

# Processing Temporal Constraints and Some Implications for the Investigation of Second Language Sentence Processing and Acquisition. Commentary on Baggio

Leah Roberts

Max Planck Institute for Psycholinguistics

Baggio presents the results of an event-related potential (ERP) study in which he examines the processing consequences of reading tense violations such as *\*Afgelopen zondag lakt Vincent de kozijnen van zijn landhuis* (\*“Last Sunday Vincent paints the window-frames of his country house”). The violation is arguably caused by a mismatch between the semantics of the temporal adverb in the topic position *Afgelopen zondag*, which refers to the past time, and the present tense semantic feature as expressed by the morphological marking on the verb *lakt* “paints.” Baggio reports that sentences with this type of tense violation elicited a left-anterior negativity (LAN) between 200 and 400 ms following the onset of the critical word (*lakt*), which was followed by a positive shift at about 700 ms (a so-called P600 effect), in comparison to conditions where there was no such temporal mismatch (*Afgelopen zondag–lakte*). Baggio’s formal semantic analysis of tense and temporal adverbs underlies his view of the parsing of such violations and his functional account of these ERP data. Essentially, tenses are considered to be *integrity constraints*, which serve as instructions to the processing system to update the discourse model in order to locate the situation that is being talked about in (past/present/future) time. The LAN effect is argued to reflect the disruption in the system’s attempt to satisfy the sentence’s constraints. Baggio also finds a negative-going waveform between about 400 and 700 ms following the onset of the final word in the tense violation condition, which he identifies as a sentence-final negativity (SFN). He argues that this SFN reflects the system’s readjustment of the sentence’s

---

Correspondence concerning this article should be addressed to Leah Roberts, Max Planck Institute for Psycholinguistics, P.O. Box 310, 6500 AH Nijmegen, The Netherlands. Internet: Leah.Roberts@mpi.nl

constraints in order to make them satisfiable. In other words, at least in this case, the LAN reflects the *detection* of the anomaly, and the SFN reflects its *correction*.

The fact that the LAN is elicited by a *semantic violation* might pose a challenge to comprehension models that see syntax as the driving force of the parse. Earlier ERP studies have found that a LAN effect is often elicited by the processing of word-category violations and morphosyntactic mismatches including subject-verb, gender, and case agreement violations (for an overview, see Hagoort, 2003). These findings have lent support to syntax-first models of comprehension (e.g., the three-stage model of Friederici and colleagues; e.g., Friederici, 2002), which view the building of syntactic structure as the autonomous first step of the parse and which, crucially, precedes semantic processes. Integration of syntactic and semantic processes is assumed to occur only later, in the 500–700-ms time window. The LAN effect has therefore been taken to indicate automatic, morphosyntactic processing. How can we reconcile the fact that Baggio finds a LAN effect for a *semantic violation*, and so early on in the processing of the critical item? One way is to appeal to the difference between Baggio's tense violation sentences and the types of violations that have been used in earlier studies. Specifically, the subject-verb and gender agreement violations used in earlier studies involve agreement between two *formal* (morphological) markers. In contrast, the tense violations used in Baggio's study concern agreement between the (lexical) semantic features of the adverb and the semantic feature as expressed by the verbal morphology. Therefore, both involve agreement, but of different types.

The view that tense violations are semantic (rather than strictly morphological) violations is unlikely to be a problem for most linguists. How else could it be that many languages effectively express complex temporal relations without having formal morphosyntactic marking (e.g., Moroccan Arabic, which has a large set of temporal adverbs)? The language of adult (particularly untutored) second language (L2) learners can be included in this group, as it is often characterized (at earlier stages) by a lack of productive tense/aspect morphology. Irrespective of language background, learners have been found to start out using temporal adverbs and general information structure principles to establish temporal relations, before they move toward a productive use of verbal morphology, which in fact some learners never do (Starren, 2001).

Baggio's article raises many other interesting questions. One concerns how adult L2 learners might process such tense violations and whether any differences observed can be attributable to specific properties of their first language (L1). Although there is an enormous body of research into the L2 acquisition

of tense and aspect (see, e.g., Bardovi-Harlig, 2000, for an overview), there appear to be very few studies investigating L2 learners' real-time processing of tense (and aspect) violations. Some researchers investigating L2 processing claim that L2 processing differs from L1 processing in that, although applying lexical semantic knowledge online is no problem, learners are less able to compute nonlocal syntactic dependencies in real time (e.g., Clahsen & Felser, 2006; Marinis, Roberts, Felser, & Clahsen, 2005). Others claim that it is the integration of syntactic knowledge with other types of knowledge (semantic/pragmatic) that might be problematic for L2 learners, irrespective of language background (e.g., Roberts, Gullberg, & Indefrey, 2008). In fact, it is only in the domain of lexical-semantics and pragmatics that robust L1 effects on L2 processing have been found (see, e.g., Roberts, 2007, for a review). These L2 processing findings coupled with Baggio's semantic approach to the processing of tense predict that if an L2 learner has not acquired the semantic feature underlying the morphological marker of tense and/or aspect, then they should not be sensitive to a mismatch between a temporal adverb and such a morphologically marked verb. Furthermore, the semantic nature of the computational process predicts that a learner's L1 might influence their processing of the L2. Some recent L2 reading time data can be brought to bear on these questions.

