

Prosodic Effects of implicit Causality in German and Norwegian?

Bistra Andreeva, Oliver Bott, Jacques Koreman, Torgrim Solstad

Abstract

When two participants are mentioned in a sentence, accentuation of a pronoun (or lack of it) later in that same sentence can create a preference for interpreting one of them as coreferent with the pronoun. The selection of the referent depends on a number of factors. In this paper, we examine the potential influence of a lexical-semantic property of verbs known as implicit causality. The effect of implicit causality on coreference has previously been investigated in written language using a sentence completion task (e.g. Ferstl et al. 2011). By investigating the effect of implicit causality on accentuation, we are extending the evidence for the role of implicit causality from written to spoken language.

1. Introduction

Generally, the reference of ambiguous pronouns can be resolved by accentuation, as illustrated in the utterances in (1a,b) (see e.g. Venditti et al. 2002). The pronoun and its preceding referent are italicized; capital letters indicate accentuation.

(1a) *John* hit Bill and then *he* hit George.

(1b) John hit *Bill* and then *HE* hit George.

According to Centering Theory (e.g. Brennan 1995), the subject pronoun in (1a) is usually not accented, because it is coreferent with the (forward looking) center of the first part of the utterance. Accentuation, as in (1b), is a means to indicate a shift to an entity that was not the center of discourse before, hence reference to the object is facilitated. In its classical form, centering theory models these shifts solely on the basis of grammatical information. For instance, reduced forms are predicted to appear when the referent is the grammatical subject in sentence-initial position rather than a later-mentioned object in the immediately preceding clause (*subject first principle*). The centering algorithm can be extended to incorporate non-structural information, too. What would be expected, then, is the interaction of violable constraints. In the present study we investigate the influence of a semantic bias, caused by implicit causality, on pronoun accentuation.

Directly relevant for our research is a written production study by Fukumura & van Gompel (2010) who investigated the impact of implicit causality and subject bias on the form of the anaphor (pronoun vs. name). In a sentence

completion task, subjects were asked to write a possible continuation for the first part of a sentence shown on a computer screen. Interestingly, their study showed no effect of semantic bias on the choice of anaphoric *form*, e.g. pronouns vs. proper names (*he* vs. *John*). However they used gender disambiguated nouns (e.g. *John_{masc} hated Mary_{fem} because ...* (a) *he/John...* (b) *she/Mary...*) which allow unique reference to the referent by the selected pronoun. This makes their materials different from the examples in (1a,b) where the (prosodic) form of the pronoun serves to create a preference for a particular resolution of anaphoric relations. Note that without accentuation of the pronoun, hearers experience a strong garden-path (1c). The ambiguity is not resolved until the name *John* appears, which is the same as the subject of the first part of the sentence, so that the pronoun *he* must refer to *Bill*.

(1c) John hit Bill and then he hit John.

The present study will demonstrate that in the case of ambiguous pronouns the semantic bias of implicit causality outranks the subject first principle and that consequently, implicit causality may indeed influence the form of reference in terms of *prosody*. Implicit causality is demonstrated in (2a,b). For an account of implicit causality the reader is referred to Bott & Solstad (submitted).

(2a) Mary impressed John because... *she won the chess tournament*.

(2b) Mary admired John because... *he played chess so well*.

For *subject-bias* verbs like *impress* the pronoun in *because* continuations tends to refer to the subject. For *object-bias* verbs like *admire*, on the other hand, the pronoun tends to refer to the object. Importantly, not all verbs exhibit a bias. With *bias-neutral* verbs, either continuation is equally probable:

(3a) Mary hit John because... *she was angry at him*.

(3b) Mary hit John because... *he insulted her*.

Obviously, violations of the bias for subject- or object-bias verbs are possible. *Because* clauses which follow the bias are called *congruent* whereas non-bias-compliant continuations are termed *incongruent*, cf. the contrast between the congruent continuation in (2a) and the incongruent one in (4):

(4) Mary impressed John because... *he liked a good game of chess*.

