

Propositional attitudes towards presuppositions. An experimental approach

Filippo Domaneschi (+), Elena Carrea (#), Carlo Penco (+), Alberto Greco (#)

According to the Common Ground account proposed by Stalnaker (2002, 2009), speakers involved in a verbal interaction have a number of different propositional attitudes towards their presuppositions. In this paper we propose an experimental study aimed at estimating the psychological plausibility of the Stalnakerian model. In particular, the goal of our experiment is to evaluate variations in accepting as appropriate a sentence that triggers a presupposition, where different attitudes are taken towards the presupposition required. The study conducted suggests that if a speaker has the attitude of *belief* towards the content of a presupposition, she may evaluate an utterance as more appropriate in a shorter time than in cases where she holds an attitude of *presumption* or of *assumption*. Therefore, data collected support the psychological soundness of what might be considered the main, but also most debated, theory of presupposition on the market.

Keywords: experimental pragmatics, presuppositions, propositional attitudes

1 Introduction

According to the traditional pragmatic framework proposed by Stalnaker (2002, 2009), the common ground of presuppositions in a conversation at a particular time corresponds to the ‘cognitive context’ provided by the speakers’ backgrounds in different psychological states (e.g. beliefs, assumptions, presumptions, etc.). In this perspective, the utterance of a sentence p is *appropriate* only if, at time t , the common ground includes the presupposition q required by p . A sentence q belongs to the common ground if all the participants in the conversation accept q for some reason, e.g., they believe q , they suppose q , they hypothesize q . Hence, Stalnaker’s cognitive framework is based on the thesis that interlocutors take sentences for granted for a number of different reasons corresponding to different propositional attitudes.

The Common Ground account has been subject to many types of criticism from a theoretical point of view¹. Here we do not want to address directly this debate, but to propose an experimental study aimed at evaluating the psychological plausibility of Stalnaker’s account. Particularly, the goal of our experiment is to estimate potential variations in evaluating as appropriate an utterance of a sentence containing a presupposition trigger, where different attitudes are taken towards the presupposition required.

¹ Chris Gauker (1998, 2002), for instance, has criticized Stalnaker’s account by claiming that the appropriateness of an utterance is independent on speakers’ background of mental states and, rather, it depends on the *propositional context* that is the set of objectively relevant propositional elements that speakers ought to share in order to evaluate an utterance as appropriate so to achieve the goal of a conversation. Hence, in this perspective speakers’ attitudes towards presuppositions are irrelevant for the appropriateness evaluation of an utterance containing a presupposition trigger. It should be noted that our experimental design and data collected do not directly allow to evaluate the psychological plausibility of the normative account proposed by Gauker.

2 Presuppositions, cognitive context and propositional attitudes

Speakers involved in a verbal interaction presuppose many things that influence both what they say and how what they say is interpreted. According to a very basic definition, presuppositions are a condition for the *appropriateness* of utterances: to appropriately utter a sentence p containing a presupposition trigger² that activates a presupposition q , interlocutors must take q for granted. Consider, for example:

(1) My neighbours' dog started barking

In order to appropriately utter (1) and recognize the utterance (1) as appropriate, the sentence

(1a) My neighbours have a (single) dog

induced by the definite description 'My neighbours' dog', and the sentence

(1b) My neighbours' dog was not previously barking

triggered by the change of state verb 'to start' must be taken for granted.

According to the Common Ground account (CG), proposed mainly by Stalnaker (2002, 2009), the *common ground* is the background of common presuppositions in a conversation: a sentence p presupposes q if the use of p would be inappropriate if q did not belong to the common ground, namely unless q were taken for granted by the interlocutors. According to this prevailing framework, speakers' pragmatic presuppositions do not generally coincide merely with actual shared beliefs. Rather, common ground should be characterized in terms of *acceptance*:

Acceptance [...] is a category of propositional attitudes and methodological stances toward a proposition, a category that includes belief, but also some attitudes (presumption, assumption, acceptance for the purposes of an argument or an inquiry) that contrast with belief and with each other. To accept a proposition is to treat it as true for some reason. One ignores, at least temporarily, and perhaps in a limited context, the possibility that it is false. Belief is the most basic acceptance concept: the simplest reason to treat a proposition as true is that one believes that it *is* true (Stalnaker 2002:716).

² A presupposition trigger is a construction or lexical element that induces a presupposition. We will use a simplified classification following the standard one given by Levinson (1983).

