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Erstgutachter:
Dr. Jon Ander Mendia

Zweitgutachterin:
Univ.-Prof. Dr. Hana Filip, PhD

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Claire-Emeraude Filtz
Matrikelnummer: 2292793
Piusstraße 45
50823 Köln

claire-emeraude.filtz@hhu.de
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1 Introduction

Consider the sentence in (1).

(1) Andy said: "I ate some of the cake."

If one was to hear this utterance, they will probably draw the conclusion that the person did not eat *all* of the cake.

(1b) inference: Andy did not eat all of the cake.

But why is it that we usually make this kind of inference? When having a conversation, one commonly makes a few general assumptions, one of them being that the person one is speaking to is saying the truth. When asking someone *"What did you eat?"*, and their conversation partner answers with *"I ate some of the cake."*, one can usually assume that what he is saying is true. If the conversation partner had eaten all of the cake, they would probably have said something as in (2).

(2) Andy said: "I ate all of the cake."

For the example sentence (1) which contains the quantifier *some*, we have concluded that the hearer is likely to inference that Andy did not eat *all* of the cake. In (2), the only thing that changed was that *some* was replaced by *all*. Because of this, a hearer is not likely to make the inference as in (1) since the speaker said that he ate *all* of the cake. It seems that *some* and *all* evoke different inferences. The inferences that terms evoke will become the main topic of this thesis.

Let us look at the quantifiers *some* and *all* and their corresponding inferences. A first observation we can make about the meaning of *all* is that, if Andy ate *all* of the cake, then he also must have eaten *some* of the cake. To eat an entire cake, one first has to eat parts of it in order to get to the point of having eaten everything. Does this also apply the other way around, from *all* to *some*? Unless the person is lying, that is not the case. Eating some of the cake, does not imply that one ate all of it. If we imagine the eating of a cake as a process, then the point of having eaten *some* of the cake will be reached first and then, later in the process, the point of having eaten *all* of the cake will be reached. Thus, when using *all*, one commonly implies that *some* is true as well. Seemingly, the meaning of *some* is contained in the meaning of *all*. We could therefore make an informal generalization stating that *all* is "informationally stronger" since it conveys more than *some*. Uttering a sentence containing *all* implies that *some* is true as well.

But how do we get to an inference such as (1b)? As mentioned earlier, we generally make a few assumptions about our conversation partner. Not only do we assume our conversation partner to say the truth, but also we can generally assume that one is giving as much relevant information as possible.

Let us assume that a speaker has the choice between the two utterances *"I ate all of the cake"* and *"I ate some of the cake"*. If he chose the latter, then it must be because this utterance contains as much relevant information as possible. Uttering the first sentence with the quantifier *all* would not only have been wrong, but would also have conveyed too much information.

We can now look at what the train of thought of a hearer could look like. A speaker utters (3).

(3) Andy said: "I ate some of the cake."

A first assumption the hearer of sentence (3) will make is that the person he is speaking to is saying the truth. In the previous section I talked about a notion of "informational strength" that can be observed with certain kinds of words, such as quantifiers. If the hearer knows that for the term *some*, there is an "informationally stronger" term such as *all* that the speaker could have used, the hearer might ask himself why the speaker did not choose the stronger term. As stated above, it might be that the term *some* was informationally strong enough for the purpose of that conversation. Because a speaker is assumed to be saying the truth, he might purposefully not have chosen *all* because he was unsure about the truth of this quantifier. The speaker must either not have been sure about the truth of *all* or must know that *all* is false or contains too much information. However, he must have been sure about the truth of *some*. A hearer knowing that there is an "informationally stronger" item that is available to the speaker therefore can conclude that the speaker is saying the truth and any "informationally stronger" statement is false. I will represent the inference with the sign "$\rightsquigarrow$". We will later see that these inferences can be called *scalar implicatures*. Consider the initial example in (4) and its inference.

(4) Andy said: "I ate some of the cake."

⇝ Andy believes that it is not the case that he [=Andy] ate all of the cake.

It is important to notice that a kind of inference as in (4) is not an individual case and does not only appear with *some* and *all*. Implied meanings are very common in everyday conversations. This happens not only with quantifiers, but also with adjectives or modals and in general with any two expressions that stand in the right information strength relationship.

For instance, a teacher saying *"Students can turn in their homework"* is probably not impliying that students *must* turn in their homework. We can link this to the notion of "informational strength" we have seen before. *Must* is informationally stronger than *can* and therefore a sentence containing *can* does not imply the truth of *must*.

(5) Teacher: "Students can turn in their homework on Wednesday morning."
⇝ It is not the case that students **must** turn in their homework on Wednesday morning.

As mentioned earlier, we can also encounter this phenomenon with other kinds of words. Let us look at an example with adjectives.

(6) A: What did you see in the park yesterday night?
B: I saw an animal.

After hearing the answer in (6), the speaker A would probably ask himself why B did not say what kind of animal he saw. The reason for that is that the speaker knows there is an available "informationally stronger" term such as a specific animal; e.g. a dog or a cat. Why did B not use a specific animal name instead of just using *animal*? As mentioned above, we generally assume that our conversation partners are saying the truth, thus, what he said must be true. In contrary, saying that he saw a dog would not have been true. The reason could be that B was not able to see what animal it was; maybe it was too dark and therefore B could not recognize the animal properly. In conclusion, after hearing the answer in (6), A is likely to conclude that B did not know at the point of seeing the animal, what kind of animal it was. So, we could say that, as in the above example with *some* and *all*, *dog* is "informationally stronger" than *animal*. In conclusion, an inference of (6) could be that it is not the case that the speaker saw a dog or cat. We are going through the same process as with example (4). A hearer assuming that the speaker is saying the truth and knowing that there is an "informationally stronger" item, concludes that any "informationally stronger" item is false.

What happens when the answer of B is more specific such as in example (7)? We should expect it to behave the same as the above examples, since a hearer seemingly should be able to infer that: If there is an "informationally stronger" item the speaker could have used, then the hearer can conclude that this "informationally stronger" item is false.

(7) A: What did you see in the park yesterday night?
B: I saw a dog.

Along the lines of (4) and (6), we could draw an inference saying that: Assuming that there is a stronger item than *dog*, e.g. a specific dog breed like *poodle* or *spaniel*, the speaker probably did not see or did not know what kind of breed the dog he saw belongs to. While the inference in (6) is convincing, the same kind of inference for (7) seems odd. In the situation of example (6), it does not seem like being more specific about the dog by e.g. naming the dog breed is absolutely necessary. Thus, we do not conclude that the speaker B in (7) did not know the breed of the dog and there simply seems to be no inference at all for (7).

The question that will become the main topic of this thesis is why we can find inferences for (4) and (6) and there seems to be a lack of such inference for (7)? We start with the assumption that there is always a stronger lexical item that a speaker could have used. In (4), the available stronger item one could have used is *all* while it is *dog* in (6). For (7), stronger items would contain a dog breed. Provided that there is an item stronger in information for every term standing in the right information relationship to it, we should expect all cases to behave the same. A speaker choosing to use a weaker term (e.g. *some* or *animal*), would infer that the stronger item is false or that the speaker is unsure about the truth of the stronger item. If that is the case, then why is there no such inference for example (7)? If there is an "informationally stronger" item such as *poodle* that is available, then why do speakers seem to make no inference after hearing (7)? That is the question that I will discuss in this thesis.

The main topic that I am addressing will be the structural differences between the two examples (4) and (7). I will start by looking at general properties of conversation such as Grice's Cooperative Principle and the Maxims of Conversation. This will help to understand the phenomenon of inferences which will be introduced as conversational implicatures. The background information will serve as a basis to analyze the examples from the introductory section. In the Proposal in chapter 4, we will first look at a theory by Matsumoto (1995) which includes a notion of a "default level" to explain the phenomenon. In order to properly talk about the differences between two kinds of sets, we will have to take a look at formal properties of different sets or scales. We will see that the terms *all* and *some* have very different properties than *animal* and *dog* which can be accounted for the non-arising implicature in example (7). Arising consequences for the calculation of scalar implicatures will be discussed in chapter 5. In the end, it will become clear that the reason for an implicature for (4) and the lack of such for (7) lie in the structure of the sets that the concerned lexical items are in.