In sentences (2a) and (4), the gender of the pronoun makes the coreference pattern clear. In this paper, however, we want to examine which prosodic means, if any, are used in *speech production* when several coreference patterns are possible, i.e. when proper names of the same sex are used in the above examples. In particular, we are interested in whether and how implicit causality may be viewed as a constraint in the spirit of Centering Theory which influences

accentuation of pronouns coreferent with the subject or object. To our knowledge, the influence of implicit causality bias has not been investigated in speech production. Put briefly, we examine the following hypothesis:

Implicit Causality Accentuation Hypothesis

Violations of implicit causality bias lead to accentuation of the pronoun coreferent with the dispreferred referent.

From this, we derive the following predictions:

1. In the spoken realization of continuations which do not violate the bias, i.e. pronouns referring to the subject of a subject-bias verb or to the object of an object-bias verb, the pronoun is not accented.
2. For continuations involving subject-bias verbs where the pronoun is coreferent with the object –in violation of the bias– the pronoun is accented. This would still be in accordance with the subject first principle referred to above.
3. In continuations involving object-bias verbs where the pronoun is coreferent with the subject –again violating the bias– the pronoun is accented. It should be noted that in these cases, the influence of implicit causality would outrank the Centering Theory constraint that pronouns are not accented when coreferent with a subject antecedent.
4. Finally, in continuations for bias-neutral verbs, i.e. verbs without a preference for a particular continuation, the pronoun is unaccented, regardless of a subject or object coreference. Not accenting the pronoun when it is coreferent with the object would also violate the subject first principle (cf. prediction 2).

2. Method

2.1. Stimuli

In order to investigate the accentuation of pronouns in sentences with different verb types (subject-bias, object-bias and bias-neutral verbs), we constructed short texts in German and Norwegian. The texts had the same meaning in the two languages. For the sake of readability, we use English examples (translations) in the present article. Four different verb types were used:

- Six of the texts contained a subject-bias verb.
 German: beeindrucken, erschrecken, erstaunen, faszinieren, gefallen, schockieren
 Norwegian: imponere, skremme, forbause, fascinere, glede, sjokkere
- Twelve contained an object-bias verb.
 German: beneiden, bewundern, danken, gratulieren, hassen, loben, mögen,
 respektieren, verabscheuen, verachten, verehren, vergöttern

Norwegian: være misunnelig, beundre, takke, gratulere, hate, rose, like, respektere, avsky, forakte, tilbe, forgude

- Six contained a bias-neutral verb.

German: entlarven, helfen, hypnotisieren, schubsen, verjagen, verpügeln

Norwegian: avsløre, hjelpe, hypnotisere, dytte, jage, gi bank

- In addition 16 filler items were used.

The reason for using more sentences with object-bias verbs is that these are decisive for investigating the role of implicit causality for accentuation, as explained in prediction 3 in the Introduction.

Each text consisted of an introductory sentence and a test sentence. The introductory sentence sketches a background situation, and introduces both possible referents of the pronoun as equal participants, as for instance in (5a). This sentence was followed by a test sentence, which was either a congruent continuation as in (5b), or an incongruent continuation as in (5c). Half of the sentences read by each listener contained a congruent, and the other half an incongruent continuation. The subjects were blocked so that each verb was used with a congruent continuation for one set of subjects, and with an incongruent continuation for the other subject set. Two different randomizations of the texts were used in each subject group.

(5a) Eric and John recently participated in a swimming contest.

(5b) John congratulated Eric, because he swam 1000 metres in 15 minutes.

(5c) John congratulated Eric, because he was unable to swim 1000 metres in 15 minutes.

In order to make the subclauses semantically as similar as possible, incongruent continuations like in (5c) were derived from the congruent continuations like in (5b) by expressing the opposite, but avoiding explicit negation as much as possible. Each speaker read only one of the two test sentences (5b) or (5c).

2.2. *Subjects and task*

Eight German (4 male and 4 female) and five Norwegian subjects (3 male and 2 female) participated in the experiment. Recordings were made in the studios of the phonetic labs at Saarland University in Saarbrücken, Germany, and at the Norwegian University of Science and Technology in Trondheim, Norway.