In this view, a proposition φ belongs to the common ground if all members in a group *accept* φ (Ibid.). The common ground of a conversation at a particular time thus corresponds to the set of propositions that the participants in a conversation mutually accept to be true and take for granted at that time. However, the ways in which speakers accept these propositions correspond to different propositional attitudes.³

Given that presuppositions are a condition for the appropriateness of utterances from the CG point of view, it is only appropriate to utter a sentence p if at time t the common ground includes the presupposition q required by p . For example, the utterance:

(2) It was John who ate the cake

is appropriate only if participants in the conversation mutually accept that

(2p) Someone ate the cake

since, if the interlocutors had any reason to reject (2p), they would refuse utterance (2) as inappropriate.

Since speakers have different propositional attitudes towards presuppositions according to the CG approach, the common ground is strongly connected to the *cognitive context* given by speakers' background of mental states, corresponding to propositional attitudes (e.g., beliefs, presumptions, assumptions, etc.). To sum up, the common ground does not coincide only with common beliefs, because during a conversation a speaker may "make *assumptions*, and what is assumed may become part of the common ground, temporarily. One may *presume* that things are mutually believed without being sure that they are. That something is common belief may be a *pretense* – even a mutually recognized pretence" (Stalnaker 2002:705). For example, a speaker may recognize utterance (2) as appropriate because she believes (2p), simply assumes (2p), or because she presumes or accepts (2p) to be true for the sake of the argument, or because she simply takes it for granted in order to preserve cooperative behaviour with her interlocutors.

Therefore, Stalnaker's cognitive framework is based on the thesis that interlocutors accept and take propositions for granted for a number of different reasons corresponding to different propositional attitudes.

³ Following Russell (1918: 227) propositional attitudes are defined as mental relations connecting a person to a proposition (e.g. believing, desiring, hoping, etc).

3 Experiment

In the Experimental Pragmatics literature, there are few experimental works concerning presuppositions (Chemla 2009b, Schwarz 2007, Tiemann et al. 2011) and, to our knowledge, none concerning the role of propositional attitudes towards presuppositions. In what follows we present an experiment aimed at evaluating whether different attitudes towards the presuppositions triggered by an utterance containing a presupposition trigger in some way affect the evaluation of the appropriateness of the utterance.

The main difficulty was to find a way to have participants entertain different attitudes towards a presupposition, as suggested by Stalnaker. As we will exemplify in the report below, we considered using pictures representing situations that provided three different levels of perceptual evidence supporting the content of a presupposition required by the utterance of a sentence containing a presupposition trigger. It was thought that these different pictures should induce three different attitudes towards the proposition taken for granted. Strong evidence should induce a *belief*; weak evidence should induce a *presumption*, and no evidence should lead the listener to *assume* the presupposition for the sake of argument. The rationale was to investigate whether, depending on these different propositional attitudes, the evaluation of the appropriateness of the utterance (the sentence with a presupposition trigger) changes in terms of (i) time needed to accept the utterance as appropriate and (ii) degree of appropriateness.

Method

Participants

Thirty-nine students (27 women, 12 men) from the University of Genoa took part in this experiment for course credit. Their ages ranged between 18 and 44 years ($M = 24.00$; $SD = 5.62$). All participants were native Italian speakers. Informed consent was obtained. Participants were randomly assigned to one of three experimental groups (A, B, C). Three participants were excluded from the sample because they violated the protocol by interrupting the experiment.

Stimuli

Twelve target sentences were created in order to provide three tokens for the four main types of presupposition triggers: definite descriptions (DD), change of state verbs (CS), iterative

and focal adverbs (IF) and factive verbs (FV)⁴ (the twelve target sentences are listed in Table 1). Each of these target sentences was embedded in a list including two distractors (for examples see Table 2). Targets were sentences containing a presupposition trigger that induced a presupposition P. Distractors were two sentences used to prevent subjects from focusing all their attention on the target sentence. All the target sentences were appropriate, while distractors were composed of one appropriate and one inappropriate sentence for each list. For example, in the CS1 list the sentences were:

1. 'Patricia has given up smoking' (target sentence)
2. 'Patricia and Edward have been friends for a long time' (distractor)
3. 'Patricia returned to Mars' (distractor).

