in situation C is hard to judge true.

(21) Situation D

✓(10b)-(i) ((22))
The number of superior element is 1, which is "small"



✓(10b)-(ii) ((23))
Difference is 1, which is "small"

Finally, let's look at the interpretation of sentence (3) in situation D. In this case, condition (10a) is satisfied as well. Conditions (10b)-(i) and (ii) are represented in bar-graph (21). In this case, (10b)-(i) is satisfied in (22b), because the number of superior elements to the focused element *Toyota* is only 1, which is "small". Next, (10b)-(ii) is also satisfied in (23b), because the difference between the topmost element and focused element is only 1 million, which is relatively "small." This is why sentence (1) is easily judged as true in situation D.

< Truth condition (10)b-(i) for (3) in situation D >

(22) a. |{x∈ALT(like driving TOYOTA):
| drivers of Toyota in Germany| > |driver of x in Germany|}|

b. |{x: x is on superior position to TOYOTA}|
= |{BMW}|
= 1, which is "small"

< Truth condition (10)b-(ii) for (3) in situation D >

(23) a. |drivers of x in Germany| - | drivers of Toyota in Germany| is "small"

b. |drivers of BMW in Germany| - | drivers of Toyota in Germany|
= 1, which is "small"

As we have seen so far, given the truth conditions (10) for the List Reading of *Many*, we can explain the different judgments for (1) and (3) in situations A, B, C, and D.

4. Previous Treatments

In the previous literature, several kinds of analyses for *many* have been suggested. I will now compare my analysis of the List Reading of *many* to some of the previous analyses. Due to space limitations, I do not provide a detailed survey.

4.1. Proportional reading (Partee (1988), Cohen (2001), among others)

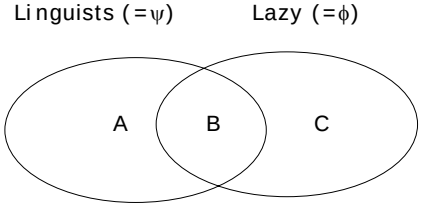
The first analysis is the so-called Proportional reading suggested by Partee (1988), among others.

(24) $\mathbf{many_{proportional}}(\psi, \phi)$ = True iff $\frac{|\psi \cap \phi|}{|\psi|} > \rho$, where ρ is "large."

Let's consider sentence (25).

(25) Many linguists are lazy

(26)



(27) $\frac{|B|}{|A+B|}$ is "large" (cf. (26))

Here we have a Venn diagram (26). Domains A and B comprise the set of all linguists. Domains B and C comprise the set of lazy people. The Proportional reading in (24) says that the truth conditions of *Many linguists are lazy* can be represented as (27). That's enough to judge the sentence *Many linguists are lazy* for the Proportional reading, as seen in (27). Here suppose a situation (28).

(28) All linguists (= A+B): 1000
Lazy linguists (=B): 800

(29) $\frac{|\text{Lazy linguists}|}{|\text{All linguists}|}$ is "large"

(30) [[Many linguists are lazy]] = True iff $\frac{800}{1,000}$ is "large"

800 out of 1000 is actually large, so (25) is judged as true under the situation (28).

Let's look at our German Toyota Drivers sentence. Its truth conditions would be (31).

(31) $\frac{|\text{German drivers of Toyota}|}{|\text{All Germans}|}$ is "large"

If we suppose the situation A and B in (2) with additional information on the number of all Germans, as represented in (32), the truth conditions for *Many Germans like driving a Toyota* would be (33).

(32) All Germans 85 million
German Toyota Drivers 11 million

(33) [[Many Germans like driving a Toyota]] = True iff $\frac{11,000,000}{85,000,000}$ is "large"

However, This analysis cannot explain our data. First, we didn't have the population of Germany in our situations A, B, C, D to judge sentences (1) and (3). The population of Germany has nothing to do with the List reading under which (1) and (3) are interpreted. Second, in our situations A, B, C, D, the number of German drivers of Toyota is the same in all four situations: 11 million. This means the relevant proportion is 11 million out of 60 million in all cases. Therefore, the proportional analysis predicts that sentences (1) and (3) have the same truth value in all the situations A, B, C, D. This is not the case, however.

4.2. Reverse reading (Westerståhl (1985))

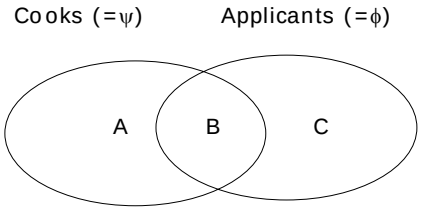
The next analysis is the Reverse reading proposed by Westerståhl (1985). In this analysis, the occurrence of ψ and ϕ in the Proportional reading is reversed, as represented in (34).

(34) $\textbf{many}_{\textbf{reverse}}(\psi, \phi)$ = True iff $\frac{|\psi \cap \phi|}{|\phi|} > \rho$, where ρ is "large."

Let's see how this interpretation works in sentence (35) under situation (37).

(35) Many cooks applied

(36)



(37)

The number of all cooks (in a relevant context) (=A+B):	600
The number of all applicants (=B+C):	50
The number of cooks who applied (=B):	48

(38) a. |B| / |B+C| is "large"
b. 48/50 is "large"

Intuitively, *Many cooks applied* is true in situation (37). The Reverse reading in (34) means that the truth conditions of (35) are (38). This predicts that the sentence is true, appropriately. In this case, the interpretation violates the "live-on" property, which is mentioned in the Generalized Quantifier Theory of Barwise and Cooper (1981). The domain A in the Venn diagram has nothing to do with its interpretation.

Now we will look at our German Toyota Drivers sentences. The truth conditions would be (39). Here, let's suppose the situation in (40). These numbers come from our situations A, B, C, D.

