Replication Report

Original paper: Speaker Knowledge Influences the Comprehension of Pragmatic Inference by L.Bergen, J. Grodner (2012)

SS 2020

Seminar: Experimental Psychology Lab

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Abstract

We are able to infer more than what a spoken message literally conveys, taking into account the speaker's goals and their knowledge of the topic they talk about. For example, depending on the speaker's knowledge of the topic, the sentence "Some investments lost money" can imply that not all investments lost money or that the speaker doesn't know whether all investments lost money. Bergen and Grodner investigated how, and at what point in interpretation, speaker knowledge affects the comprehension of scalar implicatures (which attribute an implicit meaning beyond the explicit meaning of an utterance) (Bergen & Grodner, 2012). This was done by showing the participants sentences containing *some* in contexts where a speaker should know whether *all* was true, in a self paced presentation. They found evidence for effects of speaker knowledge on the inferred meanings. In the present paper, we replicate this study and adapt the hypothesis slightly. We found no evidence suggesting effects of speaker knowledge on implicature generations. Possible reasons will be given in the *Discussion* section.

Keywords: **Pragmatics, language comprehension, implicature generations**

Introduction

This study aims to replicate the study "Speaker Knowledge Influences the Comprehension of Pragmatic Inferences" by Bergen and Grodner (2012). Speakers often communicate more than only the literal message they utter. The study examines whether implicature generation caused by encountering the existential quantifier "some" is sensitive to speaker's knowledge. An example stimulus sentence given in this study is "Some of the investments lost money". This sentence can imply that not all investments lost money or that the speaker doesn't know whether all investments lost money. The former is a strong implicature, whereas the latter is a weak implicature. A scalar implicature can arise whenever a speaker uses a weaker expression than a salient alternative. Thus, if the speaker chooses to say "Some P are Q" instead of saying "All P are Q", there is a scalar implicature. Some theorists have argued that the strong implicature is generated automatically and mandatorily upon encountering a weak expression regardless of the context (Levinson, 2000, cited by Bergen & Grodner, 2012). However, recent evidence demonstrates that the strong implicature is not obligatorily generated whenever a weak scalar expression (i.e. "some") is encountered (Bergen & Grodner, 2012). This indicates that context influences implicature generation. An aspect that remained unclear was the role of the speaker's knowledge in implicature generation. Speaker knowledge here refers to what a speaker knows about the topic they are talking about. The original paper (Bergen & Grodner, 2012) tries to shed light on the role of speaker knowledge and provides evidence that speaker knowledge affects incremental implicature generation and perceivers incorporate speaker knowledge immediately if the stated perspective is made sufficiently salient. This means that a perceiver will set what a speaker says into the context of what they know about the speaker. The purpose of this study is to replicate the original study and see if we can find similar findings.

The Present Experiment

In line with the original study, it is expected that speakers' knowledge will affect the generation of scalar implicatures, in that full-knowledge (knowing whether the stronger statement was true) will lead to a generation of strong implicatures and partial-knowledge (considering it merely possible that the stronger statement was true) will facilitate the generation of weak implicatures.

Like it was done in the original study, we tested the effects of speakers' knowledge in two types of sentences, which are trigger sentences and continuation sentences. A trigger sentence is a sentence that gives information on a potential subset of the group of objects that the first sentence refers to and triggers comprehension of speaker knowledge. It is either of the type *scalar* or *focused*. If a trigger sentence is of the type *scalar*, the relative sentences start with "Some". If it is a sentence of the type *focused,* it starts with "Only some". The continuation sentences are sentences that follow the trigger sentences and are either of the type *complement* or *cancelation.* If the continuation sentence is of the type *complement*, the sentence confirms a strong implicature. If continuation is of the type *cancelation*, the sentence contradicts either a strong or a weak implicature triggered by context sentences.

Generation of strong implicatures will lead to longer reading times of trigger sentences and shorter reading times of complement sentences. It is because the first integration of a strong implicature causes more effort. But once a strong implicature is created, it will be beneficial for processing the subsequent complement information. Differently from the original study where they examined every predefined language region in the sentences, we will only focus on language regions where significant effects of knowledge were found in the original paper. The language regions we are focusing on are called critical language regions. These are quantifier regions (e.g. consisting of "some of") in trigger

sentences and predicate regions (e.g. consisting of "were successful") in complement sentences. Besides, we will leave out the analysis for the factor continuation, as there were no effects found as well in the original study.