2 Background

2.1 Grice's Cooperative Principle

As stated earlier, one is likely to assume that the person one is speaking to is saying the truth. But what is the reason for that? Grice first remarks in *Logic and Conversation* in 1975 that in a conversation, all participants usually have a general common purpose or set of purposes. Participants of a conversation do not align unrelated utterances, but they are cooperating with each other. This is summarized in the Cooperative Principle.

> Cooperative Principle: Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged.
>
> (Grice 1975: 45)

The Cooperative Principle states that we should align our contributions to a conversation to the purpose of that conversation. However, it does not explain what it means exactly to be a cooperative speaker. The principles or rules we follow are specified in the four MAXIMS OF CONVERSATION: the Maxim of Quantity, Quality, Relation and Manner. These tell us how much information and in which way we should present it when engaging in a conversation (from Grice 1975: 45-46).

- QUANTITY:
  - Make your contribution as informative as is required (for the current purposes of the exchange).
  - Do not make your contribution more informative than is required.
- QUALITY: Try to make your contribution one that is true:
  - Do not say what you believe to be false.
  - Do not say that for which you lack adequate evidence.
- RELATION: Be relevant.
- MANNER: Be perspicuous:
  - Avoid obscurity of expression.

- Avoid ambiguity.
- Be brief (avoid unnecessary prolixity).
- Be orderly.

A person engaging in a conversation and wishing to be cooperative, should make his contributions to the conversation according to these maxims. A speaker should not give too much or too little information, only say what he believes to be true, be relevant and convey all of this information in an orderly and clear way.

In the following example, we can see an illustration of a person not following the Maxim of Manner.

(8) (while assembling a piece of furniture)
A: Where is the screwdriver?
B: In the garage.

According to the Maxim of Manner, Person B should not be ambiguous. However, he has only stated that the screwdriver is in the garage which is probably not specific enough for speaker A. A more unambiguous statement would have contained the specific location of the screwdriver in the garage, so that person A can find it.

Furthermore, if speaker B had answered the question with the following sentence, he would have been violating the Maxim of Relevance.

(9) (while assembling a piece of furniture)
A: Where is the screwdriver?
B: The hammer is broken.

Speaker A asked for the location of the screwdriver, but speaker B answered with a completely unrelated topic. Thus, the Maxim of Relation has been violated.

Grice does not define these as set rules that one *needs* to follow in order to have an effective conversation. He calls the use of these *reasonable* if one wants to be cooperative (Grice 1975: 48). If one was to flout of violate one or more of the maxims, a conversation can still be lead. In fact, doing so leads to possible inferences a hearer can draw, which we will see in the following section. Grice shows various ways in which a speaker can fail to fulfill a maxim.

A speaker might choose to violate a maxim or opt out of using a maxim because he is unwilling to be cooperative. One might also be faced with a contradiction between maxims, that is; following one maxim violates another maxim.

Consider the example (10) from Grice (1975: 51).

(10) (while planning an itinerary for a holiday in France)
A: Where does C live?
B: Somewhere in the South of France.

At first sight, B has violated the Maxim of Quantity, since he has not made his statement informative enough for the current conversation topic. This can be explained by the fact that he chose to answer with an unspecific location. Naming only the region and not a specific city makes him follow the Maxim of Quality ("Do not say what you believe to be false") without giving too small an amount of information. Therefore, it is implied that he does not know the exact town in which C lives, but he answered as truthfully as he could.

It is worth mentioning at this point that the inferences we draw from statements can be calculated. Grice states that "the presence of a conversational implicature must be capable of being worked out" (Grice 1975: 50). In the following section, we will see what a calculation of an implicature could look like.

2.2 Conversational Implicatures

The question that is arising at this point is the following. How we can we flout maxims and still be reasonable and have an effective conversation? One case where this happens is with conversational implicatures. Grice draws a difference between saying and implicating. What one says is truth-conditional content (Geurts 2010: 7), while what is implicated goes beyond the truth conditions and also factors in the CP (Cooperative Principle) and the Maxims of Conversation.

In the conversation in (11), the speaker B has simply stated that he has to work on that night.

(11) A: Are you coming to my party tomorrow?
B: I have to work tomorrow.

In a regular conversation, we can commonly understand from B's utterance that he will not go to the party *because* he has to work. The fact that he is not going to the party was not explicitly mentioned e.g. by adding *"Therefore I can't go to your party"*, but was implied from the utterance. An implicature thus differs from what a speaker conventionally says.

The first distinction that is important to make is the one between conventional and conversational implicatures. The former one arises from solely the conventional meaning of the utterance while the conversational implicature depends on general features of discourse (Grice 1975: 45).

(12)
a. Alex is German and therefore punctual.
b. Alex is German and punctual.
c. Alex being punctual follows from him being German.

Notice that a speaker using (12a) implicates (12c) due to the use of *therefore*. (12b) simply states the two facts, namely that Alex is German and that Alex is punctual. Due to the use of *therefore*, a speaker uttering (12a) is likely to imply that Alex is punctual *because* he is German, as stated in (12c) (Davis 2014). For the purpose of this thesis, we will only be looking at conversational implicatures, more specifically at scalar implicatures.

A conversational implicature arises because in general, participants of a conversation assume that their conversation partner is being a cooperative speaker. The hearer might have observed that the speaker violated one of the maxims (the reason could be a clash between maxims). Nevertheless, if a hearer has no reason to think that the speaker is opting out of the general CP, then a conversational implicature can arise. As mentioned earlier, Grice explains briefly how an implicature can be worked out.

> '[A speaker] has said that p; there is no reason to suppose that he is not observing the maxims, or at least the CP; he could not be doing this unless he thought that q; he knows (and knows that I know that he knows) that I can see that the supposition that he thinks that q IS

> required; he has done nothing to stop me thinking that q; he intends me to think, or is at least willing to allow me to think, that q; and so he has implicated q.'
>
> (Grice 1975: 50)

We will now look at exactly how a calculation of a conversational implicature. One type of conversational implicatures are the Quantity Implicatures, their name being related to the fact that these implicatures arise because of the Maxim of Quantity. The Q-Implicatures first mentioned by Horn (1984) are said to be hearer-based. According to Horn, generalized "Q-implicata arise from scalar predications" (Horn 1984: 13). As mentioned earlier, implicatures can be calculated and so can Quantity Implicatures. As the name "hearer-based" implicatures already says, the hearer goes through a reasoning process, which will turn out to be part of our calculation process.

For the calculation I will follow Geurts presentation of the reasoning process which he calls the "Standard Recipe" (Geurts 2010). To illustrate this, let us use the example sentence (1) from chapter 1.

(1) Andy said: "I ate some of the cake."

We start the calculation of Quantity Implicatures with the utterance (1) and the assumption that the speaker is being a cooperative speaker. Providing that Andy is making his contribution according to the CP and the Maxims, especially the Maxim of Quantity, then we can presuppose the following. In the Introduction, we briefly talked about the notion of "information strength". We can now link this to the Maxim of Quantity which we learned about in the previous section. According to the rule of Quantity, Andy should give the maximum amount of information he possibly can.

This means that there might be other statements that contain more information. However, he did not choose to utter these alternative sentences. If he is following the Maxim of Quantity, it must be that stating other sentences would be wrong since they contained too little or too much information for the current purpose of conversation. As the Maxim of Quality must also be followed, the speaker should use an utterance that is true and which gives the right amount of information.

The sentence the speaker uttered will be called φ. The more informative statement, the *alternative sentences*, Andy did not choose to use will be called ψ. Again, on the assumption that the speaker is following the CP, we can assume that he is saying the truth (because he is also following the Maxim of Quality). Therefore φ is true.

