Impairments in Verb Retrieval in Aphasia: a Lexical-Syntactic Model

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Introduction

Theories of production deficits in types of aphasia are usually stated either in terms of lexical-retrieval, or in terms of syntax and sentence building. However, these two processes must be interdependent. We examine an area of language that heavily relies on this interdependency – the retrieval of morphologically-complex verbs. We focus on a phenomenon that involves lexical retrieval, lexical-syntactic information, and syntactic structure: alternating-verbs (e.g., "closed" in 'Daniel closed the door' and 'the door closed'). Whereas in English alternating verbs usually sound the same ("close"), in Hebrew they usually share a consonantal root but differ in their verbal pattern (there are 5 verbal-patterns in Hebrew) each with a separate argument structure. For example, the alternating-verbs *sagar* and *nisgar* ('closed$_{Transitive}$' and 'closed$_{Intransitive}$' respectively) share the root SGR, related to closing, but have different verbal patterns and argument structures. *sagar* is used in sentences with two arguments (*'Daniel closed the door'*), whereas *nisgar* is used in sentences with one argument (*'The door closed'*).

How are alternating verbs retrieved and inserted into the correct pattern and into a sentence with their arguments in the right syntactic positions? Which patterns of impairment in aphasia can be identified in retrieving and producing such verbs?

Methods

We designed a battery of seven tasks assessing the production of alternating verbs, presented in Table 1. We then tested 34 Hebrew-speaking individuals with various types of aphasia or developmental language-impairments, whose functional locus of impairment we diagnosed independently of verb-morphology, and compared their performance to each other and to control groups of non-impaired individuals. Finally, we inferred the function of each cognitive component in the production of morphologically-complex words based on patients' error pattern.

Results

We report five error patterns corresponding to five different functional loci of impairment in the proposed model. Based on this, we propose a lexical-retrieval model that considers morphology and other sentence-level considerations, elaborating on the role of each component in the production of morphologically-complex verbs in Hebrew.

Our model (Figure 1) suggests that the conceptual stage includes the action and the participants, the semantic lexicon retrieves the abstract verb, the syntactic lexicon (Brian & Friedmann, 2012) selects the correct alternant with the relevant arguments according to the selected participants. The selected abstract verb is inserted in the syntactic tree, according to its selected argument structure. Then, the phonological lexicon selects a matching

phonological form, and the phonological buffer, which stores preassembled morphemes (Dotan & Friedmann, 2015), adds the phonological structure of the morphological pattern.