Precisely, it is expected that:

1. Full-knowledge will lead to a longer reading time of the critical regions of trigger sentences and shorter reading time of the critical regions of complement sentences under scalar conditions, compared to partial-knowledge.

2. The level of knowledge should make no difference in the reading time of the critical regions in both trigger sentences and complement sentences under focused conditions. It is because the focus particle "only" has the effect of asserting the not-all interpretation. As a result, contextual information about the speaker's knowledge should not alter interpretation for both trigger sentences and complement sentences.

Method

Participants

Participants in the study by Bergen and Grodner (2012) were native English-speaking College students. Because of time constraints, we did not recruit native English-speakers. We simply required our participants to have good English language knowledge (at least B1 (self-declared) according to the English language level (CEFR)). All in all, we recruited 12 participants (7 males, 5 females, Mage = 31.8, 70% have bachelor or master degree) for the main replication study.

Materials

The study is a 2 X 2 X 2 within-subjects multifactorial design. The three factors with two levels each are knowledge-context (full vs. partial), trigger-type (scalar vs. focused), and

continuation-type (complement vs. cancelation). We will use the sentence passages provided by Bergen & Grodner (2012). There are 24 stimulus passages which consist of 3 sentences and a comprehension question. The first sentence is the one displaying the speakers' knowledge which is either full- or partial-knowledge. The participant will see a sentence in first person singular that gives some information about what someone did or knows. The context of the sentence can be full-knowledge if it is such that it is likely that the subject of the sentence has full knowledge on what was described in the sentence. Otherwise the context is partial-knowledge. For example, the sentence "In the school parking lot, I carefully inspected an old bus" would be stating that the speaker has full knowledge, whereas "In the school parking lot, I passed by an old bus." would state that the speaker has partial knowledge (Bergen and Grodner, 2012). The second sentence is of the form Some P are Q and contains a trigger which is either scalar ("Some") or focused ("Only some"). The third sentence then is a continuation one which either is a complement to the trigger describing the set that is not Q or a cancelation sentence which contradicts either a strong or a weak implicature.

Of these 24 passages each has 6 different conditions in which knowledge-context, trigger-type and continuation-type alter. These 6 conditions are: full-scalar-complement (c1), full-focused-complement (c2), partial-scalar-complement (c3), partial-focused-complement (c4), full-scalar-cancelation (c5), partial-scalar-cancelation (c6). The passages are pseudorandomly mixed with 65 fillers consisting of 2- to 4-sentence first-person passages. Besides, we create 6 experimental stimuli and 6 fillers by ourselves to make the practice trial.

Procedure

The experiment consists of four parts:

1. introduction & instructions

2. practice phase

3. main test phase

4. post-experiment questionnaire

Participants are at first presented with written instructions about the task. Next, the practice trials follow, which are exactly like the main trials. After that, the main test phase begins where sentences are presented in a noncumulative, self-paced word-by-word display.

Each trial goes as follows:

- Each trial begins with dashes standing for the blank spaces of the sentences.

- Participants have to press the spacebar to replace these dashes with the words. Every time they do so, the word which was displayed before disappears. The time between button presses is recorded.

- Sentences are displayed in the following order: knowledge sentence, trigger sentence, continuation sentence.

- Following each passage, participants have to answer a yes-or-no comprehension question.

Finally, the experiment terminates with a post-experiment survey asking participants to optionally supply their English language level socio-demographic information and feedback.

Results

Four participants from the datasets were excluded: one had English language level below B1, another one didn't state their language level, the rest had an accuracy of correctness below the 80% border. The average accuracy of correctness of comprehension questions is 83.68%. Besides, the average accuracy is lower than in the original paper (91%), since none of our participants was a native English speaker. Extreme individual RTs (greater than 2000 ms or lower than 100 ms) were trimmed (3.13%). The remaining RTs were log-transformed and given to linear mixed-effects regression analyses using R-package lme4 (Bates, 2008, cited by Bergen & Grodner, 2012) in the statistical language R (R Development Core Team, 2008, cited by Bergen & Grodner, 2012). Speaker knowledge (full vs. partial) and trigger-type (scalar vs. focused), and their interaction were modeled as fixed effects using sum coding in R. Participants and items were modeled as crossed random factors. Untransformed RTs over critical language regions of both trigger and continuation sentences under 4 conditions are shown in Figure 1 and 2.