Following from the previous steps, we can argue that, because it is the case that the speaker is only making statements that he believes to be true, any other alternative sentence ψ does not match with the speaker's beliefs. The speaker must have had a reason for not choosing to utter ψ. The reason for that is that he probably did not have enough evidence. From the Maxim of Quality we know that a speaker should only say that for which he has adequate evidence. Thus, it must be that for an alternative statement ψ, the speaker did not have enough evidence. Consider the steps we took so far in (13):

(13)
a. A speaker utters a sentence φ.
b. Assuming that speaker S is a cooperative speaker and following the Maxims of Conversation, he could not have made a better, more informative statement.
c. Epistemic Implication: Saying p, we infer Kp: the speaker knows that p. Therefore, φ is true.[1]
d. There are more informative statements such as ψ that the speaker could have uttered, but chose not to.
e. There must be a reason why he did not utter ψ.
f. Saying ψ would have violated the Maxim of Quality: Either the speaker didn't have enough evidence for ψ or the speaker thinks ψ is false. Either K(ψ) or K($\neg$(ψ)

Nevertheless, we are still missing one important step before being able to properly calculate the right implicature. We have stated there is a more informative utterance ψ. If we want to calculate an implicature on the basis of ψ, we need to make sure

[1]Kp: The speaker knows that p. (Hintikka 1962: 119). Hintikka introduces the operator "K" to explain the notion of "knowing that one knows". "The general reason lies in the fact that "I know" implies "I know that I know" epistemically." (Hintikka 1962: 122). A speaker uttering a sentence p therefore knows that p is true.

that the speaker is opinionated about the truth of the more informative statement. This step is called the *Epistemic Step* and states that for any more informative alternative sentence, the speaker knows whether this sentence is true or not. This leads us to the implicature that the speaker must believe the alternative sentence ψ to be false. The last three steps for the calculation of implicatures are as follows.

g. Epistemic Step: For a stronger, more informative alternative sentence ψ, the speaker knows whether ψ is true or false.

h. Conclusion: The speaker must believe ψ to be false.

i. Quantity Implicature: K¬[I ate all of the cake]. The speaker knows that it is not the case that he [=the speaker] ate eat all of the cake.

With this way of calculating implicatures, we are comparing alternatives as sentences. As we have seen above, we can always assume that a speaker could have used an informationally stronger statement. The reason for that is that speakers are said to follow the Cooperative Principle. Therefore, their utterances should align with the Maxims of Conversation. It follows that they could have made stronger statements which we have talked about for the calculation of Quantity Implicatures. We are thus comparing sentences with putative statements as a factor of speakers being cooperative.

At this point, it is important to notice that not all alternative sentences can be factored into the calculation process as this would result in an overgenerating of alternatives. It is necessary to restrict the putative statements for the calculation in order to not run into problems such as one called “Symmetry Problem”. The Symmetry Problem arises because for every statement φ, there is an alternative statement φ' and also φ” = $\varphi \wedge \neg \varphi$' which contradicts with the initial statement φ (Katzir 2007: 673). As stated above, for the sentence *“She ate some of the cake”*, there is a more informative statement *“She ate all of the cake”*. As we have seen above, the hearer can follow that the speaker must believe the more informative alternative sentence to be false if he is a cooperative speaker. Nevertheless, this is not the only relevant more informative statement. Another one could be *“She ate some, but not all of the cake’*. Again, because this statement is stronger in information than the original sentence, the hearer can conclude that the speaker believes this utterance to be false. Providing that *"She ate some of the cake"* is right, it can not be that the two stronger alternative statements are both wrong since this would contradict the original statement (Katzir 2007: 673). In order not to run into this problem, it might be necessary to restrict the relevant alternatives.

2.3 Horn scales

In the Introduction, we have briefly discussed the notion of one lexical item being stronger than another one due to more information. With the "Standard Recipe", we have compared alternative statements as whole utterances. The alternatives were computed by forming new stronger statements, as *"I ate all of the cake"* being more informative than *"I ate some of the cake"*. I will now introduce Horn's theory (1972) which helps us generate good alternative sentences by lexical substitution without running into the Symmetry Problem. Horn introduced quantitative scales as a way to avoid stating alternatives for each sentence separately.

Certain word classes, e.g. numerals, quantifiers or adjectives are thought to be on a quantitative scale. A Horn scale is a "sequence of increasingly informative expressions" (Geurts 2010: 50); informativity being defined in terms of entailment.

Entailment: A entails B iff whenever A is true, B is true as well.

(Geurts 2010: 197)

The process of generating alternatives is divided into two steps. The scalar term inside an utterance is first substituted by another item of its Horn scale to then generate a new alternative sentence.

In a scale $\langle\alpha, \beta, \gamma\rangle$, the term on the right is stronger in informativity than the term on the left, meaning that the term on the left is entailed by the term on the right. So, if we have γ and γ belongs to the Horn scale $\langle\alpha, \beta, \gamma\rangle$, then γ entails β because it is more informative than β and therefore stands on the right side of γ.

Examples of Horn scales are (from Levinson 1983: 134):

⟨or, and⟩

⟨sometimes, often, always⟩

⟨..., 3, 4, 5, ..., n⟩

⟨clever, brilliant⟩

⟨like, love⟩

⟨warm, hot⟩

Let us take sentence (1) from the Introduction to see how we can include Horn's substitution mechanism into our calculation process.

(1) Andy said: "I ate some of the cake."

In the previous sections, we have talked about the notion of information strength. We had informally said that a quantifier like *all* seem to be informationally stronger than *some*. It is important to notice that the entailment relationship does not go vice versa, which means that the terms stand in an asymmetric entailment relationship. In the Introduction, I had observed that the meaning of *all* does not seem to be included in the meaning of *some*. This is what we see here. The terms in a Horn scale are ordered by informativity, which mean that a weaker item is entailed by its stronger scalemate. However, the weaker item does not entail the stronger item, which makes the two items stand in an asymmetric relationship.

Horn identifies items to be scalemates if they are on the same scale which makes them be ordered in informativity. In order to generate alternative statements we must now use the substitution mechanism. For this, we replace the scalar item *some* of (1) with a more informative scalemate *all*. This is the first step of the substitution. We can now insert *all* inside the sentence (1) which results in a new, more informative alternative sentence (2).

(2) Andy said: "I ate **all** of the cake."

Horn's theory goes on to calculate scalar implicatures by negating stronger alternatives. The use of a less informative item of a Horn scale implicates the negation of a more informative term of the Horn scale (Horn 1972: 112). The use of *some* in example (1) therefore implies that *all* is false, making the complete utterance false.

Negation of stronger alternative of (1): ¬[I ate all of the cake.]

Implicature: The speaker knows that it is not the case that he [=Andy] ate all of the cake.

The problem with Horn scales is that before using the substitution mechanism, we would need to know for every lexical item to which Horn scale it belongs. We might therefore want to look at other properties of the items of scales in order to be able to make better predictions.

To sum up, we can say that so far we have introduced a way of calculating scalar implicatures. Horn scales helped us in generating good alternative sentences by lexical substitution.

2.4 Prediction

With this background knowledge, we are now in a good position to talk about the problem we saw in the Introduction. We started with the sentence in (14), for which we calculated the implicature to be the following.

(14) Andy said: "I ate some of the cake."
Implicature: The speaker knows that it is not the case that he [=Andy] ate all of the cake.

The theories explained in the background section showed us how we could come to such an implicature. According to Horn, the terms *some* and *all* are scalemates which we can then use for the substitution mechanism in the calculation process.

If we can identify the quantitative scale ⟨some, many, all⟩, we might want to try to do that for the examples (6) and (7) as well.

As mentioned above, for the example (6), we can easily find stronger lexical items than *animal* such as a name of an animal. We could therefore identify a scale ⟨animal, dog, poodle⟩. This seems to qualify perfectly as a quantitative scale as the terms stand in an asymmetric entailment relationship. *Dog* is informationally stronger than *animal* and so is *husky* for *dog*. This means that we should be able to calculate an implicature with our Standard Recipe using any quantitative scale. Thus, we can calculate the following implicature.

(15) Andy said: “I saw an animal.”
Implicature: The speaker knows that it is not the case that he [=Andy] saw a dog.

Using a stronger item of the Horn scale and substituting it to generate an alternative statement allows us to calculate the implicature. If that is the case, it should also be possible to calculate an implicature for the following example.

(16) Andy said: “I saw a dog.”
Implicature: The speaker knows that it is not the case that he saw a poodle.

As stated in the Introduction, while the implicature in (15) appears to be right, the one for (16) seems odd. When hearing the sentence in (16), hearers usually do not make an inference such as the one stated above. It seems more plausible that in this case, there is simply no implicature at all. This however contradicts with what the theories introduced in section 2.2 and 2.3 said. All quantitative scales should allow us to get a right implicature. If that is the case, then what happens in (16) and why is the implicature odd or even completely missing?

3 Earlier Accounts

We will start analyzing the phenomenon by looking at previous theories that attempted to explain the lack of implicature in (16). To explain this phenomenon with scales such as ⟨animal, dog, poodle⟩, Matsumoto (1995) starts by differentiating between two kinds of quantity of information. To illustrate this, he imagines the two kinds of information to be a graph with one kind of information on the horizontal and the other on the vertical axis of the graph.