The data that follow come from a word-by-word self-paced reading study by Roberts and Liszka (Roberts & Liszka, 2008), who looked at how French and German L2 learners of English processed present perfect (1) and past simple (2) sentences involving tense/aspect violations. As in Baggio's study, the critical sentences all contain a temporal adverb in the topic position, thus modifying the time being talked about (the Topic Time, TT; cf. Klein, 1994). The experimental manipulation (the tense violation) was created by having the immediately following verb either match in temporal features with the adverb [the *match* conditions: (1a) and (2a)] or not [the *mismatch* conditions: (1b) and (2b)].

(1) *Present Perfect*

- a. For months now, Jill has wanted to get married. *match*
- b. \*Last year, Jill has wanted to get married. *mismatch*

(2) *Past Simple*

- a. Last year, Jill wanted to get married. *match*
- b. \*For months now, Jill wanted to get married. *Mismatch*

Reading times were measured on the critical verb. Interestingly, the native English speakers showed an asymmetry in their sensitivity to these tense

violations. Only in the present perfect sentences did they find the mismatch condition harder to process than the match condition. In contrast, in the past simple sentences, there was no reading time difference between the two conditions. This asymmetry in processing cost appears to be caused by the fact that the tense component of the present perfect condition includes the time of the utterance (TU), so it cannot be used with a temporal adverb that refers to a specific point in the past, as this would exclude the TU. In contrast, in the past simple condition, the time that is being talked about is situated earlier than the TU. Therefore, although it is pragmatically odd to use a temporal adverb that refers to a time span that includes the TU, the past time is not *excluded* as it is in the present perfect condition.

For the L2 learners, there seemed to be an effect of the learners' native language. In French, the compound past form (the *passé composé*) can express the present perfect interpretation like English, whereas in German the compound past mainly licenses the past simple interpretation. The French learners showed a mismatch effect for both the present perfect and the past simple conditions, unlike the German learners who showed no mismatch effect whatsoever. Therefore, for the German learners, the formal morphological marking on the verb did not affect their processing; that is, for the German learners, both sentence types were treated as merely *past tense*, and so there was no online conflict with the semantics of the temporal adverb, even for those German L2 learners who were able to produce the present perfect in the appropriate contexts, as measured by a cloze task. It seems that the German learners had metalinguistic knowledge that they could draw upon in the offline production task. This suggests that in many cases they were able to distinguish correctly the present perfect from the past (and present) simple but that this knowledge was not accessible during real-time processing.

Given these and Baggio's findings, it would be interesting to see the results of an ERP version of this study. For native English speakers, we would predict a LAN effect for temporal adverb mismatches in the present perfect condition. An interesting test case, however, would be the past simple conditions, where there was no behavioral difference in the reading time study. It is possible that because of the mismatch, the past simple items would elicit a LAN effect. On the other hand, they might induce a modulated SFN if one assumes that it is less costly to force the constraints so that they are satisfiable in this case. For the French L2 learners, a LAN and a SFN might be elicited by both sentence types and, in contrast, by neither type for the Germans. It should be noted here that very few ERP studies of L2 comprehension have in fact found LAN effects, and this has often been taken to suggest that early, automatic (morphosyntactic)

processing is absent in L2 comprehension (Clahsen & Felser, 2006). However, the processing of this type of (semantic) anomaly has not been tested in L2 learners, so it may be that such violations *can* induce this effect in learners, but only for those whose L1 also encodes the relevant distinction (i.e., French vs. German L2 learners). Alternatively, it might be exactly this automatic, feed-forward process that is lacking in L2 processing, irrespective of the type of violation being processed. All of these interesting questions remain to be addressed.

## References

- Bardovi-Harlig, K. (2000). *Tense and aspect in second language acquisition: Form, meaning, and use*. Oxford: Blackwell.
- Clahsen, H., & Felser, C. (2006). Grammatical processing in language learners. *Applied Psycholinguistics*, 27, 3–42.
- Friederici, A. D. (2002). Towards a neural basis of auditory sentence processing. *Trends in Cognitive Sciences*, 6, 78–84.
- Hagoort, P. (2003). How the brain solves the binding problem for language: A neurocomputational model of syntactic processing. *Neuroimage*, 20, S18–S29.
- Klein, W. (1994). *Time in language*. London: Routledge.
- Marinis, T., Roberts, L., Felser, C., & Clahsen, H. (2005). Gaps in second language sentence processing. *Studies in Second Language Acquisition*, 27, 53–78.
- Roberts, L. (2007). Investigating real-time sentence processing in the second language. *Stem-, Spraak- en Taalpathologie*, 15(2), 115–127.
- Roberts, L., Gullberg, M., & Indefrey, P. (2008). On-line pronoun resolution in L2 discourse: L1 influence and general learner effects. *Studies in Second Language Acquisition*, 30, 333–357.
- Roberts, L., & Liszka, S. A. (2008). *The L1 affects the processing of tense/aspect agreement violations on-line in the L2: Evidence from self-paced reading with French and German L2 learners of English*. Unpublished manuscript.
- Starren, M. (2001). *The second time: The acquisition of temporality in Dutch and French as a second language*. Utrecht: LOT.