Trigger Sentences

There was no effect of trigger-type ($t = -0.26$), speaker knowledge ($t = 1.24$) and their interaction ($t = 1.41$) over critical quantifier regions of trigger sentences. In order to investigate the possible separate effects of speaker knowledge, different models were used to the scalar and focused conditions. No effects knowledge were found in both scalar ($t = -0.12$) and focused ($t = 1.75$) conditions.

Complement Sentences

While there was no effect found for the trigger type ($t = -0.56$) and speaker knowledge ($t = 1.33$), their interaction ($\beta = 0.05$, $t = 2.31$, p = 0.02) showed a significant

result over critical quantifier regions of continuation sentences. Again, in order to investigate the possible separate effects of speaker knowledge, different models were applied to the scalar and focused conditions. No effects of knowledge were found in both scalar ($t = -0.62$) and focused ($t = 1.23$) conditions.
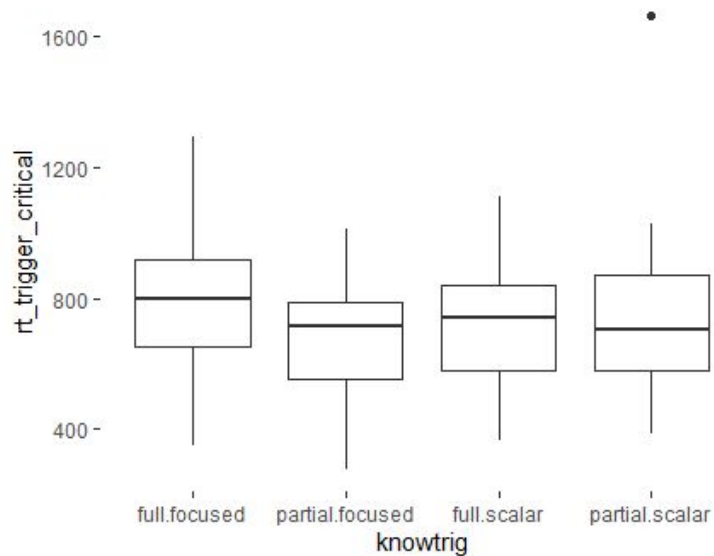

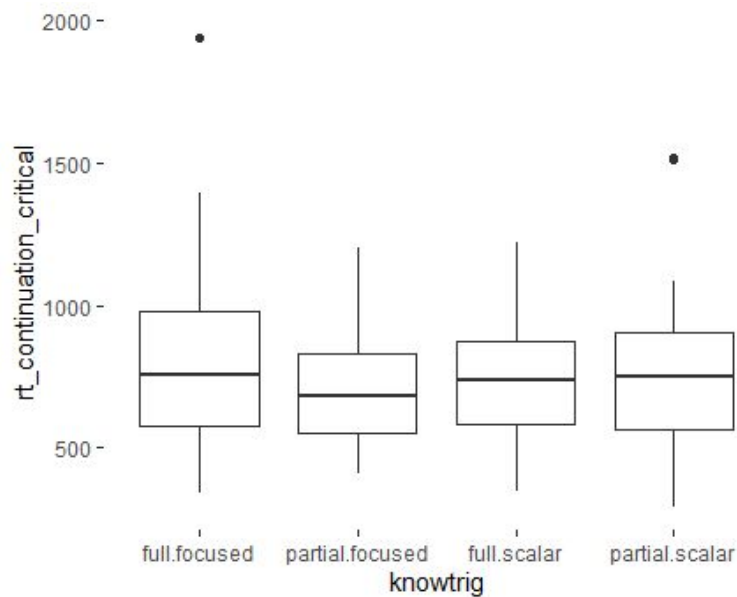*Figure 1.* Mean reading time for trigger sentences under the four conditions