(39) a. $\frac{|B|}{|B+C|}$ is "large"

b. $\frac{|\text{German drivers of Toyota}|}{|\text{All Drivers of Toyota}|}$ is "large"

(40)

The number of all Toyota drivers	64 million
The number of all German Toyota drivers	11 million

Now we would have the truth conditions for *Many Germans like driving Toyota* in (34).

(41) [[Many German like driving a Toyota]] = True iff $\frac{11,000,000}{64,000,000}$ is "large"

11 million out of 64 million may be large, or may be small, but it doesn't matter. The problem is, these truth conditions make an incorrect prediction for our situations A, B, C, D. In all four situations, the proportion of German Toyota drivers out of all Toyota drivers is 11 million out of 64 million. This ratio is the same in all four situations. The Reverse reading in (34) predicts that the sentence *Many Germans like driving a Toyota* has the same truth value in all four situations. Again, this is not the case.

4.3. Relative reading (Cohen (2001))

The third analysis is the Relative reading presented by Cohen (2001). This interpretation can be formalized as in (42).

(42) $\mathbf{many}_{\mathbf{relative}}(\psi, \phi)$ = True iff $\frac{|\psi \cap \phi|}{|\psi \cap \bigcup A|} > \rho$, where

(i) ρ is "large" or

(ii) $\frac{|\bigcup A \cap \phi|}{|\bigcup A|}$ where $A = \{\psi' \cap \phi' \mid \psi' \in ALT(\psi) \,\&\, \phi' \in ALT(\phi)\}$

Here we have a famous example (43). Let's suppose the situation in (44). In this situation, sentence (43) is judged true, as shown in (45).

(43) Many Scandinavians have won the Nobel Prize in literature

(44)

All Nobel Prize winner in literature	81
All Scandinavian Nobel Prize winners in literature	14
All Scandinavians	60 million
All human beings	6 billion

(45) [[Many Scandinavians have won the Nobel Prize in literature]] = True

iff $\frac{\text{Scandinavian Nobel Prize winner in Lit.}}{\text{All Nobel Prize winner in Lit.}} > \frac{\text{All Scandinavian}}{\text{All human}}$

iff $\frac{14}{81} > \frac{60 \text{ million}}{6 \text{ billion}}$

Intuitively, these truth conditions mean that Scandinavians are very good at the Nobel Prize in literature, even though the proportion of Scandinavians out of all human being is not large.

Now, let's apply this Relative reading to our German Toyota drivers sentence. Suppose (46) as a situation for the sentence *many Germans like driving a Toyota*. Following the Relative reading, the truth condition would be (47). These truth conditions are applied to all our situations A, B, C, and D. There is no difference between these four situations with respect to the Relative reading.

(46)

All Toyota drivers	64 million (from situation A, B, C, D)
German Toyota drivers	11 million (from situation A, B, C, D)
All German	85 million
All human beings	6 billion

(47) [[Many German like driving Toyota]] = True

iff $\frac{\text{German Toyota Driver}}{\text{All German}} > \frac{\text{All Toyota driver}}{\text{All human}}$

iff $\frac{\text{11 million}}{\text{85 million}} > \frac{\text{64 million}}{\text{6 billion}}$

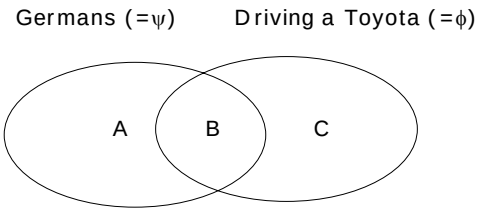
As consequence, the Relative reading analysis predicts that *Many Germans like driving Toyota* has the same truth value in all four situations A, B, C, D. Here again, this is not the case.

4.4. Cardinal reading (Barwise and Cooper (1981), Partee (1988), de Hoop and Solà (1996), among others)

As we have seen, none of the previous treatments can explain why *Many Germans like driving a Toyota* does not have the same truth value in our situations A, B, C, and D. The only previous study that is compatible with my analysis is the final one: Cardinal reading suggested by Partee (1988), among others. The truth conditions of the Cardinal reading are shown in (48).

(48) $\mathbf{many}_{\mathbf{cardinal}}(\psi, \phi)$ = True iff $|\psi \cap \phi| > \rho$, where ρ is "large."

(49)



(50) |B| is "large"

The number of elements in the intersecting area of the denotations of the two arguments of the determiners, which is B in the Venn diagram, should be "large." In short, the number of individuals in domain B of the Venn diagram should be "large."

(51) German Toyota drivers 11million (from Situation A, B, C, D)

Following this analysis, it seems that our German Toyota Drivers sentence can be explained. That is, the number of German Toyota Drivers, 11 million, is "large" in situations A and D, but it is not "large" in situations B and C.

Yet, this analysis is too naïve to explain various kinds of data with *many*. It needs to be modified because the truth conditions are vague. In particular, it doesn't explain the effect of focus on the judgments. My analysis of the List reading of *many* in (10), and this Cardinal reading (48), are basically on the same track. Yet, the List semantics (10) shows where the "large"-requirement comes from clearly, in terms of the focus structure.

5. Conclusion

We have seen examples of an interpretation that we named the "List reading." The determiner *many* is focus sensitive, taking a context variable C as its first argument. This context provides a set of alternatives for comparison. I do not intend to say that the List reading is the only reading of *many*. We still need the interpretations identified in previous studies. These analyses are necessary, but not sufficient. What I'm trying to do in this paper is point out that previous treatments for determiner *many* are incomplete.

Previous studies cannot explain the data that I have presented, with the exception of the Cardinal reading. The List reading is basically similar to the Cardinal reading, but the List reading is more precise because it indicates how satisfaction of the "large"-requirement depends on focus structure.

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