

Morphological Complexity in Aphasia: An Overview

Marija Brašić², University of Nova Gorica

Abstract: Morphologically complex words, compounds and affixed forms, pose unique challenges for lexical representation and processing. Experimental research demonstrates that complex words are accessed through interacting mechanisms of decomposition and holistic retrieval, with processing modulated by factors such as headedness, semantic transparency, and lexical frequency. Studies in clinical populations reveal characteristic errors—omissions, substitutions, misorderings, neologisms, and circumlocutions—that reflect disruptions at semantic, lemma, and phonological levels. Evidence from compound and affix processing confirms that morphological knowledge is flexibly organised in the mental lexicon, with constituent structure influencing both production and comprehension. These findings integrate theoretical accounts, including full-listing, decomposition, and dual-route, and provide important insights for clinical assessment and intervention in language impairments.

Keywords: compounds, affixed words, mental lexicon, neurodegenerative and acquired language impairments, aphasia, morphological processing

1. Introduction: Properties of Compounds and Affixed Words

Morphologically complex words result from word-formation processes that combine two or more lexical items into a single form. Compounds involve nouns, verbs, adjectives, or prepositions and show cross-linguistic variation in structural relations between constituents, including coordinate, subordinate, and attributive types (e.g. Lorenz, Heide and Burchert 2014; Kordouli et al. 2018). Across languages, compounds may be formed through stem-stem or stem-word combinations, word-based constructions, or fixed templates, and may include linking elements, hyphenation, or function words. Such variation has been documented in languages including but not limited to English (e.g. Libben 1998), German (e.g. Lorenz et al. 2014), Greek (e.g. Kordouli et al. 2018), and Italian (e.g. Semenza, Luzzatti and Carabelli 1997), which differ in morphological flexibility and head position.

Complex words are also formed through derivation (e.g. *uplight*, *lighter*) and inflection (e.g. *lights*), whereby prefixes and suffixes attach to a base. These affixed forms are represented, stored, and retrieved during production and comprehension, interacting with the same lexical and morphological mechanisms involved in compound processing (e.g. Ciaccio, Burchert and Semenza 2020).

The constituent relations are central to interpretation. One component functions as the head, determining grammatical category and inflection, while the other serves as a modifier restricting the head's meaning (e.g. the compound *moonlight*, where *light* is the head and *moon* the modifier; Marelli et al. 2014). A distinction is drawn between grammatical heads, which govern syntactic properties, and logical heads, which reflect semantic relations (Schapansky 2012). Compounds are endocentric when these coincide and exocentric when they diverge.

² ORCID: <https://orcid.org/0009-0005-8747-5141>, email: marija.brasic@gmail.com.

Research on complex-word processing provides key insights into the organisation of the mental lexicon and lexical retrieval. Experimental studies show that such processing recruits morphological, semantic, and syntactic knowledge, with different structures accessed via distinct routes. Evidence from clinical populations further indicates selective vulnerability of compound and affixal morphology: speakers with acquired or neurodegenerative aphasia exhibit characteristic errors in compounding, prefixation, and suffixation. These findings inform debates on whether complex words are stored as whole forms, decomposed into morphemes, or accessed via dual-route mechanisms.

This review surveys selected recent behavioural studies on complex words, focusing on well-attested Indo-European languages above chosen for their typological diversity and robust empirical base. Section 2 discusses storage and representational models, Section 3 examines morphological knowledge and its impairment in compounds, and Section 4 addresses the processing of affixed words. Section 5 concludes.

2. Morphological Complexity in the Mental Lexicon

Experimental studies of complex word processing are commonly framed within three major approaches to lexical representation: full-listing, decomposition or full parsing, and dual-route. These approaches make distinct predictions about how compounds and affixed forms are represented in the mental lexicon and accessed during production and comprehension.

Full-listing proposals assume that complex words are stored and retrieved as unanalysed whole forms, similarly to mono-morphemic words. Although economical in terms of storage, the accounts do not predict sensitivity to internal morphological structure and therefore fail to explain *the compound effect*, namely systematic processing differences between simple and complex words (Chiarelli, Menichelli and Semenza 2007; Semenza and Mondini 2010, a.o.). They also cannot readily account for error patterns reflecting access to individual constituents rather than whole words.

In contrast, decomposition or full-parsing approaches posit that complex words are obligatorily analysed into their constituent morphemes during lexical access. Structural and rule-based knowledge is therefore central to word retrieval, independently of phonological form. Support for this view comes from experimental evidence showing constituent-based errors in compound production. For instance, Mondini et al. (2004), using visual naming tasks, reported omissions, substitutions, and misorderings of compound constituents in aphasia, indicating access to internal morphological structure during production.