[TABLE 1 ABOUT HERE]

[TABLE 2 ABOUT HERE]

A picture was attached to each list of three sentences (one target and two distractors). The pictures were of three kinds, providing three decreasing levels of empirical evidence for the content expressed in presupposition P as presupposed by the target sentence. The purpose of the pictures was to induce three different kinds of propositional attitudes towards the presupposition P. The first picture was designed to induce an attitude of *belief* (condition C1), the second an attitude of *presumption* (condition C2), and the third of *assumption* (condition C3). The example below (Figure 1), concerns the list CS1, i.e. the set of sentences (i) 'Patricia has given up smoking', (ii) 'Patricia and Edward have been friends for a long time', (iii) 'Patricia returned to Mars'. In the example, picture (a) shows Patricia smoking a cigarette, and thus provides strong evidence to believe the presupposition P of the target sentence (i), that is 'Patricia had been smoking'. Picture (b), on the other hand, provides elements to lead to the presumption that 'Patricia had been smoking', because it shows Edward offering her a cigarette; this empirical evidence is just sufficient to presume the veracity of the

⁴ It was decided to use four prototypical categories of presupposition triggers. Iteratives and focal adverbs were included in the same category because they are types of presupposition triggers that, differently from DD, CS and FV, do not induce complete propositions (i.e. propositions that can be evaluated as true or false). The distinction between presupposition triggers that activate *weak presuppositions* and triggers that induce *strong presuppositions* is presented in Glanzberg (2003). However, the focus of the present experiment is not on the difference of presupposition triggers, and the use of many of them was just for the sake of completion. Further work will be needed to study the different roles of different kinds of triggers..

presupposition P because it could generate different scenarios (e.g., Patricia either accepting or refusing the cigarette). Picture (c) does not provide empirical elements to support the statement ‘Patricia had been smoking’ and therefore it induces participants to assume the presupposition P. Pictures were shown with a short caption introducing the situation represented by the picture. The *caption* was the same for the three pictures; for example, in the case of list CS1 the caption was: “Patricia was at home with her friend Edward. After this conversation, some things happened in her life”.

[FIG 1 ABOUT HERE]

Design

We used a between-subjects design where each of the groups A, B, and C was exposed to each list of three sentences (DD1, DD2, DD3, etc.) under different experimental conditions, (C1, C2, C3), i.e. approaching the list of sentences with different associated pictures intended to create different propositional attitudes (as in (a),(b),(c) above). In this way, each group was exposed to all three conditions for each type of presupposition trigger, but with different target sentences (Table 3).⁵

[TABLE 3 ABOUT HERE]

For each list of sentences (one target and two distractors) the only difference among the conditions was the picture shown to the participants. Comparing the three conditions for each list allows us to study the effect of a different propositional attitude towards the content of the presupposition. Both the presentation order of each list and the order of the three sentences of the lists (target, first distractor, second distractor) were randomised for each participant in order to minimise the effects of speeding up due to growing familiarity with the task, and of decreasing attention due to the repetitive nature of the stages.

⁵ We chose not to use the same group for each condition in order to reduce extraneous variables related to individual differences in the performance of the task.

Procedures

The study was conducted in a laboratory. Instructions, stimuli, response recordings, and data collection were controlled by a PC running custom software. A 14" CRT monitor (Nek MultiSync V720 with 800x600 screen resolution) was used for displaying stimuli. Participants sat approximately 60 cm from the display in a separate room. The room was normally lightened, the monitor was positioned at a 90° angle to the window, and other light sources were controlled to minimize glare and reflections. Only a mouse (no keyboard) was available for responses.

The first stage (introduction) introduced the participants to the first task, which consisted of assessing as appropriate or inappropriate a set of sentences related to a picture and a caption. Responses were made by clicking one of two buttons, green for 'appropriateness' or red for 'inappropriateness'. The second task, performed after each of these choices, was to evaluate the degree of appropriateness/inappropriateness on a 7-point scale.⁶

There was no definition of 'appropriateness' in the introduction, only a few prototypical examples of belonging to that category (see Appendix). We are aware that the concept of appropriateness was not identical for each participant, and could become "fuzzy" in the execution of the task (which lasted 11-17 minutes). However, this choice was made in order to bring out an intuitive notion of 'appropriateness' as close as possible to the broad concept that plays a role in real communicative exchanges. This kind of instruction, which calls for intuition, is widely used in the field of experimental pragmatics (Chemla 2009a, Chemla and Spector 2011; Chemla, Homer, and Rothschild 2011).

In the *introductory phase*, the appropriateness/inappropriateness buttons and the panel with the 1-7 buttons were shown to the participants. A *warm-up phase*, which followed the introduction, included three cases, identical for all three groups, and similar to those seen during the test phase. These evaluations were not taken into account in the final data. The sequence of the *test phase* (Figure 2) followed these steps:

1. The first picture and caption was shown. For the first sentence in each list a 'Start' button had to be pressed to begin the sequence.
2. The first of three sentences (related to the first picture) and the 'appropriateness/inappropriateness' buttons were shown below the picture.