The short texts were presented on a computer screen, with two comprehension questions below the text, as in (6a,b).

(6a) Who swam 1000 metres in 15 minutes?

(6b) Who was congratulated?

The subjects were asked to first read the texts internally, and then answer the two questions aloud. The questions were about the referents in the test sentence, and were intended to ensure that the subject had understood the text. After answering the questions, the subject also read the text aloud.

At the end of each recording session, the experimenter discussed the texts containing test sentences with the subject, in order to evaluate whether the subject felt these were special in any way. These discussions were also recorded.

3. Results

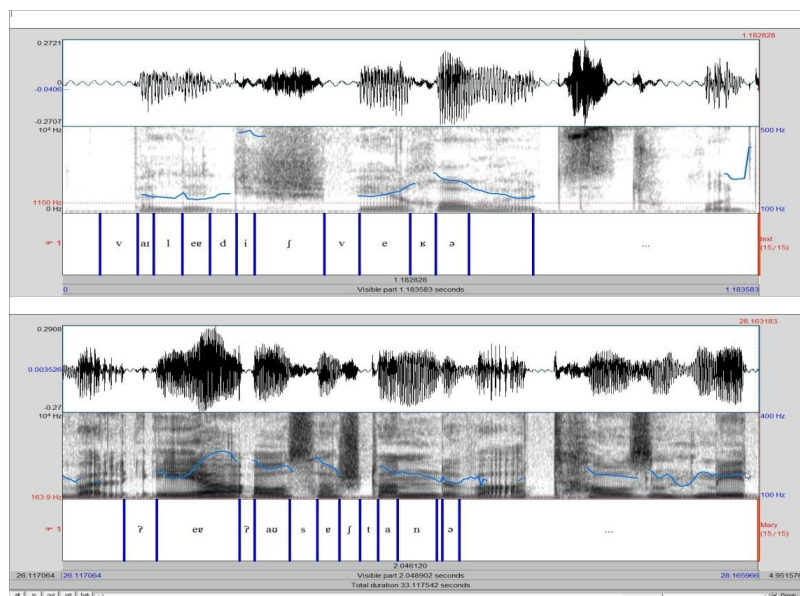
The pronoun in the second part of the test sentences was not accented or made otherwise prominent by the speakers in sentences containing bias-neutral verbs (confirming prediction 4 in the Introduction) or in sentences containing fillers. This was also the case in congruent continuations of subject-bias and object-bias verbs, although there were sporadic exceptions in all of these cases. The general result confirms prediction 1 in the Introduction.

Table 1: Realization of the pronoun in incongruent continuations of verbs with a subject and an object bias for German and Norwegian. Subjects are denoted with initials, with their gender in brackets. The column labelled “correct” lists the number of texts with correctly answered questions; the column labelled “prom” shows the number of accented (prominent) pronouns for texts with correctly answered questions.

language	subject	subject bias (n=3)		object bias (n=6)	
		correct	prom	correct	prom
German	MR (f)	3	3	6	6
	BR (m)	3	3	6	6
	EL (f)	2	1	5	3
	XK (m)	2	2	6	6
	SK (f)	2	2	5	5
	SO (m)	3	3	5	5
	AH (f)	1	1	6	5
	FM (m)	3	3	6	6
Norwegian	TF (m)	1	1	2	2
	IF (f)	2	0	4	0
	fS (m)	2	0	4	0
	OH (m)	3	2	5	1
	ÅØ (f)	3	2	6	6

The most interesting results concern *incongruent* continuations in our test material. There was a clear tendency of accentuation, although this varied across the subjects. Table 1 above shows the results for sentences containing an incongruent continuation. The German speakers and one of the Norwegian speakers

generally accented the pronoun in test sentences containing an incongruent continuation, but not in other sentences. German subjects MR, BR and FM answered all questions about the short texts correctly for the texts containing an incongruent continuation, and they also accented the pronoun in all these cases (3 out of 3 possible accents on the pronoun in verbs with a subject bias, and 6 out of 6 accents on the pronoun for verbs with an object bias). This is also true for subject ÅØ in Norwegian, with one exception. This result corresponds perfectly to predictions 2 and 3 in the Introduction. Other subjects were more variable, but all the German subjects followed this tendency.