One kind of information is the *"strength of information"*, which he illustrates to be on the horizontal axis. The strength of information is usually socially or physically given, such as height, numerals, temperature or age. The second kind of information is said to be on the vertical axis and is called the *"degree of detailedness"* or *"specificity of information"*. This kind of information is used to describe a referent of a state (Matsumoto 1995: 27).

An example for the quantity of information on the horizontal axis is the pair *hot* vs. *warm*. The information that *hot* gives is that it is on a range of temperature and on this range, *hot* is relatively higher than *warm*. It "depends on the degree of temperature that the speaker describes with these terms." (Matsumoto 1995: 27). In contrast, a speaker using a term from the vertical axis is free to choose the level of specificity. His choice only "depends on how much he [wants] to convey in describing a referent or a state" (1995: 27). An example for this could be the use of *dog* vs. *husky*.

It has however been observed that speakers of a language usually all make use of the same level of specificity. This has to do with the fact that one level is considered the basic level (Rosch et al. 1976), which will be explained in the following part.

Lexical items usually form a taxonomy; taxonomy being the process of classifying and arranging objects into groups according to their similarities and differences. Taxonomies can be made for both biological items, like animals, plants, vegetables, fruits and non-biological items, f.ex. clothes or furniture.

> In general, the basic level of abstraction in a taxonomy is the level at which categories carry the most information, possess the highest cue validity, and are, thus, the most differentiated from one another.
>
> (Rosch et al. 1976: 383)

The basic level is thus the level of specificity that is most differentiable from other levels. In animal taxonomy, the basic level is usually the generic level, which is for instance *cat, dog* or *horse*. When a speaker utters a sentence containing the basic level, the sentence is unmarked because that level of specificity is considered as informative enough for speakers of that language (Matsumoto 1995: 28). If the speaker makes use of a more detailed level of specificity, for example the dog or cat breed, then the utterance is marked. Matsumoto assumes this basic level to be the default level that all speakers of a language have in common. I will from now on refer to Matsumoto's basic level as the default level.

Matsumoto also introduces a new condition called the Quantity-2 Condition, which is a rephrased version of Grice's Maxim of Quantity:

> The Quantity-2 Condition: S must not convey more information than is required in the particular context of utterance in which W is used.
>
> (Matsumoto 1995: 27)

If an implicature does not arise, then it is because the Quantity-2 Condition was violated. For a sentence like *"I saw an animal."*, using the term *dog* instead of *animal* would not have violated the Quantity-2 Condition since it does not convey more information than is required in the context. If however the speaker had chosen *dog*, then the use of the possible stronger item *poodle* would have violated the Quantity-2 Condition. Uttering *"I saw a poodle."* would have contained too much information than required. The reason for that is that *poodle* is not a default. In a normal context, it conveys too much information. *Dog* on the other hand, is at the default level and therefore never conveys more information than needed.

It is nevertheless important to notice that a more detailed description of a referent is not always inappropriate. In certain cases, the speaker has the freedom to choose the level of detailedness. The speaker's free choice about the necessary level of specificity is illustrated in the following example:

(17) A: Where were you born?
B: I was born in Oregon.

When making use of a term from a partonomy, e.g. a set of place names such as in figure (1), the speaker is free to choose the level of specificity according to the context (Matsumoto 1995: 32).

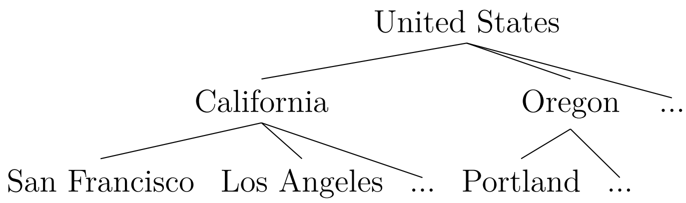

Figure 1: set of place names

In (17), the speaker B could have chosen to use the other items of the set such as *United States* or *Portland* or any other item of the subset of *Portland*. Matsumoto assumes that in this context, the expected level of specificity is the country's name. Therefore, the speaker A was more informative than necessary and an implicature does not arise (Matsumoto 1995: 32).

It seems that another information must also to be factored in by speaker B when answering the question, namely the knowledge of the speaker A. It might be the case that B knows that A, being from another country than the United States, is not familiar with all US-states. Also, A might not know the town in which B was born. Thus, B chooses to use a less specific term from the vertical axis. Matsumoto calls this the "Non-Obscurity Condition", which as the Quantity-2 Condition with the Maxim of Quantity, is a rephrasing of the Maxim of Manner.

> Non-Obscurity Condition: S must not be obscure (to the hearer).
>
> (Matsumoto 1995: 40)

A less informative item of the set can be used if the speaker knows that the hearer is not familiar with a more informative item of the set. Here again, the speaker's knowledge about certain facts in the world are relevant information when calculating implicatures.

As Matsumoto does with the default level, Geurt also assumes that hearers have an expectation about which level of specificity is necessary for the current purpose.

> [...] when introducing a new discourse entity, speakers should employ expressions of at least a minimum level of specificity: "sofa" and "dog" are sufficiently specific; "piece of furniture" and "animal" are not.
>
> (Geurts 2010: 46)

Nevertheless, there remain cases in which implicatures still arise even if the level of specificity is higher than usually expected. Let us expand the background information we have about the speaker and hearer and assume that they are both very familiar with the topic of dog breeds. In this case, an implicature appears to arise.

(18) set: ⟨animal, dog, poodle⟩
context: The speaker and hearer are experts in the field of dog breeds.
utterance: Andy said: "I saw a dog in the park this morning."
⇝ The speaker knows that it is not the case that he [=Andy] saw a poodle.

If both the speaker and hearer have good knowledge about the topic of dog breeds, then the implicature seems to be right, contrary to what we saw in the Introduction. Changing the context thus seems to have an impact on the end result of the calculation since we can make more assumptions about the information that is available to the speaker and hearer.

While a default level indeed seems to exist and helps to explain why in certain cases, implicatures do not arise, it is difficult to make predictions with this approach. The reason for that is that other factors such as the speaker's and hearer's knowledge seem to have an impact on whether an implicature arises or not. In a regular conversation, it is undeniable that we seem to have a level of specificity that we expect our conversation partner to use. However, I argue that this theory is not enough to explain the phenomenon in (17). In (17), if the expected level is the general name of an animal, then why does the implicature still arise if we change the context? We are still left with open questions which I will try to answer in the following sections.

4 Proposal

As we have seen in the previous sections, we are left with various problems when it comes to calculating implicatures with a set like ⟨animal, dog, poodle⟩. Why does the context have an impact on whether or not we get an implicature? Furthermore, what does it mean to be default and why do we even need a default level? Also, what are the restrictions when calculating scalar implicatures and where do these come from?

In the following sections, I will attempt to find out why two sets like ⟨some, many, all⟩ and ⟨animal, dog, poodle⟩ behave differently. This task will be divided into two parts. Section 4.1 will be concerned with the question of what it really means to be default and why some levels appear to be more privileged than others. We will then have to take a look at the formal properties of the two sets in section 4.2 to find out how this affects if we get implicatures or not. This knowledge will allow us to turn back to our problematic case with *dog* and *poodle* to try to find an explanation for why items from certain sets give us seemingly odd implicatures or even completely block the implicature. The second part of the proposal in chapter 5 will address the consequences that follow from what we will have discussed in chapter 4.

4.1 What does it mean to be default?

The "basic level", as called by Matsumoto (1995), denominates a default level and served as a way to explain why and in which cases utterances containing items from lexical taxonomies are unmarked. According to him, a speaker making use of the "basic level" produces an unmarked utterance because the level of specificity of that level is generally informative enough for speakers of a language. But where does this default level come from and what does it mean to be default? Also, what is the reason for the priviledged status of some levels of specificity over others?

As mentioned above, experiments have shown that there is a common "basic level" used across speakers of a language. We should start by observing that a speaker wanting to refer to something, usually has a variety of terms he can choose from. In the example (6) of the Introduction, one can choose between *animal, dog, poodle* or even *mammal*. This comes from the fact that lexical items usually form a taxonomy. We can therefore find a taxonomy for any animal, plant or other object, such as furniture or a clothing piece. According to researches of Brent et al., there are at most five levels in any folk taxonomy (Berlin et al. 1973: 215), which are the inclusive, kind, generic, specific and varietal level (from Rhodes 1984: 362). These taxonomies have various properties, one of them being that the generic taxa has a "cognitively privileged status"(Rhodes 1984: 362). In a taxonomy of animal terms, the levels are the following (from Matsumoto 1995: 28):

- inclusive level: animal
- kind level: bird, fish, mammal
- generic level: dog, cat, sheep
- specific level: poodle, siamese, ...
- varietal level: Miniature Poodle, Seal Point (Siamese), ...