The patients who were impaired in the different stages of the model and their error patterns are presented in *Figure 1*. We show that impairments in early stages of retrieval – the conceptual-system, the semantic-lexicon, and the syntactic-lexicon, cause (beyond other well-attested errors) verb-pattern substitutions only between verbs that are systematically related (alternating-verbs). When the deficit is in the syntactic-lexicon, the selected verb may also violate argument-structure-restrictions. Impairments in the phonological-output-lexicon cause substitutions with verbs sharing the root but not only alternating ones, but also verbs with no systematic alternation-relation (*cava*-'paint'↔*hicbi'a*-'vote'). Phonological-output-buffer deficits cause verb-pattern errors as well as tense and agreement errors.
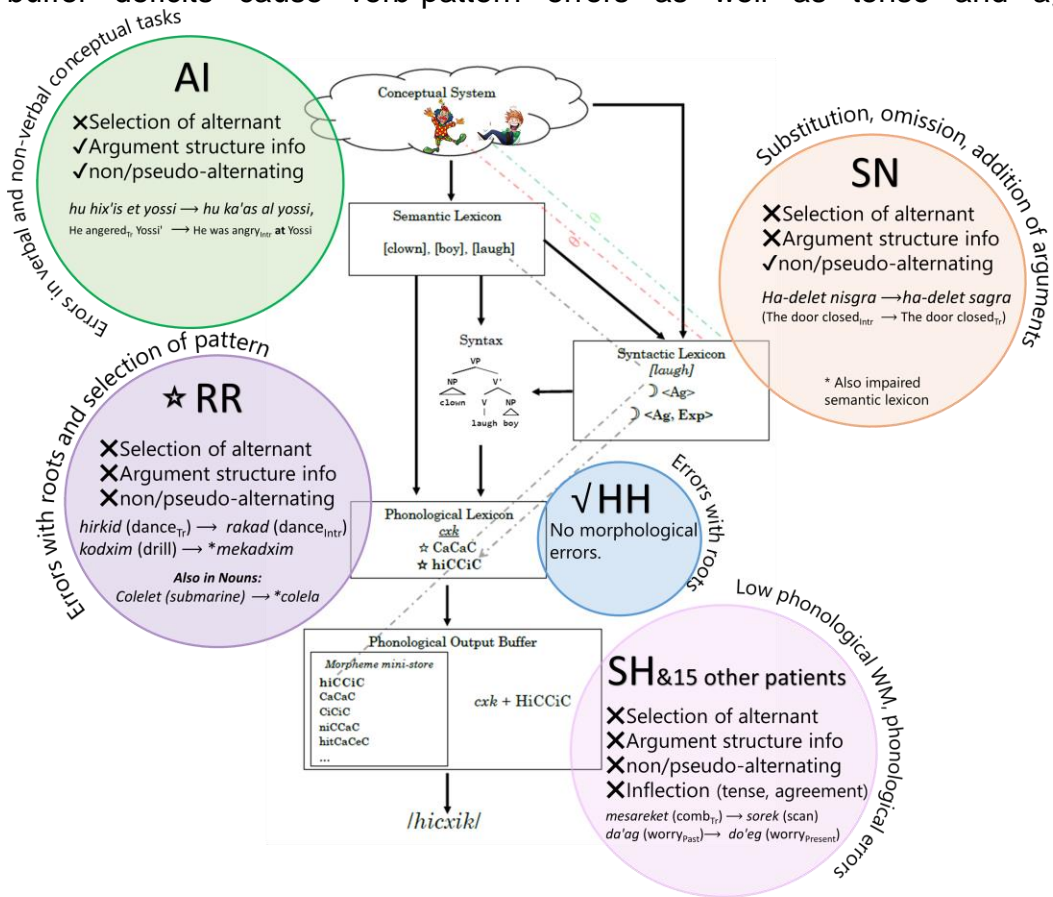

Figure 1. A model for lexical retrieval of morphologically complex verbs in Hebrew with patients' initials, their functional locus of impairment, and their error pattern in alternating-verbs and verb morphology.

Conclusions
Modeling sentence-building and lexical-retrieval as a unified process is not only conceptually desirable, but also useful for describing types of aphasia. Our results show that there is not one but many morphological impairments, and that production errors that may seem similar on the surface may stem from different underlying impairments in functional components that

are usually not considered as involved in morphological processes. This has clinical implications for diagnosis and treatment.

Table 1. Tasks in the test battery for morphologically complex alternating verb retrieval.

Task		# of items
Sentence completion – various verb types	The experimenter reads a sentence with an alternating verb in one of four alternations, and a missing word. The target is the other alternant.	48
Sentence completion – various verb patterns	The experimenter reads a periphrastic causative or reflexive sentence, and the participant produces the corresponding verb. This test includes all possible pattern combinations for alternating verbs.	49
Sentence completion – inflection manipulation	The experimenter reads a sentence with an infinitive verb, and the participant produces a finite verb inflected for tense and agreement.	56
Sentence completion – multiple choice	The experimenter reads a sentence with a missing word, and the participant chooses one of four possible responses. The target is an alternating/non-alternating verb, and the distractors are morphologically similar.	54
Sentence production to a given verb	The experimenter says a morphologically complex alternating/non-alternating verb, and the participant produces a sentence with the verb.	16
Picture description	The experimenter shows a picture depicting a morphologically complex verb, and asks about one of the characters in the picture. The participant responds with a morphologically complex alternating/non-alternating verbs.	14
Verb and noun reading aloud	The participant reads a list of morphologically complex verbs that are homographic to definite nouns.	39

References

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