*Fig. 1: Realization of the pronoun <er> by speaker SK (female) in a congruent (top panel) and incongruent continuation (bottom panel). The realization in the bottom panel differs from the one in the top panel by the L*H accent on the pronoun and the glottal stop before the pronoun.*

In these incongruent continuation sentences, some of the German subjects used a glottal stop or laryngealization at the start of the ambiguous pronoun in addition to an accent. Figure 1 shows a typical realization of the pronoun <er> (E. “he”) in a congruent continuation in the top panel, with neither an accent nor a glottal stop or laryngealization at the beginning of the pronoun. In the bottom panel, an incongruent continuation is shown, with an L*H accent on the pronoun and a preceding glottal stop. The glottal stop is a strengthening gesture which shows the articulatory effort the speaker is putting into the realization. In Figure 2, an alternative strengthening strategy is exemplified. In this case, the pronoun is followed by a short pause to lend extra prominence.

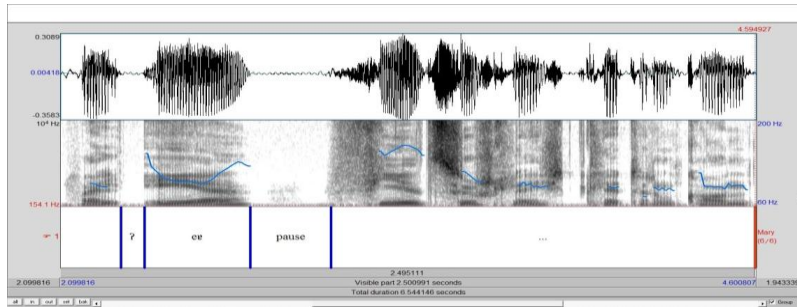


Fig. 2: Realization of the pronoun <er> by speaker XK (male) in an incongruent continuation (bottom panel), with a clear pause after the pronoun.

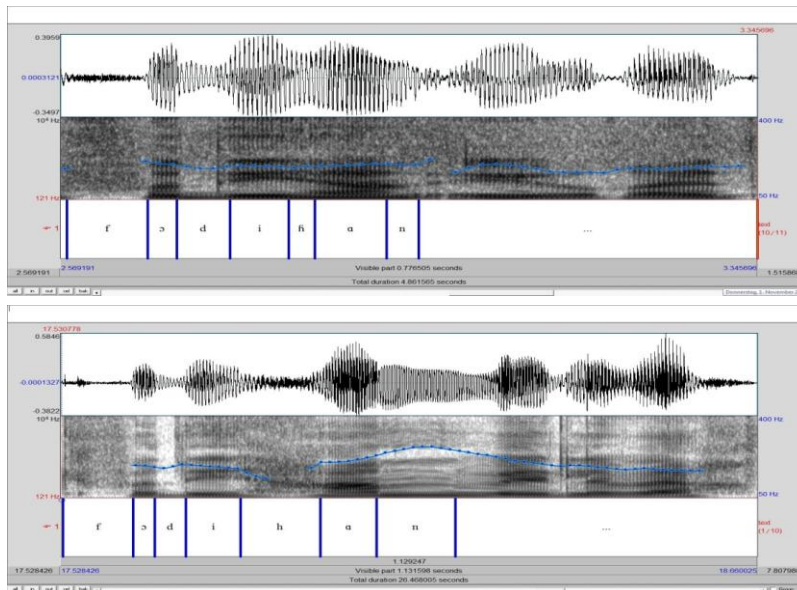


Fig. 3: Realization of /h/ by speaker ÅØ (female) in a congruent (top panel) and incongruent continuation (bottom panel), with a longer and voiceless /h/ in the bottom panel.