But why is it that the generic level is more frequently used by speakers than another level from the taxonomy? Rosch et al. argue that the generic level carries the most information and is the most differentiated from others (1976: 383). Similarly, Brown talks about the notion of *utility*. An object, a person or an animal has various possible designation names. The choice of the designation name to denote that object, person or animal, depends on the utility level for the person or group that uses it (Brown 1958: 16). A dog could thus be a *poodle*, to be differentiated from other dog breeds by dog breeders, it could be a *Fido* to his owners who feed and take care of him, while it is just a *dog* to be differentiated from cats or horses to most people. Naming something in the world means that one is "able to distinguish members of the referent category from everything else in the world" (Brown 1958: 16).

> Brown suggests that the usual name 'categorizes at the level of maximum utility'. In other words, it is more often the fact that a spaniel belongs to the class of dogs that is important, or relevant, than the fact that it belongs to the class of animals, or the class of spaniels.
>
> (Cruse 1977: 155)

Cruse furthermore suggests representing the basic level as the INS, the Inherently Neutral Specificity. He predicts the use of the INS in a context CNS (Contextually

Neutral Specificity) to result in an unmarked utterance. Consider the following example (from Cruse 1977: 156).

- Uttered by the owner of two dogs, a spaniel and an alsatian.
  (a) I'll have to take the dog to the vet tomorrow.
  (b) I'll have to take the alsatian to the vet tomorrow.

While the term *dog* is the basic level or INS, *alsatian* is in a context of CNS since saying *dog* leaves the hearer questioned about which of the two dogs the speaker is talking about. If an INS results in an ambiguous statement, the INS should therefore be changed to the level that ensures a conversation of 'normality' (Cruse 1977: 156).

In sum, we could say that being default means using the appropriate level of specificity. The level of specificity is determined by the utility level for the speaker and needs to be changed to a more detailed level of specificity, e.g. if an utterance leads to an ambiguous statement due to a certain context. It is undeniable that a basic or inherent level has a utility and helps explain certain cases of implicatures. Nevertheless, the choice of the level seems to be more conventional than inherent since speakers arbitrarily pick which level they believe appropriate enough for the purpose of the conversation. Therefore, it is not enough to stay at this point, but we must move on and look at other aspects of this phenomenon. I will therefore take a look at the structural properties of sets which we will see, will explain why the context affects if an implicature arises or not.

4.2 Formal Preliminaries

Hirschberg (1985) first suggested the reason for non-arising implicatures to be due to certain formal properties of scales. According to Hirschberg, only items from certain sets can make scalar implicatures arise. Other sets, e.g. ones that have a cyclic ordering and temporal paralellisms "do not support scalar implicatures" (Hirschberg 1985: 122). We might therefore want to take a look at different kinds of sets and start by establishing a definition of sets. This will allow us to look at possible differences between ones such as ⟨some, many, all⟩ and ⟨animal, dog, poodle⟩.

In set theory, sets are defined as a group or collection of objects. To denote that an item o is a member of a set A, we say that "o ∈ A" (Springer Verlag GmbH, European Mathematical Society n.d.(a)). There are different kinds of sets. For the purpose of this paper, we need to look at strictly and partially ordered sets. These two kinds of sets differ in the ordering of their set members. The first goal is to find a way with which we can compare any two members of a set. A practical way to do so, is by looking at the relationship of members of a set with each other.

A strictly ordered set is defined by the following three properties: asymmetry, transitivity and totality. The set X is totally ordered if these three properties hold for all a, b and c in X (≤ = related to). Consider the properties in the following (from Springer Verlag GmbH, European Mathematical Society n.d.(b) & Simovici and Djeraba 2008: 129).

- **Asymmetry:** If a≤b and b≤a, then a=b
- **Transitivity:** If a≤b and b≤c, then a≤c (If *a* is related to *b*, and *b* is related to *c*, then *a* and *c* are also related.)
- **Connectedness:** a≤b or b≤a

Examples of totally ordered sets are natural numbers or integers. Consider a representation of the set of intergers in figure (2)

Figure 2: set of integers $\mathbb{Z}$

Partially ordered sets differ in the connex relation. Asymmetry and transitivity also hold for partially ordered sets, additionally to reflexivity. Reflexibility means that every element is related to itself (Springer Verlag GmbH, European Mathematical Society n.d.(b)).

- **Reflexivity:** a≤a

The difference between the two kind of sets is that in a strictly ordered set, every pair of elements is comparable. In a partially ordered set, only if a≤b or b≤a, a and b are comparable. If this does not hold, the elements of the set are incomparable. Consider the following representation of the poset of $\{x, y, z\}$ (from Simovici and Djeraba 2008: 133).

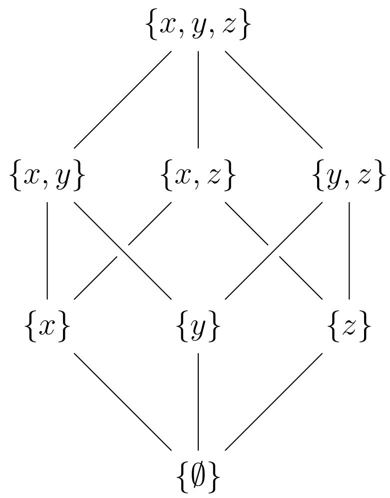

Figure 3

The above figure shows the set of all subsets of the set $\{x, y, z\}$. In this figure, incomparable items are $\{x\}$, $\{y\}$ and $\{z\}$ and $\{x, y\}$, $\{x, z\}$ and $\{y, z\}$ but we can e.g. compare $\{y\}$ and $\{x, y, z\}$. The items that are incomparable will be called *alternates*.

I will from now on use the term *scale* to refer to strictly ordered sets and *poset* to refer to partially ordered sets.

4.3 Further Differences

Before looking at the consequences for the SI (scalar implicature) calculation process that arise from the structural differences between scales and posets, let us look at more constrasting features of the two types of sets. To do so, we can now apply the formal tools that I introduced, to the sets we are dealing with.

An example for scales is the set of positive integers. The set of positive integers contains all positive natural numbers and zero. Negative integers are not part of that set. A (tree) representation of this set could therefore look like the following.

n
|
...
|
6
|
5
|
...

Figure 4: set of positive integers

This set also qualifies as a Horn scale, written as ⟨n, ..., 5, 6, 7⟩, because the items stand in an ordering according to their informativity. An item always entails the member of the set that is on the left of it.

Let us now turn to our problematic case with the set $\{animal, dog, husky\}$. This set classifies as a Horn scale, represented as ⟨animal, dog, husky⟩ since the terms stand in an asymmetric entailment relationship. This set could be represented as a tree in figure 5.

animal
|
dog
|
husky

Figure 5: set: ⟨animal, dog, husky⟩

If we were to define the meaning of *animal*, we would say that it refers to a set of things and all animals are a subset of this set. The set of *animals* contains the names of all animals. Futhermore, the set of *dogs* contains all dog breeds.

animal: $\{cat, dog, horse, elephant, ...\}$

dog: $\{husky, poodle, corgi, shepherd, ...\}$

Given that not only *dogs* are in the set of *animals*, we may want to include other alternates of *dog* in the tree representation, as well as other alternates of *husky*.

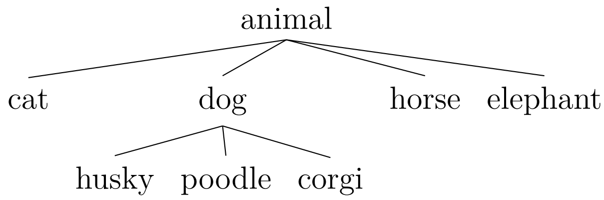

Figure 6

The tree (6) shows that, as we saw with the set $\{x, y, z\}$ above, there are items in that set that can not be compared. These are the terms on the horizontal axis. It seems to be a poset. Therefore, the subsets of *animal* and *dog* are not comparable. We can compare the items *poodle* and *animal*, but not *elephant* and *cat*. Thus, *elephant* and *cat* are alternates.

