Verbal Morphology in Aphasia and Developmental Language Impairments: Theoretical Implications

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1. Introduction

As the study of morphology and its interfaces is becoming more central in the investigation of the architecture of language, many of theories attempt to capture facts about morphology, differing in where they assume morphology is and in what it does. A way of bounding the possible set of theories is to consider data from the set of observed language impairments.

In this study we examine the production of verbal morphology by Hebrew speaking individuals with language impairments by using linguistically-informed stimuli, in order to infer about the theoretical mechanisms responsible for verbal morphology. We focus on the distinction between alternating and non-alternating verbs as a theoretically relevant contrast.

Two verbs are defined as alternating if they have a systematic relation with respect to their argument structure and meaning. The two instances of the English verb 'close' in (1a-b) demonstrate an alternation: in the two cases the basic meaning is similar (it refers to a breaking event), and the two instances of the verb have a systematic relation in argument structure: in (1a) there is only one argument, which is, descriptively speaking, the THEME ('window') of the event, whereas in (1b) there are two arguments, a THEME ('window') and a CAUSE or an AGENT ('John').

(1) a. The window closed.
b. John closed the window.

We tested two groups of alternations: the causative alternations, which are sometimes further divided into the transitive-unaccusative alternation ('break'), the causative alternation ('march'), and the experiencer alternation ('worry'), and the reflexive alternation ('shave'). In English, alternants are usually homophonous, e.g., there is no phonological or morphological difference between the transitive and intransitive form of 'break' in (1). This is not the case in all languages. Many languages have ways of marking one alternant or both, which results in a morphological contrast between the alternants. Hebrew is such language. The Hebrew sentences corresponding to (1) are in (2) below:

(2) a. *ha-xalon* ***nisgar***
The-window closed$_{\text{-INTR(ansitive)}}$
'The window closed'
b. *Dan* ***sagar*** *et* *ha-xalon*
Dan closed$_{\text{-TR(ansitive)}}$ ACC the-window
'Dan closed the window'

In what follows we provide a basic description of the relevant facts of Hebrew morphology. Hebrew, as a Semitic language, has non-concatenative morphology. Most inflectional and derivational morphemes are not linearly stringed to the root, but discontinuously modify it. The Semitic root is understood in classical grammars as an ordered set of three (and sometimes more) consonants, which has a phonological realization only when modified by a pattern. A verbal pattern is called *binyan*, and a nominal one is called

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mishkal. In addition to that, verbs, nouns, and adjectives are also marked for inflection (number and gender for nouns and adjectives; number, gender, and person for verbs), which can also be realized discontinuously. Although the theoretical status of roots and patterns in Semitic languages is debated (Bat-El, 1994 and following work), we do not take sides in this debate, but informally use the classical system for the sake of clarity. Roots will be represented as strings of three consonants. Patterns will be represented as the patterns' fixed consonants and vowels within which the root consonants (C) are incorporated. The verbal domain consists of 5 patterns: CaCaC (sometimes termed *kal*), CiCeC, niCCaC, hitCaCeC and hiCCiC.

There are two additional passive patterns which are traditionally considered *binyanim*, CuCaC and huCCaC. However, we will not discuss them in this context, since, unlike the other patterns, their form and distribution are almost completely predictable and productive: CuCaC is the passive form of verbs in CiCeC, and huCCaC is the passive form of verbs in hiCCiC. In this sense, passive formation in CuCaC and huCCaC resembles inflection: the output form is almost always dependent on the active pattern (which is, at least to some extent, idiosyncratic), but given a pattern it is regular and predictable.