⁶ It was decided to use two phases (i.e. the appropriateness/inappropriateness choice and the appropriateness/inappropriateness assessment) in order to obtain a measure of the time necessary to accept an utterance as appropriate, excluding the time required to make the appropriateness/inappropriateness assessment.

3. After the choice of one of two buttons had been made, the evaluation panel (with 7 buttons) appeared. To confirm the assessment an 'Ok' button was pressed.
4. When the 'Ok' button was pressed the second sentence appeared and the choice-assessment sequence was repeated. The same applied for the third sentence.
5. The task then shifted to the second picture, and so on for all twelve cases.

[FIG 2 ABOUT HERE]

To make sure that the participants had properly understood the task, it was decided to exclude participants who did not score a minimum of 80% correct answers in the first task (i.e. choice between appropriateness and inappropriateness) from the sample. This criterion for inclusion was calculated considering all 45 sentences evaluated by the participants (9 sentences in the training phase plus 36 in the test phase). At the end of the experiment a short debriefing was conducted to check participants' understanding of the task by asking about criteria used during the performance.

Groups A, B, and C were created in order to assign the different lists to each group under different conditions, and to assign each kind of presupposition trigger to each group under different conditions (see Table 3).

Variables

The *independent variable* was the difference among the conditions linked to the three propositional attitudes induced by the three different pictures, connected in turn to the target sentences. The *dependent variables* were: (V1) time taken to elaborate the appropriateness assessment of the 12 target sentences (the time elapsed from clicking the 'Start' button to clicking the green 'Appropriate' button); (V2) the degree of appropriateness evaluation of target sentences on the 7-point scale.

The time taken to elaborate the appropriateness assessments was the result of the time spent to read the sentences plus the time spent in the evaluation of appropriateness. The reading time was the same in the three experimental conditions given that the sentences read by the participants were exactly the same in the three conditions. Thereby, comparing the elaboration times in the three conditions allowed a comparison of any different times of evaluation of appropriateness.

Results

The mean of the correct answers (both target sentences and distractors) given by participants during the whole test phase was .87 ($SD = .34$). This indicates that most participants performed the task correctly. If participants failed to make the correct appropriateness choice regarding a target sentence by clicking the 'Inappropriate' button, that single item was removed from the data analysis. Overall, 57 items were excluded from the analysis (12% of all recorded items).

Average times for the three conditions were $C1 = 5852$ ms ($SD = 3593$ ms), $C2 = 7959$ ms ($SD = 4829$ ms), $C3 = 8393$ ms ($SD = 5034$ ms). Average rates were $C1 = 5.72$ ($SD = 1.01$), $C2 = 4.68$ ($SD = .94$), $C3 = 4.08$ ($SD = 1.62$) (see Table 4 and Figure 3).

[TABLE 4 ABOUT HERE]

[FIG 3 ABOUT HERE]

Results of each category of presupposition triggers are reported in Table 5.

[TABLE 5 ABOUT HERE]

A repeated measures variance analysis (ANOVA) was conducted on the average time of the three conditions. The effect of the time variable was highly significant, $F(2, 76) = 8.012$, $MSE = 8991767$, $p < .001$. Another repeated measures ANOVA was conducted on the average degree of appropriateness evaluation for the three conditions. The effect of the ratings was highly significant, $F(2, 76) = 18.95$, $MSE = 1.42$, $p < .001$.

To verify that the result patterns concerned the target sentences only (those containing the presuppositions related to the picture), the distractor sentences for timescale were also analysed: $C1 = 5361$ ms ($SD = 3254$ ms), $C2 = 5267$ ms ($SD = 2701$ ms), $C3 = 5544$ ms ($SD = 4376$ ms) and quantitative evaluation, $C1 = 5.71$ ($SD = .90$), $C2 = 5.65$ ($SD = .82$), $C3 = 5.60$ ($SD = .89$). A repeated measure ANOVA was then conducted on average times of the distractor sentences for the three conditions. The effect of the time variable was not significant, $F(2, 76) = .23$, $MSE = 3336117$, $p = .79$. Furthermore, another repeated measure

ANOVA was run on average rates of the distractor sentences, which again showed no significant differences between the three conditions: $F(2, 76) = .289$, $MSE = .412$, $p = .750$.

Since increasing and decreasing data were noted respectively in the three experimental conditions for the two dependent variables, a correlation analysis of average times and average rates was conducted to investigate the relation between V1 and V2. A significant inverse correlation was found between the two dependent variables: $r = -.330$ ($P < .001$).