The Norwegian subjects sometimes produced a longer duration of the /h/ at the beginning of the pronoun <han> (E. “he”) or <hun> (E. “she”). Figure 3 shows an unaccented realization of the pronoun <han> in a congruent continuation sentence in the top panel, and an accented realization of the same word in an incongruent continuation sentence in the lower panel. In addition to the much longer duration of /h/ in the incongruent continuation sentence, it is also clearly voiceless, while it is voiced in the congruent continuation sentence. This shows that besides accentuation, the (female) speaker is putting more articulatory effort into a larger and longer glottal abduction gesture in the incongruent continuation which lends the pronoun extra prominence, comparable to the effect of a glottal stop or laryngealization in German.

Another Norwegian speaker (male) differentiated between the two conditions by a similar difference in the realization of the pronoun. As with the previ-

ous speaker, the /h/ was long in the incongruent continuation, but it was voiced throughout. The contrast between the two conditions is maintained by the fact that the articulatory gesture for /h/ is strongly reduced in the congruent continuation. It is only recognizable in the oscillogram as a reduction of the amplitude on the boundary between the two vowels (the final vowel of <fordi> and the vowel of <han>, cf. Figure 4).

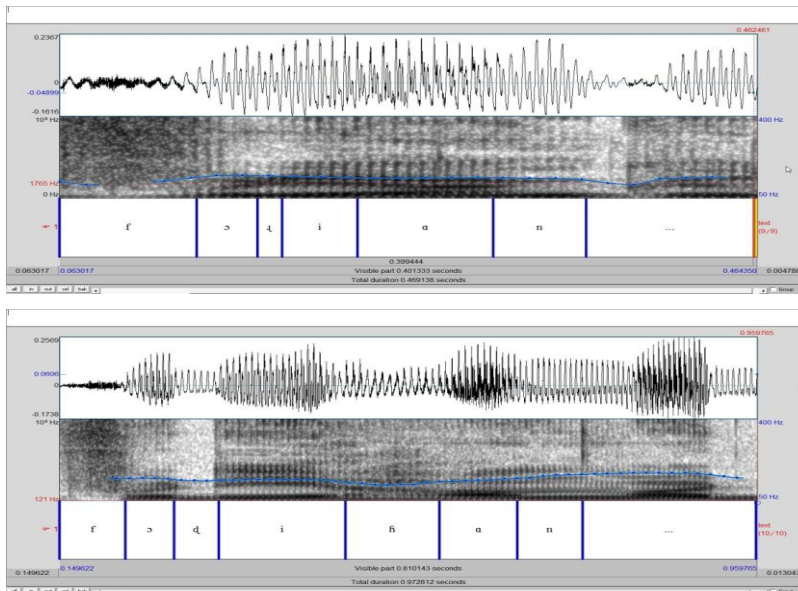


Fig. 4: Realization of /h/ by speaker TF (male) in a congruent (top panel) and an incongruent continuation (bottom panel), enhancing the contrast between the two conditions by reducing the /h/ in congruent continuations.

There were also many subjects who did not accentuate any of the pronouns in the test sentences, including in incongruent continuations. These subjects often indicated that had a problem understanding the texts, for instance by thinking much longer about the texts which contained an incongruent continuation than about other texts before reading them aloud. In the discussion which took place after the experiment, these subjects often expressed that they found the incongruent continuation texts difficult to understand. Some of the subjects arrived at the conclusion that the pronoun should be accented in order to obtain an acceptable reading of the test sentences containing incongruent continuations, in accordance with our hypothesis.

Other subjects who did not accentuate the pronoun in test sentences which were intended as incongruent continuations resolved the situation by construing a *congruent* continuation interpretation instead. An example of this is an ironic interpretation of test sentence (5c), where the interpretation chosen was that “no one swam 1000 metres in 15 minutes” and Eric is congratulated ironically for being unable to swim 1000 metres in 15 minutes. The irony obviously lies in the

fact that one normally congratulates a person on achieving something instead of on *not* achieving something. When a text which was intended to elicit an incongruent continuation interpretation is instead interpreted by the subject as *following* the verb bias, i.e. when the text is interpreted as a congruent continuation, this is often accompanied by the construction of a paralinguistic interpretation of the meaning (cf. Andreeva 2005, p. 147). In these cases, of course, no accent is expected on the pronoun.