Going back to verbal alternations, alternants share the same root, but usually have a different pattern. In (2a), *nisgar* (close$_{\text{-INTR}}$) and *sagar* (close$_{\text{-TR}}$) share a root (SGR), but *nisgar* is in the niCCaC pattern, whereas *sagar* is in the CaCaC pattern. All verbs in Hebrew, not only alternating verbs, appear in a morphological pattern. This morphological marking often marks derivationally-related words, like alternating verbs, in a somewhat predictable and compositional way. However, in some other cases verbs are marked idiosyncratically to some extent, and the morphological marking of verbs that share a root may not have a strong relation in meaning, grammatical properties, or their location in a derivational paradigm. For example, *šilem* ('pay'), *hišlim* ('complete') share root consonants, and, like all Hebrew verbs, are marked with a morphological pattern (CaCaC and hiCCiC respectively). However, there does not seem to be an inherent reason that 'pay' is in CaCaC and 'complete' is in hiCCiC and not the other way around. The pattern does not seem to contribute to the meaning, nor do the two verbs seem to be derivationally related. We call pairs of verbs that share a root but are not derivationally related "pseudo-alternating verbs". In some cases, it is clearer that two pseudo-alternating verbs have something shared in their meaning, even if it is not predictable. For example, the intuition is that *hištalem* (be worthwhile, pay off) is somehow related in meaning to *šilem* (pay), as can also be seen by the similarity of the verbs in the English gloss. This shared meaning is difficult to formulate, and is not easily predictable (it is not the case that to pay is to make something worthwhile, for example).

2. Methods

We tested 34 Hebrew-speaking patients with various acquired or developmental language impairments. We first identified the functional locus of impairment of each of these participants using a wide battery of tests. In the next step we administered to the participants a test battery assessing the production of alternating verbs, as well as additional aspects of verbal morphology.

2.1. Participants

Fourteen patients had acquired aphasia, loss of language abilities due to neurological damage (following stroke or traumatic brain injury), seven patients had language loss due to Parkinson's disease, seven were adolescents who had thiamine deficiency during infancy, three were orally-trained children with a hearing impairment, and three were children with a developmental language disorder (SLI/DLD). Each participant's functional locus of impairment was determined by a series of tasks. In addition to these 34 patients, we examined production data from patient SN who was part of the study of Biran and Friedmann (2012). The control group for each task consists of Hebrew speakers who were recruited through Tel-Aviv University Facebook groups, and were each paid 15 NIS for a 10–15-minute testing session. Each patient was first tested with a variety of other tasks in order to determine their exact functional loci of impairment in the lexical process, and then tested with the current battery.

2.2. Materials - Assessment of verbal morphology

The battery consists of seven tasks designed to elicit the production of verbs: sentence completion with various verb types (48 items), sentence completion with various morphological patterns (49 items), sentence production to a given verb (56 items), multiple choice sentence completion (54 items), sentence completion with tense and agreement manipulation (16 items), picture description (14 items) and verb and noun reading (39 items). The tasks included transitive and intransitive alternants in causative and reflexive alternations in all possible *binyanim*, as well as pseudo-alternating verbs, and non-alternating verbs. Some of the tasks also required the participants to manipulate the tense and agreement of the stimulus verb while producing the target verb, in addition to a designated task designated for tense and agreement. Because of the unpredictable nature of work in the clinic, not all participants were able to participate in every task, or to complete all items in each task. Patient SN was not tested with this test battery, but was tested with the PASTA battery for argument structure (Biran & Friedmann, 2012). Relevant stimuli (alternating and non-alternating verbs) were inspected, and his performance was compared to control data from the PASTA battery.

2.3. The diagnosis of the impaired component in the lexical retrieval process

Below we report five patterns of morphological impairment corresponding to five different loci of impairment in the lexical retrieval process. We will now describe the cognitive function of the components in the lexical retrieval process, the way impairment in each of these components is manifested (in simple nouns and nonwords), and the criteria according to which we diagnosed each of these impairments:

A. The conceptual system: During the first stage of lexical retrieval, a conceptual representation is formed. The existence and the content of such representation is debated in cognitive science and philosophy. It may include relevant properties, a visual image, relevant memories and associations, or other representations that are sufficient in order to activate a linguistic representation. Crucially, the conceptual system is a pre-lexical component, conceptual representations are not linguistic, and accordingly a conceptual impairment affects not only language, but also cognitive, non-linguistic abilities, affecting the impaired individual's understanding and conveying of non-linguistic messages. An impairment in the conceptual system was diagnosed in this study when the participant had meaning-related errors in linguistic tasks in production and comprehension (e.g., picture naming, word definition, word-to-picture matching), as well as in non-linguistic tasks (such as "odd one out" tasks with pictures).