5 General Discussion

Our data suggest the following patterns linked to the key role of propositional attitudes: the mean elaboration time t_1 for C1, t_2 for C2 and t_3 for C3 increases according to the pattern:

$$t_1 < t_2 < t_3$$

While the mean scores of appropriateness of the target sentences on the 7-point scale in the three experimental conditions (p_1 for C1, p_2 for C2 and p_3 for C3) show a reverse pattern with respect to that of the elaboration times:

$$p_1 > p_2 > p_3$$

Our results indicate that if a speaker holds an attitude of *belief* towards a presupposition, she has a cognitive benefit when evaluating an utterance as appropriate because the cognitive process involved is processed faster than in cases of a speaker holding an attitude of *presumption* or of *assumption*. In addition, if an utterance is supported by a believed presupposition, the speaker is supposed to accept the utterance as more appropriate than in cases where less evidence is available for the presupposition required (presumption or assumption).⁷

The results presented above seem to indicate that, in accordance with the Common

⁷ The target sentences evaluated in the course of the experiment can be described as cases of accommodation of an informative presupposition (i.e. the presupposition P as triggered by the target sentences). There are however two possibilities concerning belief: (i) the evidence given by the picture stimulating an attitude of belief can be considered as taking something for granted in the conversation, thus avoiding the need of accommodation; (ii) the target sentence still needs to be accommodated also in case of belief, given that there is no explicit statement and belief is implicitly formed through the picture. In the first case we would have a gap between a presupposition already shared (case of belief) and a presupposition only accommodated through the target sentence in case of presumption and acceptance. However, the gap does not affect our interpretation of the data, because the difference in empirical evidence supporting the content of the presupposition P in any case induced different attitudes towards the presupposition to be accommodated or believed.

Ground account, different propositional attitudes towards presuppositions play a role in the evaluation of appropriateness of utterances that contain a presupposition trigger. The CG account proposed by Stalnaker thus seems to be psychologically plausible: given that in Stalnaker's view in order to recognize an utterance as appropriate speakers must hold an attitude towards the presuppositions required, our results support the core of his model.

On the one hand, a possible explanation for the results pattern concerning the times of appropriateness evaluation is that, in order to understand a sentence, speakers are supposed to mentally represent a model of the state of things as described by that sentence. Thus, following the traditional view in which perception is the primary source of mental models (Johnson-Laird 1983), it is reasonable to assume that when someone already has a model compatible with the presupposition of an utterance (e.g., because he saw a picture with Patricia smoking), he is not required to spend time in the construction of a new model. On the contrary, less evidence allows the construction of more than one possible model, thus requiring more cognitive effort. Hence, different levels of evidence supporting the content of a sentence may correspond to different cognitive loads in representing the content described by that sentence.⁸ This is probably why, where the content of the same presupposition was supported by three decreasing levels of empirical evidence, the average time spent by participants to represent the content of the presupposition increased depending on the amount of evidence. On the other hand, depending on the context, an utterance can be supported by different kinds of evidence, e.g., written statements, oral testimony, the visual perception of scenes or other inputs from the context. Results concerning the average rates suggest that the more evidence is available to support the content of an utterance, the higher the felicity or appropriateness of the utterance itself.

The inverse correlation between average times and average rates shows that when the content of the presuppositions triggered by speakers' utterances is supported by strong empirical evidence, speakers evaluate an utterance as highly appropriate in a short time. This could be accounted for by considering that if a speaker in a certain context evaluates an utterance as highly appropriate, it means that she has good reasons (in our case, strong evidence) supporting the content of that utterance; therefore, she is supposed to recognize the appropriateness of the utterance quickly, as she has no reason to question the content of the

⁸ It is not necessary, however, to rely on a specific hypothesis of mental models. It would be enough to refer to the commonly agreed upon vision, supported by empirical data, that inferential processing takes longer than direct retrieval (Collins and Loftus 1975, Norman and Rumelhart 1975, Camp, Lachman and Lachman 1980, Kahneman 2003). It is also apparent that with less evidence, more space is given to inferential processing.

utterance evaluated.

We have identified two main limits in our experimental design, the first relating to the generalizability of the results to real communicative situations, and the second to the vagueness of the notion of ‘appropriateness’. In actual communicative behaviour, speakers always evaluate utterances on the basis of a complex notion of conversational context, where a number of elements connected with the physical and cognitive context are involved. To what extent can we apply our results given that participants were required to evaluate the appropriateness of utterances with respect to fictional and highly abstract cases of prototypical conversations? Second, the use of the vague notion of ‘appropriateness’ did not permit us to identify the precise criterion used by each participant to perform the choice of appropriateness/inappropriateness in each case proposed during the experiment. It should be noted, however, that we were not directly interested in determining that criterion, since in real communicative behaviour speakers recognise an utterance as either appropriate or inappropriate for a number of different reasons, depending on the context.