Finally, there were also subjects who did not accent any of the pronouns. Possibly, they overestimated their effectiveness, expecting their addressees to understand who was the intended referent of the pronoun without explicitly signalling this (cf. Keysar et al. 2002). But most of the subjects presumably simply had difficulty with the task, as was clear from their (wrong) answers to the questions with texts containing incongruent continuations.

4. Discussion and conclusion

The experimental results seem to confirm the hypothesis presented in the Introduction, since the evidence is generally in accordance with our predictions. The results show a tendency for subjects to accentuate the pronoun (and often also make it prominent by other means) when the verb bias is violated, i.e. when the pronoun refers to the dispreferred noun phrase in the first part of the utterance. In particular the fact that this is the case for verbs with an object bias lends support to the role of implicit causality for pronoun accentuation, as explained in prediction 3 in the Introduction. The assumed reason for the accentuation is that an incongruent continuation produces an implicit contrast to the expectations caused by the verb bias. Accentuation makes the pronoun prominent by acoustic means, comparable to the use of the word “himself”, as the identical meaning of the sentences in (7a, b) show.

- (7a) John congratulated Eric, because HE was unable to swim 1000 metres in 15 minutes.
- (7b) John congratulated Eric, because he was unable to swim 1000 metres in 15 minutes HIMSELF.

The idea of contrast is strengthened by the fact that most of the incongruent continuations included an implicit contrast. The continuation sets up a possible alternative, as for example in the phrase “was unable to” in (7a), which sets up a contrast by implying that Eric *was* able to swim 1000 metres in 15 minutes. The accentuation of the pronoun can therefore be analysed as a contrastive focus accent. It is possible that the accentuation we observed is not directly caused by

the violation of the implicit causality of the verb (i.e. by the incongruent continuation), but by the possible contrast introduced in the incongruent continuations, while the congruent readings did not imply a contrast. This alternative explanation will be tested in a follow-up experiment.

The fact that we observed variable accentuation in sentences containing incongruent continuations indicates the difficulty of the reading task for these texts. This difficulty is likely to be caused by the fact that readers have a strong bias towards congruent continuation readings, as was also shown in a written sentence completion task in Bott & Solstad (2012, submitted). It is possible that speakers more consistently use accentuation of the pronoun in incongruent continuations when they are expressing a concept they have built up in their own mind as part of a natural conversation.

Acknowledgements

The authors would like to thank Thorstein Fretheim for pointing out the possibility that the pronoun accentuation is induced by the contrast in the subclause.

Bibliography

- Andreeva, B. (2005). Zur Phonetik und Phonologie der Intonation der Sofioter Varietät des Bulgarischen (Ph.D. dissertation, Saarland University).
- Bott, O. & Solstad (submitted). From verbs to discourse: a novel account of implicit causality. Submitted to Hemforth, B., Schmiedtová, B. & Fabricius-Hansen C. (eds.): *Experimental approaches to crosslinguistic meaning*. Studies in theoretical psycholinguistics, Springer.
- Bott, O. & Solstad, T. (2012). The mechanics of implicit verb causality. Poster presented at the 25th CUNY conference, CUNY graduate center, NY.
- Brennan, S.E. (1995). Centering attention in discourse. *Language and Cognitive Processes* 10(2), 137-167.
- Ferstl, E.C., Garnham, A. & Manouilidou, C. (2011). Implicit causality bias in English: a corpus of 300 verbs. *Behaviour Research Methods* 43(1), 124–135.
- Fukumura, K. & van Gompel, R.P.G. (2010). Choosing anaphoric expressions: Do people take into account likelihood of reference? *Journal of Memory and Language* 62, 52-66.
- Keysar, B. & Henly, A.S. (2002). Speakers' overestimation of their effectiveness. *Psychological Science* 13(3), 207-212.
- Venditti, J.J., Stone, M., Nanda, P. & Tepper, P. (2002). Discourse constraints on the interpretation of nuclear-accented pronouns. *Proceedings of the Speech Prosody 2002 Conference*, 675-678.