

Discussion

Unlike previously described cases of selective anomia for people's names and patient LS, VI features an inability to retrieve people's names on face presentation vis-à-vis a normal ability to retrieve the names of the same people on definition. This case appears therefore to be an authentic case of "prosopnomia." Why, however, prosopnomics do not cue themselves? Current models of face and name processing (Semenza, Zettin, & Borgo, 1998; Valentine, Brennen, & Bredart, 1996; Fig. 1) state that semantic information and face information converge into common person identity nodes to activate proper names. To explain prosopnomia, it is tentatively suggested that in prosopnomics information from faces activates person semantics in a way that makes it difficult for the patient to efficiently address the proper names lexicon. Further investigation is needed to clarify this point.

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Consecutive ERP effects of morpho-phonology and morpho-syntax

Karsten Steinhauer and Michael T. Ullman

Departments of Neuroscience and Linguistics, Georgetown University, Washington, DC, USA

Event-related brain potentials (ERPs) have recently been used to elucidate the language impairments underlying aphasia. For example, it has been demonstrated that Broca's and Wernicke's aphasics display a double-dissociation with respect to ERP components that reflect either lexical/semantic processing (N400) or syntactic processing (early left anterior negativity and P600) (Friederici, Hahne, & von Cramon, 1998). However, the nature of ERP components and their underlying cognitive

E-mail addresses: steinhau@giccs.georgetown.edu (K. Steinhauer), michael@giccs.georgetown.edu (M.T. Ullman).

sub-processes are only partially understood. The present study demonstrates, in healthy subjects, that the 300–500 ms time window commonly used to quantify ERP components such as N400s and left anterior negativities (LANs) can reflect a cluster of consecutive effects.

We employed regular and irregular past-tense violations (e.g., “*Yesterday I *sail *eat*”). Processing inflectional morphology involves processing both the morpho-phonological word-form and the abstract morpho-syntactic information (e.g., tense). In past-tense violations, tense is violated equally by regular (**sail; sail-ed*) and irregular (**eat; ate*) verbs, whereas verb-type differences can be predicted at the morpho-phonological level: Irregular past-tense representations must be stored in memory, whereas regular past-tense forms can be composed in real-time on the basis of a rule (verb stem +*-ed*) (Ullman, 2001). Effects of morpho-phonology and morpho-syntax can be expected to occur at different time intervals. In receptive language, morpho-phonological identification of the verb-form should precede its morpho-syntactic integration.

Methods

Twenty-six male and 26 female cognitively unimpaired right-handed undergraduate students read a total of 128 critical sentences (plus 128 filler sentences), presented in a pseudo-randomized order. Half of the critical sentences (conditions 1a and 2a, see below) contained regular verbs and half contained irregular verbs (conditions 1b and 2b), which were either in the (correct) past-tense (1a, 1b) or the (incorrect) stem form (2a, 2b). Subjects judged their acceptability (“Good or bad?”). EEG was recorded from 20 cap-mounted electrodes. ERPs were computed for critical verbs and analyzed in three time windows: 300–400; 400–500; and 600–900 ms.

Condition	Example (target words underlined)
1a Regulars, correct	<i>Yesterday, I <u>sailed</u> Diane’s boat to Boston</i>
1b Irregulars, correct	<i>Yesterday, we <u>ate</u> Peter’s cake in the kitchen</i>
2a Regulars, incorrect	* <i>Yesterday, I <u>sail</u> Diane’s boat to Boston</i>
2b Irregulars, incorrect	* <i>Yesterday, we <u>eat</u> Peter’s cake in the kitchen</i>

Results

An initial analysis using traditional time windows (i.e., 300–500 ms for N400 and LAN effects; 600–900 ms for the P600) replicated previous findings observed for morpho-syntactic violations (e.g., Gunter, Stowe, & Mulder, 1997). It revealed a biphasic pattern (LAN followed by P600) that did not differentiate between regular and irregular verbs. However, a more fine-grained analysis of the 300–500 ms time window contrasting the first and second halves of this time interval indicated that the apparent LAN effect was not a unitary phenomenon.

As illustrated in Fig. 1, past-tense violations were characterized by centro-parietal N400-like negativities in the first time window (300–400 ms; Fig. 1a), whereas the second time window (400–500 ms; Fig. 1b) displayed a typical LAN effect, which was finally followed by a large P600 (Fig. 1c; note the different scaling).