This study opens up a further question concerning presupposition triggers. In particular, the next step will be to estimate whether the use of different kinds of presupposition triggers implies different cognitive demands, with the purpose of testing whether certain categories of presupposition triggers require automatic or controlled processes.^{9,10}

Acknowledgements

We are grateful to Claudio Caneva for his invaluable help concerning statistical analysis. Earlier versions of this paper were presented at the AISC 2011 Conference, (1-2 December 2011, Milan), at the *Pragmatics Reading Group* - Division of Psychology and Language Sciences of the University College (London) and at the Seminar on *Belief Attribution* held in Parma in May 2012. The paper has greatly benefited from the discussion on all three occasions. We are also indebted for highly constructive discussions and comments to

⁹ In this work we have not compared the results of different categories of presupposition triggers within each condition. The reasons are that, regarding V1, if we did so, the elaboration times of appropriateness/inappropriateness assessment would have been influenced by the different reading times of the sentences (e.g. the reading time of the sentence CS1 ‘Patricia has given up smoking’ is shorter than the reading time of the sentence FV3 ‘Sharon explains that she is happy that Michael goes work by bus’; therefore, a comparison between the elaboration times of appropriateness/inappropriateness of the two sentences would not have been valid). Concerning V2, we avoided comparing the results of different categories of presupposition triggers within each condition as there were no relevant theoretical reasons to relate differences in degrees of appropriateness with differences in triggers contained in the sentences assessed.

¹⁰ After the experiment described in the present paper, we have conducted a further experiment on the problem of presupposition triggers with some new results given in Domaneschi, Carrea, Penco, Greco, *forthcoming*.

Cristiano Castelfranchi, Christopher Gauker, Sergio Morra, Matteo Casu and Massimiliano Vignolo.

References

- Camp, C.J., Lachman, J.L., and Lachman, R. 1980. "Evidence for direct-access and inferential retrieval in question-answering". *Journal of Verbal Learning and Verbal Behaviour* 19(5): 583-596.
- Chemla, E. 2009a. "Universal implicatures and free choice effects: experimental data". *Semantics & Pragmatics* 2(2): 1-33.
- Chemla, E. 2009b. "Presuppositions of quantified sentences: experimental data". *Natural Language Semantics* 17(4): 299-340.
- Chemla, E. and Spector, B. 2011. "Experimental evidence for embedded scalar implicatures". *Journal of Semantics* 28(3): 359-400.
- Chemla, E., Homer, V., and Rothschild, D. 2011. "Modularity and intuitions in formal semantics: the case of polarity items". *Linguistics and Philosophy* (in press).
- Collins, A.M. and Loftus, E.F. 1975. "A spreading-activation theory of semantic processing". *Psychological Review* 82(6): 407-428.
- Domaneschi F., Carrea E., Penco C., Greco A. "The Cognitive Load of Presupposition Triggers. Mandatory and Optional Repairs in Presupposition Failure", *Language and Cognitive Processes*, forthcoming.
- Gauker, C., 1998. "What is a context of utterance?". *Philosophical Studies* 91:149-172.
- Gauker, C., 2002. *Words Without meaning*. Cambridge, MA: The MIT Press.
- Glanzberg, M. 2003. "Felicity and presupposition triggers". (Paper presented at the University of Michigan Workshop in Philosophy and Linguistics, Michigan, USA).
- Kahneman, D. (2003). "A perspective on judgment and choice: Mapping bounded rationality". *American Psychologist* 58(9): 697-720.
- Johnson-Laird, P.N. 1983. *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness*. Cambridge, MA: Harvard University Press.
- Levinson, S.C. 1983. *Pragmatics*. Cambridge: Cambridge University Press.
- Norman, D.A. and Rumelhart, D.E. 1975. *Explorations in Cognition*. San Francisco: W.H. Freeman.
- Stalnaker, R. 2002. "Common Ground". *Linguistics and Philosophy* 25(5-6): 701-721.

- Stalnaker, R. 2009. “A response to Abbott on presupposition and common ground”. *Linguistics and Philosophy* 31: 539-544.
- Schwarz, F. 2007. “Processing presupposed content”. *Journal of Semantics* 24: 373-416.
- Tiemann, S. and Schmid, M. et al. 2011. “Psycholinguistic evidence for presuppositions: On-line and off-line data”. In I. Reichet al. (eds), *Proceedings of Sinn & Bedeutung* 15:581–595.

