



On the processing of regular and irregular forms of verbs and nouns: evidence from neuropsychology

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Abstract

Following acquired brain damage, a native English speaking patient (AW) encountered problems accessing phonology in speech production, while her ability to access word meaning appeared to be intact. In a series of tasks, AW was presented either with a verb, and was asked to produce its past tense or past participle (*walk* → “walked”), or with a noun, and was asked to produce its plural (*glove* → “gloves”). A stark dissociation was found: while AW responded accurately with regular forms of verbs (*walked*) and nouns (*gloves*), performance was significantly less accurate with irregular forms (*found*; *children*). The appearance of a selective deficit for irregular forms in conditions of impaired lexical access is in line with dual-mechanism accounts, which proposes that irregular forms are specified in the lexicon whereas regular forms are computed via rule-based mechanisms. In contrast, AW’s data are problematic for connectionist accounts that do not posit separate mechanisms for processing regular and irregular forms, including the connectionist model recently proposed by Joanisse and Seidenberg (*Proceedings of the National Academy of Sciences USA* 96 (1999) 7592) which successfully simulated a variety of earlier neuropsychological findings. Analyses of AW’s responses shed light on further details of the representation and processing of regular and irregular inflected forms. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

In many languages, speakers modify the meaning of a word by changing the suffix appended to the end of the word. In English, for example, information about number (plural/singular) is conveyed by the presence/absence of the suffix -s at the end of nouns, and the suffixes -s, -ing, and -ed at the end of verbs express when the action or state described by the verbs takes place. Suffixation is an extremely productive process

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that speakers extend to recently introduced words like *fax* (*faxes*) and *e-mail* (*e-mailed*). But there are exceptions. English provides illustrative cases of such exceptions: a few plural nouns are not produced by adding the suffix *-s* (*teeth, women, fish*) and a good number of verbs take a past tense form that does not contain the suffix *-ed* (*ran, sat, went*). The occurrence of these irregular forms raises interesting questions about the process of word formation: are the mechanisms for word formation the same for regular and irregular words? If the mechanisms are not the same, how do they differ? Not only do the answers to these questions elucidate the organization of word formation processing (morphology) but they also have important implications for our understanding of the structure and functioning of the mental dictionary (the lexicon).

For the past 20 years, the debate about regular and irregular form processing has focused on English past tense inflection, which has become a crucial test case for theories of word formation. A view that has found wide support in linguistics and psycholinguistics is the dual-mechanism account, which holds that different mechanisms are at play with regularly inflected verbs (*walk–walked, argue–argued*) and irregularly inflected verbs (*run–ran, sit–sat*) (Bauer, 1983; Marslen-Wilson & Tyler, 1997; Pinker, 1991; Ullman, 2001). For regular past tenses, rule-based mechanisms add the suffix *-ed* to the verb stem (*walk + ed → walked*).¹ Irregular past tenses are not obtained via rule-based mechanisms, but are stored in the lexicon; consequently, to produce these irregular forms speakers have to access the lexicon. Because the process for producing regular and irregular past tenses follows different principles, it is likely that different areas in the brain support the processing of these verbs (on this point see e.g. Marslen-Wilson & Tyler, 1998).

A contrasting view holds that regular and irregular past tenses are computed by a single mechanism. This view was implemented in a number of connectionist simulations (e.g. MacWhinney & Leinbach, 1991; Marchman, 1993; Plunkett & Marchman, 1993; Rumelhart & McClelland, 1986). These simulations operate on the basis of associative mechanisms established through learning which link input nodes specifying the phonology of a verb stem (e.g. *walk*) to output units specifying the phonology of the verb's past tense (e.g. *walked*). The theoretical import of these simulations is twofold: they demonstrate that it is not necessary to postulate different mechanisms for regular and irregular past tenses, nor is it necessary to postulate rule-based mechanisms for the formation of regular past tenses.

In support of either of these views, researchers have cited various sorts of data: results from reaction time experiments, computer simulations, normal and abnormal language acquisition, and historical linguistics (for a review, see Clahsen, 1999; Marcus, 2000; Pinker, 1999; Ullman, 2001). Recently, in an attempt to gather data that may resolve the current debate as well as shed light on the brain mechanisms underlying word processing, researchers have turned their attention to brain-damaged patients with acquired language disorders. Ullman et al. (1997) tested patients with language impairments due to different pathologies in a past tense generation task. Patients were presented with a sentence like “Every day I dig a hole. Just like every day, yesterday I ____ a hole” and asked to complete the sentence by providing the past tense form of the verb, “dug” in this example. Discrepancies were observed in patients’ abilities to produce regular vs. irregular

¹ In English, the *-ed* suffix is realized differently across words – e.g. /d/ in *bored* and /t/ in *baked*. Additional assumptions have to be made to account for such variations. I return to this issue in Section 5.

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