From what we have seen so far, it seems as if the meaning of items in scales differ from the meaning of items in posets. This could explain why items in posets can belong to more than one set. Nouns, which form partially ordered sets, can be defined in different ways and can therefore have different sorts of subsets. A member of a poset itself forms a set that has subsets, resulting in the tree representation having more than one term on the horizontal axis. The horizontal axis, showing alternates, contains all members of the subset. With quantifiers in strictly ordered sets, we do not find alternates on the horizontal axis.

Let us take the set of positive integers $\mathbb{Z}^+ = \langle 0, \text{n}, ..., 5, 6, 7, 8 \rangle$ as an example of a scale. This set consists of the subset of all positive natural numbers and zero. One might object that all these members could also belong to the set of integers; this set containing the same subsets as the set of positive integers plus their additive inverses.

These might in fact also belong to other sets, like the set of rational numbers or the set of real numbers. Nevertheless, these are just bigger sets than the set of positive integers. The set of positive integers is a subset of other sets. This means that they still can only belong to one set, since these scales are only extensions of other sets.

As with members of the set of positive integers we saw above, members of posets can also have subsets. These subsets are also extensions, but the difference is that we can find more than one subset. The different subsets however differ in their information. Consider the following two subsets of *t-shirt*.

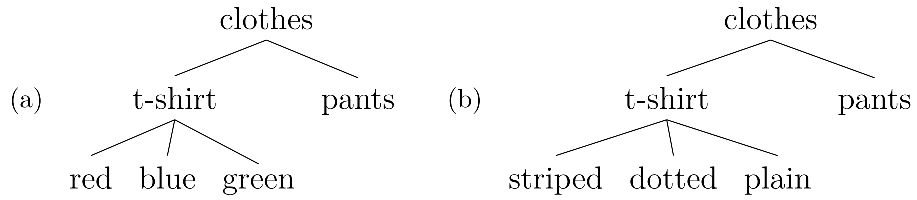

Figure 7: subsets of *t-shirt*

The subset in (a) contains colors a t-shirt can have, while the subset in (b) is the subset of patterns. The items *red, blue, green* or *striped, dotted, plain* are all in the subset of *t-shirt*. They are however not alternates of each other. *Red* is an alternate of *green*, but not one of *plain* or *dotted*, since the subset of colours in (a) contains only colors and not the pattern style.

Members of posets can thus have different kinds of subsets. In fact, we could probably find an unlimited amount of subsets of *t-shirt*: subsets of colors, pattern, fabric, length, brand etc.

The important difference between scales and posets is that members of strictly ordered sets can not have more than one item on the horizontal axis. They are entailed by all the members stronger than them and entail all members weaker than them. We cannot have *alternate* items that are also part of that set.

4.4 Resulting Problems for the Calculation Process

Having seen the formal structures and differences between strictly and partially ordered sets, we are now in a good position to look at how these properties can be accounted for restrictions in the calculation process of scalar implicatures. We will now take a look at two arising problems for the calculation process. In the previous sections, we had seen that the background seemed to have an impact on whether or not we get an implicature. This aspect will be addressed in chapter 5.

4.4.1 The Choice of the Right Subset

In order to find possible stronger statements for our calculation process for SIs, we need to figure out the scale that the term is on. For a term like *some*, there is only one identifiable scale that is ⟨some, many, all⟩ with which we can generate stronger alternative statements by substituting *some* with stronger scalemates and negating the generated stronger statement. This process turns out to be more problematic with the term *t-shirt*. Given that we have various possible subsets of *t-shirt*, presumably even an unlimited amount, as we have seen in figure 7, which all contain stronger items, we do not know which one to choose.

(19) A: What did Lisa buy at the mall yesterday?
B: She bought a t-shirt.

- possible poset 1: ⟨red, green, orange, ...⟩
- possible poset 2: ⟨plain, striped, dotted, ...⟩
- possible poset 3: ⟨woolen, cotton, ...⟩

In (19), it remains unclear which subset of *t-shirt* to choose for the calculation process. Without any additional information, there is no way we can figure out which subset should be considered for the calculation process. In most cases, we do not know which of the subsets is the right one and therefore is used in the SI calculation process. Only the context could help us determine the right subset, which we will later see in chapter 5.1, has an impact on the type of set we are dealing with.

4.4.2 The Choice of the Right Alternate

Let us assume that the context tells us exactly which of the subsets of a poset is the right one to choose. Following from the calculation process in chapter 2.2, we can now take the Epistemic Step. For any stronger, more informative alternative sentence ψ, the speaker knows whether ψ is true or false. The alternative sentence can be generated by lexical substitution. We substitute *t-shirt* with a stronger items of its set. This is where we face another difficulty. In a scale there is always only one term that is directly higher than the original set member and therefore stronger in information strength. In a poset however, we have more than one item on the horizontal axis leaving us with an open choice. Which of the terms do we use to create a stronger alternative statement ψ?

This also happens with our problematic case of the Introduction as I had showed in section 4.3 when we talked about formal properties of posets. Consider the set ⟨animal, dog, poodle⟩. Both *animal* and *dog* have subsets which contain more than one alternate. The term *dog* e.g. contains all dog breeds. Therefore, it remains unclear which term to choose for the calculation.

Let us look at the complete calculation process following Geurt's "Standard Recipe" (2010) for the following example.

(20) Andy said: "I saw a dog in the park yesterday night."

a. A speaker utters a sentence φ. (φ= I saw a dog in the park yesterday night.)

b. Assuming that speaker S is a cooperative speaker and following the Maxims of Conversation, he could not have made a better, more informative statement.

c. Epistemic Implication: Saying p, we infer Kp: the speaker knows that p. Therefore, φ is true.

Up to this point, the steps of the calculation can be taken without any problems. However, in the following steps we need to identify the set to which *dog* belongs. We have seen in section 4.3, that a subset of *dog* contains not only one dog breed such as *poodle*, but all dog breeds. For the calculation to continue we need to generate possible stronger alternative statements for φ. This is where the second problem arises. If we have a poset, we have more than one stronger item in the subset. Which one do we select to continue the calculation? If we had just one possible stronger item, we could continue the calculation as in (21).

(21) d. There are more informative statements such as ψ that the speaker could have uttered, but chose not to. (ψ containing a more informative item from its set: I saw a ***poodle*** in the park yesterday night.)

e. There must be a reason why he did not utter ψ.

f. Saying ψ would have violated the Maxim of Quality: Either the speaker didn't have enough evidence for ψ or the speaker thinks ψ is false. Either K(ψ)or K($\neg(\psi)$)

g. Epistemic Step: For a stronger, more informative alternative sentence ψ, the speaker knows whether ψ is true or false.

h. Conclusion: The speaker must believe ψ to be false.

i. Quantity Implicature: K¬[I saw a poodle in the park yesterday night.]. The speaker knows that it is not the case that he [=Andy] saw a poodle in the park yesterday night.

Assuming that there is only one available stronger item such as *poodle* results in an implicature. Nevertheless, because *dog* is part of a poset, it has various stronger items in its subset making it impossible to know which one to choose for the calculation.

We have now seen two problems that arise when trying to calculate implicatures with members of partially ordered sets. We will now look at the consequences of these two problems. This will be done by linking it to the initial assumption we made about the context having an impact on whether or not an implicature arises. We had observed that adding information about the background knowledge of the speaker and hearer seemingly affected the outcome of the calculation. This aspect will be discussed in the first section of chapter 5.

5 Consequences

In the previous sections, we have seen that the structural form of posets make us face problems for the calculation of scalar implicatures. The structure of totally ordered sets allows one to calculate scalar implicatures with the "Standard Recipe" without problems. Due to the differing structure of partially ordered sets however, with a poset we do not know which subset to choose, nor which alternate to consider for the calculation.

We will now take a look at the consequences this has on scalar implicatures with posets. First, we will turn back to the aspect of context, which seemed to have the ability to change the resulting implicature. It will later become clear that adding information to the context is only a way to flatten the structure of the poset. Another aspect that will be discussed is the negation of all stronger alternative utterances.

5.1 Flattening the poset

As we had seen in chapter 3, changing the context seemed to have an impact on the resulting scalar implicature. In example (18), the context was changed and specified that the conversation partners have expert knowledge in the field of dog breeds. Because of this extra information about the speaker and hearer, the implicature arised as we would expect. Given that we have access to a stronger alternative statement containing a dog breed, the implicature could go through.