Appendix

The Experiment has been conducted during the Winter term 2011 at the Laboratory of Psychology and Cognitive Sciences at the University of Genoa. The subjects were 39 students (27 women) of the same University. The mean age was 24.00 ($SD=5.62$). The following instructions were given to the participants at the beginning of the experiment.

1. Hello and thank you for your participation in this experiment.
2. You will be shown a picture connected with a short caption. Look carefully both at the picture and at the caption. When you are ready, push the ‘Start’ button.
3. [FIGURE 4 ABOUT HERE]
4. Afterwards, you will be required to evaluate a sentence either as appropriate or as inappropriate by pushing on one of two buttons: green for ‘Appropriate’ and red for ‘Inappropriate’.
5. [FIGURE 5 ABOUT HERE]
6. In this example, the sentence ‘Mark is tired because this morning he participated in the World Rhythmic Gymnastics Championships’ is ‘Inappropriate’. Clearly, it is unreasonable to think that Mark is a gymnast and that he participated in the World Rhythmic Gymnastics Championships.

7. Afterwards, you should evaluate how intuitively the previous sentence sounded inappropriate to you. In order to do that, you are required to choose a grade on a scale of 1 to 7 points.

8. [FIGURE 6 ABOUT HERE]

The further part of instructions consists of a repetition of the screenshots from point 3 to 7 with the appropriate sentence ‘Mark is a good midfielder’ as second example. In this part, we suggested to the participants that ‘Mark is a good midfielder’ sounds appropriate in this context because, considering the pictures and the caption, it is reasonable to think that Mark might be a good midfielder.

FIGURES AND TABLES

Fig. 1 An example of the picture shown in the three conditions with the sentence ‘Patricia has given up smoking’.



Fig. 2 Examples of test phase screenshots representing steps 1, 2 and 3.

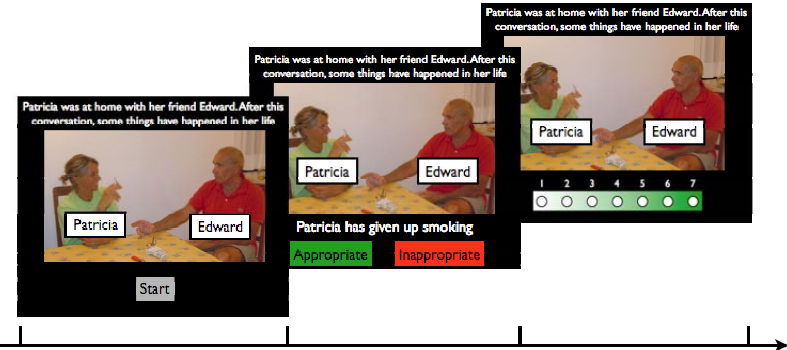


Fig. 3 Results of both variables for the three conditions.

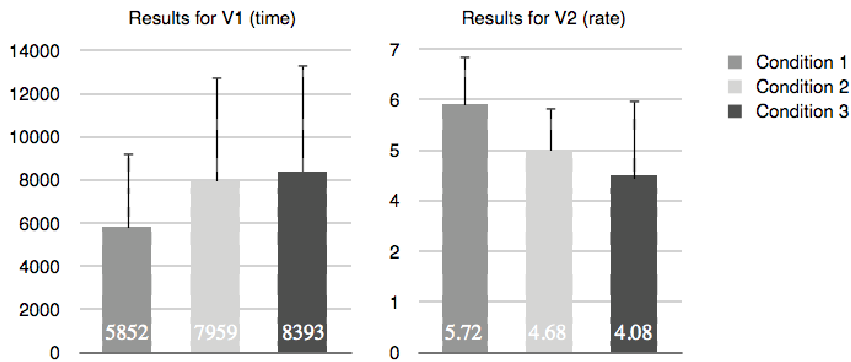


Fig. 4 An example of a picture connected with the caption ‘Mark always plays football with his friends on Sunday’.



Fig. 5 An example of a picture connected with a caption, the sentence ‘Mark is tired because this morning he participated in the World Rhythmic Gymnastics Championships’ and two buttons.



Fig. 6 An example of a picture connected with the caption, the sentence and the 7-point scale.



Table 1 The four types of presupposition triggers and the twelve target sentences used in the experiment. Each was presented alongside two distractors.