To test the reliability of differences between the first two time windows, these were contrasted in a global ANOVA with factors *Time Window* (2) × *Correctness* (2) × *Hemisphere* (2) × *Laterality* (2) × *Anterior/Posterior* (5) × *Sex* (2). A sig-

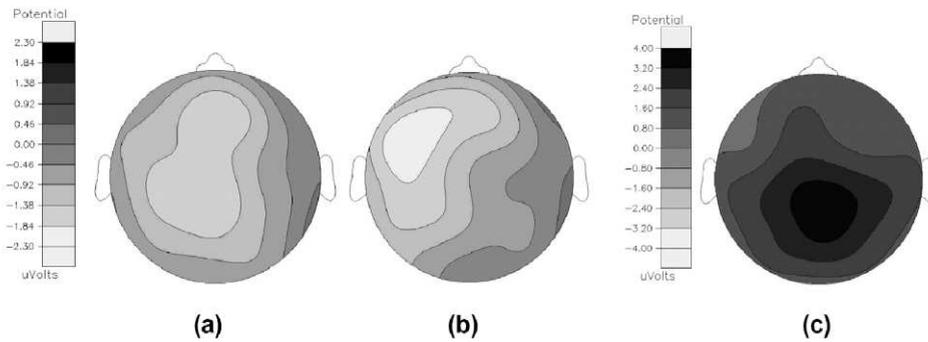


Fig. 1. Voltage maps of the *Correctness* effects (incorrect minus correct) for the three time windows: (a) 300–400 ms, (b) 400–500 ms, and (c) 600–900 ms. Illustrated are Grand Average ERPs across all 52 subjects collapsed over regular and irregular verbs.

nificant *Correctness* main effect indicated that past-tense violations elicited significant negativities in both time windows. However, additional interactions that included both the factor *Time Window* and topographical factors pointed to different scalp distributions of the negativities in the two time windows. Moreover, involvement of the factors *Verb type* and *Sex* indicated that these topographical changes were not evenly distributed across regular and irregular verbs nor across males and females.

The entire set of analyses yielded a picture consistent with the predictions of the declarative/procedural model (Ullman, 2001). This model claims that lexical memory depends on the temporal-lobe-based declarative memory system, whereas aspects of grammar depend on a frontal procedural system, which may be specialized for sequencing. This model was recently specified further on the basis of behavioral and neurological data, suggesting that women (but not men) may store complex forms (walked) in lexical/declarative memory (unpublished data).

In our present study, the early 300–400 ms time window reflected *morpho-phonological* differences between regular and irregular verbs as well as different patterns for male and female subjects. In both sexes, incorrect forms of irregular verbs elicited N400-like negativities, suggesting involvement of lexical/declarative memory. Regular past-tense violations yielded LANs in men, implicating the frontal grammatical/procedural system; in women, they instead yielded N400-like negativities, suggesting that women tend to memorize rather than rule-compute regular past-tenses. *Morpho-syntactic* processing related to the tense violation, by contrast, was likely reflected by subsequent LAN (400–500 ms) and P600 (600–900 ms) components, which were found for both regular and irregular verb violations, in both sexes.

Discussion

The present study demonstrates that fine-grained temporal ERP analyses can distinguish cognitive sub-processes such as consecutive morpho-phonological and morpho-syntactic processing. As Broca's aphasics have been shown to be selectively impaired at both syntactic and phonological sequencing (e.g., Goschke, Friederici, Kotz, & van Kampen, 2001), our findings may help to determine the nature and time-course of such processing deficits.

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Context use as the source of right-hemisphere-damaged individuals' impairment in lexical ambiguity resolution

Christopher M. Grindrod* and Shari R. Baum

School of Communication Sciences and Disorders, McGill University, 1266 Pine Avenue West Montreal, Quebec, Canada H3G 1A8

Right-hemisphere-damaged (RHD) individuals frequently present with deficits in the processing of lexical-semantic and discourse-level phenomena (e.g., idioms, metaphors; for a review see Joannette, Goulet, & Hannequin, 1990). To account for these diverse impairments, early proposals appealed to RHD individuals' inability to use context to understand words or phrases with multiple interpretations as a potential source of the deficit. However, more recent research has provided evidence that RHD individuals are able to use context, at least at the level of a single sentence (Leonard & Baum, 1998; Leonard, Waters, & Caplan, 1997). Moreover, research on the processing of lexically ambiguous words has suggested that RHD individuals' deficit may not be related to their use of context at all (Fassbinder & Tompkins, 2001; Tompkins, Baumgaertner, Lehman, & Fassbinder, 2000). Instead, it has been proposed that RHD individuals have an impaired suppression mechanism, rendering them unable to suppress inappropriate meanings.

In an attempt to shed further light on the extent of RHD individuals' deficit in ambiguity resolution, the present study examined the processing of ambiguous words in three sentence contexts (unbiased, first- and second-meaning biased) at both a short and long interstimulus interval (ISI). In biased contexts, control subjects were expected to show only facilitation of contextually appropriate meanings at both ISIs, whereas in unbiased contexts, they were expected to show facilitation of both

* Corresponding author. Fax: +514-398-8123.

E-mail address: christopher.grindrod@mail.mcgill.ca (C.M. Grindrod).