If the speaker and hearer both have a good knowledge about dog breeds, the implicature seems to be right, contrary to what we had initially seen in the Introduction.

set: ⟨animal, dog, poodle/husky/...⟩

context: The speaker and hearer are experts in the field of dog breeds.

(22) Andy said: "I saw a dog in the park this morning."
$\rightsquigarrow$ The speaker knows that it is not the case that he saw a poodle/husky/...

From the utterance *"I saw a dog in the park this morning"*, we could have two possible inferences. As we have seen above, it is probable that the speaker did not know what breed the dog he saw belonged to. We could also ask however, if the speaker has knowledge about dog breeds, then why didn't he mention the dog breed? Could it be that he does not want to tell the speaker the specific dog breed and deliberately uses a less specific word such as *dog*? That could be possible, however we would then not be able to calculate any implicature. The first step in the "Standard Recipe" is to assume that the speaker is following the Cooperative Principle or at least the Maxims of Conversation. Thus, if we cannot make the first step of the Calculation Process and not assume on the Cooperativity of the speaker, we cannot go on with the calculation. It must be that the speaker did not know what breed the dog he saw in the park belonged to. The speaker had knowledge about dog breeds and could have been more specific. However, he chose the item *dog* from the scale, resulting in the hearer following that the speaker does not know the dog breed of the dog.

The context seems to have an interesting impact on the calculation process. In the above example, we specified the context to the conversation partners having specific knowledge about the given topic. What happens if we narrow the context down even more?

Let us assume that the speaker of the conversation has very specific knowledge about only one dog breed. The speaker might for instance be an owner of numerous huskys and therefore knows a lot about that specific dog breed. If we now take the statement from the above example and go through the calculation process, we are likely to get an implicature of the following form.

set: ⟨animal, dog, husky⟩

context: The speaker has expert knowledge about the husky breed. The speaker also knows that the hearer knows that there exists a breed named husky.

(23) Andy said: "I saw a dog in the park this morning."
$\rightsquigarrow$ The speaker knows that it is not the case that he saw a husky.

If the speaker specifically has good knowledge about huskys, but he chose the term *dog* instead of *husky*, it must be that he knows that he did not see a husky, otherwise he would have said so. But why is it that this context can change the implicature?

I argue that the scale that is relevant in this conversation has been flattened. The speaker, being an expert on huskys, is only counting *husky* as a possible stronger item of the set. Thus, we no longer have a poset containing all dog breeds, but one that contains only husky as an informationally stronger item of *dog*.

- set for (22): ⟨animal, dog, husky/poodle/corgi/pug/shiba/chow chow/...⟩
- set for (23): ⟨animal, dog, husky⟩

To illustrate it better, let us look at a tree representation of these sets.

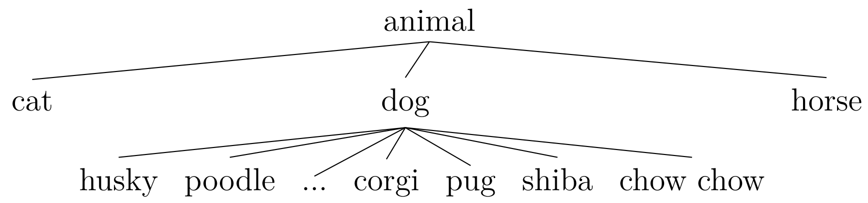

Figure 8: set:⟨animal, dog, husky/poodle/corgi/pug/shiba/chow chow/...⟩

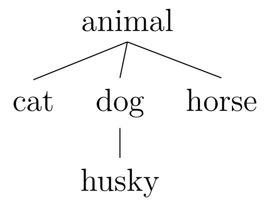

Figure 9: set: ⟨animal, dog, husky⟩

The scale in figure 9 was narrowed down, leaving us with just one possible more informative item. From the definition of sets in chapter 4.2, we know that in a partially ordered set, there are elements in the set that are incomparable. These resulted in difficulties when calculating implicatures. In the set ⟨animal, dog, husky⟩, we do not seem to have incomparable items. There is only always one stronger item than another. *Dog* is more informative than *animal* and so is *husky* for *dog*.

What happened in (23) was that the context changed the poset into a scale. Since we have no difficulties calculating implicatures with totally ordered sets, we are able to calculate a scalar implicature for (23) as well. Again, providing that we have a cooperative speaker and the Epistemic Step can be taken, the stronger alternative *husky* that was not chosen, must be believed to be false by the speaker.

In result, the set of (23) behaves exactly as the scale ⟨some, many, all⟩. With this set, we can not find alternates. The same happens for the scale of ⟨animal, dog, husky⟩ in (23) where for *dog*, no other stronger item than *husky* can be found in the set. Thus, the set of (22) that initially had the structure of a partially ordered set has now been flattened down to a totally ordered set as ⟨some, many, all⟩.

To be sure that this apparent change of set type by the context is true, let us look at another example. What happens if we expand the context in (23)? Let us assume that in the following example, there is a speaker that is owner of huskys and poodles and thus has very good knowledge about these two dog breeds. The set looks like the following.

> context: The speaker is an owner of huskys and poodles and therefore has specific expert knowledge about these two dog breeds. The speaker also knows that the hearer knows that there exist breeds named husky and poodle.
>
> set: ⟨animal, dog, husky/poodle⟩

How does this affect our scalar implicature? The structure we are left with now is not a structure of a totally ordered set, since *husky* and *poodle* are incomparable items. Nevertheless, we are able to calculate a scalar implicature, namely one saying that the speaker did not see a poodle or a husky. The reason for this is that we can negate these two stronger items. The hearer of the utterance (24) knows that the speaker has expert knowledge about these two dog breeds which leads him to include only these two items in the subset. These two are the only relevant dog breeds in the context. Nonetheless, it is also clear that other dog breeds exist. So, the reason for why we can negate the two dog breeds *poodle* and *husky* is that we know that there is other dog breeds in our world. The hearer then probably knows that the person he is talking to saw another dog breed, but does not know that specific one and therefore used a weaker term of the set instead. Negating *husky* and *poodle* does not create any contradictions, since we know that there is other possible dog breeds in our world. Consider the tree representation of the above set and the scalar implicature in (24).

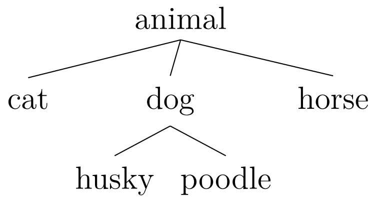

Figure 10: set: ⟨animal, dog, husky/poodle⟩

(24) Andy said: "I saw a dog in the park this morning."
⇝ The speaker knows that it is not the case that he [=Andy] saw a poodle or a husky in the park.

But why is it that this implicature goes through even though the set is a partially ordered one? It seems that in this case it is not about whether the set is a totally or a partially ordered one, but about whether all the members of the scale are identifiable. With posets it is always more complicated since there can be an infinite amount of stronger items in the subset. We will now see another case with plurals which will confirm this point.

5.2 Plurals

Interestingly, we can find other cases of posets in which we do not get contradictions and the right implicature arises. Consider figure 11 which shows a representation of the set of three people $\{Lisa, John, Mike\}$.

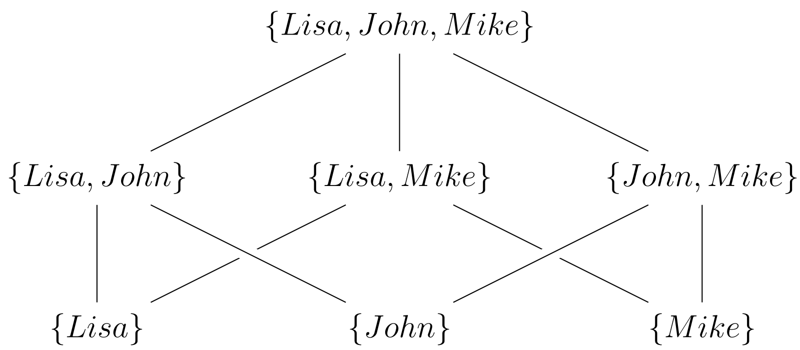

Figure 11: set: ⟨Lisa, John, Mike⟩

In an example like the following, the implicature goes through.

(25) A: Did Lisa come to the party yesterday?

B: John and Mike came!

⇝ SpeakerA knows that it is not the case that Lisa came to the party.

As in the above ⟨animal, dog, husky/poodle⟩ example, we have a set that contains more than one item on the horizontal axis. This could pose a problem for the calculation since we do not know which of the stronger alternates to choose. However, in this case, we know exactly what the alternates are. This is not the case with the subset of *dog* when the context does not contain additional information about the relevant alternates.