The dual-route model integrates the two approaches, proposing that complex words can be processed either holistically or compositionally, depending on factors such as lexical frequency, semantic transparency, and morphological structure. Strong evidence for this account comes from studies of compound processing in aphasic populations. Marelli et al. (2014) and Lorenz et al. (2014) examined compound production and comprehension using picture-naming, naming-to-definition, lexical decision, and priming tasks across visual and auditory modalities. Their findings confirm previous studies and indicate that headedness is a primary determinant of compound representation, modulated by semantic transparency and frequency: transparent and frequent compounds tend to engage decompositional processing, whereas opaque or highly lexicalized compounds are more often accessed as whole forms.

Error patterns further support a multi-stage model of lexical access (Levelt, Roelofs and Meyer 1999), comprising a semantic-conceptual level, a lemma level specifying grammatical properties, and a phonological level. Errors such as omissions, substitutions, phonological paraphasias, neologisms, and circumlocutions observed in compound naming and lexical decision tasks reflect disruptions at different processing stages (Lorenz et al. 2014 and the works they cite). Constituent-specific errors point to lemma-level access, while neologisms and circumlocutions indicate conceptual-level impairment (Marelli et al. 2014). Crucially, the absence of constituent substitution errors for simple word targets supports the claim that morphological structure is detected during lexical retrieval of compounds (Mondini et al. 2004; Lorenz et al. 2014).

2.1. Headedness

Marelli et al. (2014) investigated the processing of head-initial and head-final compounds in Italian, where head-final compounds are more frequent and considered as default in the language (Williams 1981 for English). Their study of aphasic speakers revealed systematic asymmetries linked to head position. Head-final compounds showed evidence of hierarchical, compositional processing, whereas head-initial compounds behaved more like lexicalized units accessed holistically, consistent with dual-route accounts (Semenza and Mondini 2010; Semenza et al. 1997).

Error analyses showed more frequent omission of the first constituent in head-initial compounds, while substitution of the first constituent was more common in head-final compounds. Across aphasic profiles, modifier retrieval was more impaired than head retrieval. Head-final compounds also elicited higher rates of whole-word substitutions, circumlocutions, and neologisms. The findings indicate that in Italian, as previously proposed for English, head is the most salient element in compound processing, accessed compositionally in head-final structures and stored as part of a single lexical entry in head-initial compounds.

2.2. Semantic Transparency and Grammatical Class of Constituents

Semantic transparency also plays a role in compound processing. While grammatical class is specified at the lemma level, transparency and opacity engage different representational mechanisms. Lorenz et al. (2014) reported more constituent errors in transparent than in opaque compounds, suggesting compositional access and activation of semantically related concepts at the conceptual level.

By contrast, opaque compounds elicited more semantic errors, consistent with reliance on whole-form access. This pattern aligns with Libben's (1998) proposal that semantic links between whole forms and constituents are maintained only in transparent compounds, whereas opaque compounds are processed as unanalysed lexical units.

3. Impairments in Morphological Knowledge

Behavioural data from task-based studies in aphasic populations further supports dual-route accounts of compound processing in acquired and neurodegenerative conditions. Acquired impairments include stroke-induced agrammatism, while neurological conditions such as primary progressive aphasia (PPA), in contrast to Alzheimer's disease, reveal selective deficits in morphological processing (Chiarelli et al. 2007; Zamarian et al. 2007, a.o.).

Three variants of PPA reflect linguistic deficits affected by neurological deterioration (Mesulam 2013): (i) agrammatic PPA, marked by impaired morphological and syntactic knowledge, non-fluent speech, in both production and comprehension, (ii) semantic PPA, characterised by fluent speech but severe loss of semantic knowledge, including anomia and object recognition deficits, (iii) logopenic PPA, associated with phonological impairments in word retrieval, often manifesting as circumlocutions and phonemic paraphasias.

Alzheimer's disease, unlike PPA or classical Broca's, Wernicke's, Anomic aphasia, is primarily characterised by memory limitations and semantic deficits, with relatively preserved syntactic abilities (e.g. Chiarelli et al. 2007). In this population, compound naming errors involve substitution of compounds with simple words, a pattern known as *the no-compound effect* (Chiarelli et al. 2007; Semenza et al. 1997; Semenza and Mondini 2010), reflecting impaired morphological knowledge.