Figure 2. Mean reading time for continuation sentences under the four conditions

Discussion

Besides the interaction effect of speaker knowledge and trigger type on complement sentences, we found no evidence for effects of speaker knowledge on the inferred meanings of sentences, in that there was no evidence suggesting effects of speaker knowledge on implicature generations. The two following reasons could be responsible for that. Firstly, the number of participants was low. This was due to time constraints in recruiting them and lack of possibility to compensate for the participation. In fact, only 12 people participated and only 8 of them provided valid data. Bergen and Grodner, on the other hand, had 42 participants in their experiment. Secondly, the people who took part in our experiment were not native English speakers. Even though we tried to minimize the effect of non-native English speakers by excluding participants whose language level was below B1, we obtained a lower accuracy (83.68%) than the one found in the original study (91%). We expected a similar trend (having lower accuracy than in the original study due to the fact that the participants have worse knowledge of English language). However, we underestimated the magnitude of such an effect. To overcome the problem there could be two possible solutions: either results with accuracy below 80% were to be admitted with the risk of getting non-reliable results, or native speakers only were to be allowed to take part in the study.

Due to those constraints we could not conclude that there is no effect of speaker knowledge on implicature generations at all. However, there might be different effects of speaker knowledge on implicature generations among native speakers and non-native speakers.

Conclusion

To sum up, we found no evidence for effects of speaker knowledge on the inferred meanings of sentences. The reasons for that could be the small number of participants and their suboptimal language proficiency. Thus, we cannot affirm that there were no effects, but only that we could not find them with our constrained number of participants and their English knowledge.

References

Bergen, L. & Grodner, D. J. (2012). Speaker Knowledge Influences the Comprehension of

Pragmatic Inferences, *Journal of Experimental Psychology: Learning, Memory, and

Cognition,* pp. 1450 - 1460.

Appendix A: trial material

Experimental stimuli:

1. condition: full-scalar-complement
Full: I tried every Italian restaurant in this city.
Trigger: Some of them are very cheap.
Complement: The rest are not cheap at all.
?: Is every Italian restaurant cheap in this city? N

2. condition: full-focused-complement
Full: I spent my whole lifetime studying dinosaur fossils in this region.
Trigger: Only some fossils found in this region were from diplodocus.
Complement: The other fossils found in this region were from tyrannosaurus.
?: Were fossils of tyrannosaurus found in this area? Y

3. condition: partial-focused-continuation
Partial: I had a quick trip into the nearby mountains yesterday and I saw a black bear.
Trigger: Only some bears in the region are black.
Continuation: The other bears living in this area are brown.
?: Are all bears in these mountains black? N

4. condition: partial-scalar-cancelation
Partial: I took a quick look at the cupboard that houses my trophy collection.
Trigger: Some of the trophies were already covered by a thick layer of dust.
Cancelation: In fact, all of them were covered by a big layer of dust, so I had to clean them.
?: Were all my trophies in the cupboard covered by dust? Y

5. condition: partial-scalar-continuation
Partial: I skimmed the German vocabulary I had to learn for the final exam of the course.
Trigger: Some of the vocabulary was the same as those I learnt in the last course.
Continuation: The rest was unknown to me.
?: Did I remember all the vocabulary for the test? N

Filler items:

1. I went out today to visit a dentist.
However, I forgot to take my insurance card with me.
So, I had to go back and arrange a new appointment.
? Did I make it today to visit a dentist? N

2. I took a psychology class today.
The lecturer spoke monotonously and I could not follow him.
That's why I went to the cafeteria a little earlier.
? Did I attend the whole lecture? N

3. I like the smell of gasoline.
It reminds me of when I was a child in Michigan and I modified motorbikes.
So, I sometimes go to the countryside with my motorbike reminiscing about those times.
? Do I feel aversion to my childhood in Michigan? N

4. I had a long squash match today.
It was the second time I played it.
Unfortunately, I lost.
? Am I a squash beginner? Y

5. I danced with a person that I later found is the wife of my colleague.
We had a great time together and we are both great dancers.
I will go to have dinner with my colleague and his family tomorrow.
? Will I recognize my colleague's wife, if she shows up tomorrow? Y

Appendix B: post questionnaire

Age question: 'Age'
The participant can answer by writing freely.
Gender question: 'Gender'
The participant can choose between "male", "female" and "diverse".
Education question: 'Education',
The participant can choose between "High School", "College", and "University".
Language-knowledge question: 'Level of English based on European Reference', '(e.g. A1-C2, if you had no problems with the questions take at least B1)'
The participant can answer by writing freely.
Comments question: 'Further Comments'
The participant can answer by writing freely.