In both (24) and (25), the posets are limited. In (25), it is limited to three items on the horizontal axis, in (24) it is limited to two items. This also restricts the possible stronger alternatives we can have. In posets, in which the alternates are unlimited, we are not able to calculate an implicature.

Consider the following example. The reason why we can calculate implicatures with certain posets is that not all posets have an unlimited or a very large number of alternates. In an example like the following, where the number of alternates is unlimited, it is impossible for a hearer to consider all the alternates for the implicature calculation.

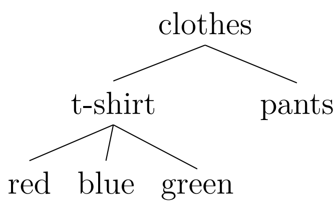

Figure 12: set: ⟨clothes, t-shirt/pants, red/blue/green⟩

(26) A: What did Lisa buy yesterday?

B: She bought a t-shirt.

⇝ The speaker knows that it is not the case Lisa bought a red/green/blue t-shirt.

As we have seen in section 4.3, we have more than one possible more informative item of the scale and do not know which one to choose for the calculation. It is unlikely that a hearer goes through the process of negating all possible more informative statements. This suggests that the source of the problem with *t-shirt* is that there are simply too many ways of completing the poset. Only if we know the full scale as in (24) or (25), we can calculate an implicature. If the amount of alternates is unlimited or very high, we get infinite possible implicatures because there are too many ways of completing that poset. Thus, an implicature simply does not arise.

5.3 The Role of the Epistemic Step

So far we have concluded that scalar implicatures can in fact arise from posets, but only on the condition that this poset is limited. A limited poset makes an implicature goes through because we know that the other possible stronger alternates exist in this world. We will now look at another consequence of the differing structures of scales and posets which is related to the Epistemic Step.

In the problematic cases we have seen so far, in which an implicature did not arise, the posets were all non-limited ones. This means, that there is an infinite or at least a very large amount of stronger items available. In the example of (22), the set of dog breeds is not unlimited, but very large. If we were to negate all stronger alternative statements, we would have to negate a very high amount. Leaving aside the fact that it is very unlikely that hearers go this process, doing so results in a contradiction as we can see in example (27).

set: ⟨animal, dog, husky/pug/poodle/...⟩

(27) Andy said: "I saw a dog in the park this morning."
⇝ The speaker knows that it is not the case that he saw a husky.
⇝ The speaker knows that it is not the case that he saw a pug.
⇝ The speaker knows that it is not the case that he saw a poodle.

Negating all dog breeds, the utterance of the speaker turns out to be wrong. If the dog that Andy saw in the park was neither a *husky, pug, poodle* nor any other dog breed, it can not be that the animal he saw was a dog. If we call an animal a dog, it automatically needs to belong to some kind of dog breed. So, negating all dog breeds makes us negate *dog* as well. This seems odd, since in the process of implicature calculation, we took the Epistemic Step. This would result in an inference of (27) being that the dog did not see any dog at all.

This again leads us back to the calculation process. If it is not the case that Andy saw any of the numerous possible dog breeds, then he must not have seen a dog. This contradicts with the Epistemic Step and Hintikka's "Epistemic Knowledge" (1962). The speaker is assumed to know that his utterance is true. So the problem only arises from the application of the Epistemic Step. When taking the Epistemic Step, we say that the speaker is opinionated about whether his statement is true or false. If the speaker is opiniated and is sure about the truth of his statement, then his utterance cannot be false. The Epistemic Step is necessary for the calculation of scalar implicatures, so we can not leave it out. Therefore, the implicature in (22) and (27) "The speaker knows that it is not the case that he saw a poodle/corgi/husky/pug/..." does not go through since it would result in a contradiction, namely in an inference saying that the speaker knows that it is not the case that he saw a dog.

Contrarily, negating all stronger items with a scale such as ⟨OK, good, great, excellent⟩ does not result in any contradiction.

set: ⟨OK, good, great, excellent⟩

(28) Andy said: "Stevan's essay was OK."
⇝ The speaker knows that it is not the case that Stevan's essay was good.
⇝ The speaker knows that it is not the case that Stevan's essay was great.
⇝ The speaker knows that it is not the case that Stevan's essay was excellent.

Again, the fact that this implicature can go through is linked to the structure of the concerned set. In the example sentence (28), which contains a member of a totally ordered set, the Epistemic Step does not contradict with the original utterance of the speaker. Unlike in (27), negating the stronger items of the set does not make the utterance "Stevan's essay was OK." wrong.

In sum, in chapter 5 we have seen various consequences of the differing structures of scales and posets and the problems that these posed on our calculation process. Adding extra information about the speaker's or hearer's knowledge to the context is a way of flattening the scale. This can be done in two ways. It can be changed structurally from a poset to a scale, which makes it easy to calculate an implicature as no additional alternates are in the horizontal axis. The context can also flatten the structure of the poset in a way that it restricts the number of relevant stronger alternates. Even if the concerning set is a partially ordered one, a scalar implicature can be calculated because we know how to fill the poset. This was confirmed by the examples of plurals. Only if the amount of stronger alternates is limited and therefore all alternates are identifiable, we have the ability to calculate a correct implicature. Another aspect that was discussed was concerned with the Epistemic Step. If the context does not restrict the amount of stronger items and we are left with an unlimited amount of possible scalar implicatures, it is impossible for us to calculate an implicature since negating all stronger alternative statements results in a contradiction. As we have discussed, it is not the case that the initial utterance can be wrong since it would contradict with the Epistemic Step.

6 Conclusion

We started in the introduction in chapter 1 with the observation that for some sentences, we seem to get odd inferences or even completely lack inferences. For a sentence like *"I ate some of the cake."* we can easily get to an implicature saying that the speaker knows that it is not the case that he ate *all* of the cake. For the sentence *"I saw a dog in the park."*, applying the same informal process, the inference seemed to be missing. Seemingly, for this sentence, we could not identify an inference of the same type as the one of example (1).

Grice's Cooperative Principle and Geurt's "Standard Recipe" (2010) introduced a calculation process for scalar implicatures. If in a sentence we can identify a scalar term then we can use it for calculating the implicature. With the steps explained in chapter 2.2, for any term standing in a scale ordered in informativity, we should be able to calculate a correct scalar implicature. While this worked perfectly for a quantitative scale such as ⟨some, many, all⟩, we seemed to get odd results when trying to calculate an implicature with the sentence *"I saw a dog in the park yesterday."*. We said that if *dog* is in the set ⟨animal, dog, poodle⟩, then it is odd that the implicature seems not to arise for the previous sentence *"I saw a dog in the park yesterday."*?

In chapter 4.4, formal tools to compare totally and partially ordered sets were introduced. We saw that contrary to ⟨some, many, all⟩, the term *dog* is in the set ⟨animal, dog, poodle⟩ which has the structure of a partially ordered set. This explained why terms from this set behave differently and pose restrictions in the calculation process. Due to the structure of posets, we are faced with two problems during the calculation; the choice of the right subset and the right alternate. Given that posets can have an unlimited amount of both subsets and alternates, there are too many ways to complete the poset. Only if the context restricts the amount of alternates and tells us which subset to use is it possible to calculate a right implicature.

In chapter 5.1, I argued that what happens here is only a flattening of the poset. If the context restricts the poset to have only one possible stronger alternate such as *husky* for the term *dog*, then the structure of the set was simply flattened from one of a poset to one of a totally ordered set. Even if there is more than one possible stronger item in the set, it was possible to get a correct scalar implicature. The reason for this is that the number of alternates is not infinite. We saw that this could be confirmed with examples of plurals. Plurals also contain more than one alternate, but it is possible to calculate a right scalar implicature because we know exactly what the alternates are.

The initial question of the introduction was thus answered with the formal structure of sets. The reason for why we can easily find an implicature for (4), but identifying a correct one for (7) is more tricky, is that in (4) we are dealing with a members of a totally ordered set. The member of the set in (7) is one of a partially ordered set. The structural differences can be accounted for the lack of implicature. In sum, throughout this thesis I showed that the structure of sets does matter and explains various problems that one is faced with when calculating implicatures with members of posets. The structure of posets poses restrictions on the calculation of scalar implicatures. We have seen the specific problems that arise in the calculation process and the consequences of these.

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