In a recent study with cross-linguistic evidence from Greek, Kordouli et al. (2018) attempted to compare stroke-induced and neurodegenerative agrammatism in compound production. Picture-naming and production-by-definition tasks revealed morphological impairments in both groups, consistent with Chiarelli et al. (2007); Mondini et al. (2004).

Limited sample size findings in Kordouli et al. (2018) align with decompositional and dual-route accounts. Constituent-level errors (omissions, substitutions, misorderings) support compositional representations and structural knowledge, whereas whole-word errors (neologisms, circumlocutions) indicate semantic-level disruption. Sensitivity to morphological violations, however, was severely impaired in advanced PPA but largely preserved in stroke-induced agrammatism, particularly retrieving verbal constituents (see Lorenz et al. 2014). This suggests morphological deficits progress over time and reliance on decompositional versus holistic processing depends on the nature and stage of the condition. Overall, evidence from acquired and neurodegenerative aphasia converges with earlier findings, reinforcing the view that lexical access to compounds involves both constituent-based and whole-word routes, differentially affected across clinical conditions. Methodological limitations highlight the need for future behavioural studies that can complement neuroimaging data. For an extended discussion, see Kordouli et al. (2018) and works cited therein.

4. Processing of Affixed Words

Morphological impairments in derivation and inflection typically manifest as morpheme substitutions, omissions, or semantic paraphasias affecting either the stem or the affix. Such error patterns provide strong evidence for decompositional representations, rather than access to unanalysed whole forms. Ciaccio et al. (2020) recently examined derivational prefixation and suffixation in German-speaking individuals with acquired agrammatism using a reading-aloud task. Building on earlier psycholinguistic findings and Williams' (1981) English-specific proposal—intended to capture more general properties—that prefixes tend to modify meaning, whereas suffixes are also productive in grammatical category formation (see Greenberg 1990: ch. 5, §4 for universal tendencies; cf. Lieber 2004 and Haspelmath 2010 for language-specific preference accounts), the authors hypothesised differential processing of prefixes and suffixes in German. Accordingly, they were predicted to be differently impaired in terms of higher error rates for prefixed than for suffixed words.

Stimuli were controlled for semantic transparency, imageability, lexical frequency, word length, and neighbourhood size. Errors were classified as affix-specific when the stem was preserved but the affix

was omitted, substituted, or replaced by a neologism. Results showed significantly more errors for prefixed than for suffixed words, with prefix errors most frequently involving omissions. Stem length also modulated performance, as affix errors increased with longer stems, indicating higher processing demands for more complex forms. Additional effects of imageability, word-form frequency, lemma frequency, and session were observed: error rates increased with higher lemma frequency but decreased with greater imageability and higher word-form frequency.

The higher processing cost for prefixes was interpreted as difficulty in accessing the stem in prefixed words where the stem occurs in word-final position, compared to suffixed words where the stem is followed by a suffix. Overall, the findings support a decompositional account in which stems and affixes are accessed as constituents, while prefix-stem sequencing places greater demands on cognitive resources during retrieval. Open questions remain concerning the interaction between prefixation and headedness, and the specific production stage at which these asymmetries arise.

In sum, these results extend decompositional and dual-route models to derivation, showing that morphological impairments differently affect prefixes and suffixes, and that affix position, stem length, and lexical-semantic factors modulate production costs.

5. Conclusion

The findings of the studies included in this overview suggest that complex words are processed through both decomposition and holistic routes, with retrieval affected by headedness, semantic transparency, affix type, and stem length. Clinical populations reveal characteristic errors—omissions, substitutions, misorderings, neologisms—highlighting disruptions at semantic, lemma, and phonological levels, with verbal compounds and prefixed words particularly sensitive to impairment. Despite the limited scope of the reviewed studies, the results are consistent with, and extend, previous research. These findings provide critical insights into the organisation of the mental lexicon, how complex words are accessed in both healthy and impaired language, and confirm that complex words are not only uniformly stored or accessed, but processed flexibly depending on structural, semantic, and lexical factors.

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Author Biography

Marija Brašić is a doctoral candidate at the Graduate School and the Centre for Cognitive Science of Language, University of Nova Gorica (Slovenia). Her research interests include psycholinguistics, neurolinguistics, and computational approaches, with a particular focus on experimental morphosyntax and modelling grammatical knowledge. Her doctoral dissertation examines grammatical gender and number agreement processing under coordination. For her work on gender agreement mismatches in coordination, she was shortlisted for the Charles Townsend Award at the 2022 Slavic Linguistics Society conference.