TYPES OF TRIGGERS	TARGET SENTENCES FOR EACH LIST
Definite descriptions (DD)	DD1 The students' favourite is the Professor of Mathematics
	DD2 Emma's boyfriend is called Mike
	DD3 Rose's sister gave her a nice present
Change of state verbs (CS)	CS1 Patricia has given up smoking
	CS2 Tim has turned off the mobile phone
	CS3 Sarah continued to dance
Iteratives and Focal adverbs (IF)	IF1 Luke has cooked roast beef again
	IF2 Kelly went back into the musical instrument store
	IF3 Antony is a boxer too
Factive verbs (FV)	FV1 Manuel said that John is able to ride a bike
	FV2 Alyson is disappointed because she dropped the coffee
	FV3 Sharon explains that she is happy that Michael goes to work by bus

Table 2 Complete lists (DD1, DD2, DD3) with Definite Descriptions.

LISTS	ROLE	SENTENCES
-------	------	-----------

DD1	Target	The students' favourite is the Professor of Mathematics
	Distractor 1	The grades given are too high in all courses
	Distractor 2	Men with short hair cannot enrol
DD2	Target	Emma's boyfriend is called Mike
	Distractor 1	When she is not at home, Megan only wears skirts
	Distractor 2	Megan likes romantic movies
DD3	Target	Rose's sister gave her a nice present
	Distractor 1	Rose can now get a pilot's licence
	Distractor 2	Rose blew out the candles on the cake

Table 3 Assignment of groups to the three experimental conditions.

LISTS	C1 (belief)	C2 (presumption)	C3 (assum.)
DD 1	A	B	C
DD 2	B	C	A
DD 3	C	A	B
CS 1	A	B	C
CS 2	B	C	A
CS 3	C	A	B
IF 1	A	B	C
IF 2	B	C	A
IF 3	C	A	B
FV 1	A	B	C
FV 2	B	C	A
FV 3	C	A	B

Table 4 General results of dependent variables V1, average elaboration time, and V2, average rating of appropriateness.

Variable	Condition 1	Condition 2	Condition 3
V1 (SD)	5852 (3593)	7959 (4829)	8393 (5034)
V2 (SD)	5.72 (1.01)	4.68 (0.94)	4.08 (1.62)

Table 5 Results for V1 and V2 for the four types of presupposition triggers.

Triggers	Variables	C1	C2	C3	Tot.
DD	V1 (SD)	4559 (3934)	5562 (4156)	6346 (4848)	5502 (4368)
	V2 (SD)	5.88 (1.27)	5.10 (1.55)	4.63 (2.21)	5.19 (1.80)
CS	V1 (SD)	6410 (6581)	7846 (6681)	11301 (7938)	8321 (7251)
	V2 (SD)	5.16 (2.13)	4.21 (1.43)	3.62 (1.82)	4.39 (1.92)
IF	V1 (SD)	5696 (4291)	9245 (7729)	9470 (5409)	7997 (6144)
	V2 (SD)	5.88 (1.38)	4.63 (1.70)	3.49 (2.24)	4.75 (2.02)
FV	V1 (SD)	5872 (4221)	7202 (5623)	8548 (4934)	7126 (5004)

Authors' addresses

Elena Carrea (#) elenacarrea@gmail.com

Filippo Domaneschi (+) filippo.domaneschi@unige.it

Alberto Greco (#) greco@unige.it

Carlo Penco (+) penco@unige.it

(+) University of Genoa, Department of Philosophy

via Balbi 4, 16126 Genova

Italy

(#) Laboratory of Psychology and Cognitive Sciences

via Balbi 4, 16126 Genova

Italy

About the authors

Filippo Domaneschi, PhD at the University of Genoa, has published in the *Journal of Pragmatics*, *Epistemologia*, and *Rivista di Estetica*. He has recently edited (with C. Penco) *What is Said and What is Not* (Stanford: CSLI), a collection on the divide between pragmatics and semantics. His main interest is on the pragmatics of presuppositions and generally experimental pragmatics.

Elena Carrea, PhD in psychology at the University of Genoa, has been working at the Laboratory of Psychology and Cognitive Sciences under the supervision of Alberto Greco. Besides performing many experiments in psychology, she has published in *Cognitive Processing*, and is now working on new directions of research concerning movement and coordination.

Alberto Greco is full professor of Cognitive Psychology at the University of Genoa, head of the Laboratory of Psychology and Cognitive Sciences in Genoa, and vice president of the Italian Association for Cognitive Sciences. He has published in *Cognitive Processing*, *Frontiers in Neurorobotics*, *Cognitive Systems*, and other journals. His main publications are on categorization and symbol grounding.

Carlo Penco is full professor of Philosophy of Language at the University of Genoa and head of the Doctoral School of Human Sciences in Genoa. He has published in *History and Philosophy of Logic, Pragmatics and Cognition*, *Philosophical Investigations*, and other journals. His main publications are on the philosophy of Frege and Wittgenstein and on the interface between pragmatics and semantics.