B. The syntactic lexicon: The syntactic lexicon stores information relevant to the incorporation of words into narrow syntax, such as grammatical gender of nouns, and selectional properties. Biran and Friedmann (2012) showed that impairments in knowledge of selectional properties of verbs (i.e., their argument structure) does not necessarily co-occur with impairments in phonological abilities and lexical-semantic abilities, and that impairments in core syntactic abilities (subordination and movement) can occur without any deficit in the syntactic lexicon. See also Shapiro et al. (1989) who discovered that patients with a syntactic deficit ("Broca's aphasia") may still show normal sensitivity to verb's argument structure. An impairment in the syntactic lexicon was diagnosed in this study based on Biran and Friedmann (2012), when the participant made argument structure errors, such as adding and omitting arguments or adding, omitting, or substituting prepositions.

C. The phonological output lexicon: The phonological output lexicon stores the phonological representation of lexical items, including metrical structure and segmental information. Friedmann and Coltheart (2017) showed that entries in the phonological lexicon consist of stems and idiosyncratic information about possible affixes. An impairment in the phonological output lexicon was diagnosed in this study based on naming tasks when the patient had phonological errors, hesitations, and avoidances such as "don't know" responses, using a definition instead of the target word, and using a related word. We also used reading aloud tasks, as an impairment in the phonological output lexicon entails inability to read via the lexical route, and hence, difficulty in reading aloud (Gvion & Friedmann, 2016). Comprehension of words (and pictures) was intact, and reading and repetition of nonwords was intact).

D. The phonological output buffer: The phonological output buffer is a short-term memory component that assembles phonological strings from basic units and maintains the phonological information until it is fully articulated. An impairment in the phonological output buffer (which is sometimes referred to as "conduction aphasia" when it is an acquired impairment) causes phonological errors such as phonological omission and substitution, epenthesis and metathesis (Caramazza et al., 1981; Shallice et al., 2000). Dotan and Friedmann (2015) showed that patients with a phonological output buffer deficit also make whole-unit errors and morphological errors given specific stimuli. For example, whereas for phonemes of the stem individuals with phonological output buffer impairment produce omissions, substitutions, and additions of phonemes, in multi-digit number reading and repetition, they make number-word substitutions (e.g., seven → four), and in morphologically complex words, they make morphological errors (omissions and substitutions of whole morphemes). These findings about the selectivity of errors for different stimuli led the authors to stipulate that there are several mini-stores in the phonological output buffer that store pre- assembled building-blocks beyond the single phoneme level such as a morpheme mini-store, and a number-word mini-store. While assembling the output based on the instructions from the phonological output lexicon, the phonological output buffer uses different kinds of building blocks. An impairment in the phonological output buffer was diagnosed in this study when patients had low performance in non- word repetition, non-word reading, sentence repetition, and phonological span tasks, without difficulty in comprehension and without semantic errors in the production of simple words.

3. Results

3.1. Five patterns of morphological impairment

We have examined patients with impairments focused in each of the components of the lexical retrieval process, identified according to their performance in the processing of simple nouns and nonwords, and independently of their processing of verbs. When we examined their performance with verbs using the test battery described above, we found that a deficit in each of these components results in a different pattern of impairment in verb morphology.

Pattern (1) – a deficit in the conceptual system: Patient AI, a 69-year-old man who sustained a stroke that involved his left temporo-occipital lobe showed an impairment in **the conceptual system**, where only an abstract representation of lexical items is present, which causes him difficulties in language tasks as well as in tasks that do not require language, including difficulty understanding "who did what to whom" in simple sentences. The most important observation regarding his production of alternating verbs is that he made morphological (pattern) substitutions, only between alternating verbs (e.g., *sagar*–'closed$_{-TR}$' ↔ *nisgar*-'closed$_{-INTR}$'). He made no morphological errors in non-alternating verbs, including pseudo-alternating verbs, and made no other morphological errors. AI selected the incorrect alternant in many occasions and substitutes the roles in the event, but showed full knowledge of the lexical-syntactic information of the verb he eventually selected, as evident by his almost complete lack of argument structure errors. (3) is an example from the 'sentence completion with various morphological patterns' task:

(3) **Stimulus**: *hu garam le-yossi lix'os, hu __ et yossi (target: hix'is)*
He made to-*Yossi* angry$_{-INTR}$, he __ ACC *Yossi* (anger$_{-TR}$)
'He made Yossi angry, he ___ Yossi'
Response: *ka'as al yossi*
Angry$_{-INTR}$ on *Yossi*
'He was angry at Yossi'

Pattern (2) – an impairment in the syntactic lexicon: Patient SN, a 62-year-old man who sustained a stroke involving temporo-parietal areas, had an impairment in **the syntactic lexicon**. This deficit resulted in incorrect selection of alternants. However, contrary to AI, since SN's representations in the syntactic lexicon are impaired, he not only selects incorrect alternants but also produces sentences with argument structure errors in alternating (and also non-alternating) verbs. An example from the task of sentence completion with multiple choice is given in (4):

(4) **Stimulus***: Ha-delet ___ ba-laila*
The-door ___ in-the-night
'The door ___ at night'
Answer options: *sagra* ('close$_{-TR}$')/ *xarka* ('squeak')/ *xikta* ('wait') /*himšixa* ('continue'):
SN's Response: *sagra* ('close$_{-TR}$').

This type of errors in the choice of alternant and argument structure was attested in other participants with a deficit in the syntactic lexicon (who also had additional deficits): HY, a 50-year-old woman with aphasia and DV, a 15-year-old girl with a hearing impairment both made pattern substitutions only in alternating verbs. A selective deficit in alternating verbs is characteristic of orally-trained children with a hearing impairment (Hass, 2018).

Impairments in later stages of the retrieval process, in **the phonological output lexicon and buffer**, where some morphological and phonological representations are already available, may also cause the same type of morphological substitutions, pattern substitutions, but regardless of meaning and argument structure. Namely, individuals with such impairments make pattern substitutions not only with alternating verbs, but also with non-alternating and pseudo-alternating verbs, which may result in existing as well as non-existing verbs.

Pattern (3) – a deficit in **roots in the phonological output lexicon**: Both RR and HH have an impairment in **the phonological output lexicon**. However, their patterns of errors present a striking dissociation: Patient HH, a 73-year-old man who sustained a stoke involving the basal ganglia of the left hemisphere, has difficulty only in the retrieval of roots, which causes phonological errors in roots (xagora ('belt') → kagora), as well as semantic errors and avoidances such as using an English word or providing a definition for the word. When he was given the root of the target word, HH easily retrieved it, without any morphological errors.

Pattern (4) – a deficit in roots and patterns in the phonological output lexicon: patient RR, a 37-year-old man who sustained a stroke involving the precentral gyrus of the left hemisphere, had errors with roots *and patterns* in both the nominal domain (e.g., *colelet* – 'submarine' → *colela*, a non-existing word in a different nominal pattern) and the verbal domain. His morphological errors in the verbal domain were indifferent to whether or not the verb was alternating: RR had errors with alternating verbs (*hirkid* – 'make someone dance' → *rakad* – 'dance'), pseudo-alternating verbs (*hištalma* - 'pay off, be worthwhile'→ *šilma* 'pay'), and non-alternating verbs (*kodxim* – drill$_{PL}$ → **mekadxim)*.

Pattern (5) – an impairment in the phonological output buffer: Patient SH, a 23-year-old woman who sustained a stroke involving fronto-parietal regions of her left hemisphere, as well as 15 other patients in this study showed a phonological output buffer deficit. This causes morphological errors in alternating, pseudo-alternating, and non-alternating verb and in addition it also causes errors in inflectional morphology, i.e., tense and agreement (e.g., *da'ag* 'worried $_{-TR}$' → *'do'eg'* – 'worries $_{-TR}$'). In fact, all 15 patients with a phonological output buffer impairment had errors in both derivational morphology (pattern substitutions) and inflectional morphology (tense and agreement) (Katz & Friedmann, 2021). To sum up, there are the five patterns of morphological errors we found:

1. Pattern substitution only in alternating verbs, without argument structure errors.
2. Pattern substitution only in alternating verbs, with argument structure errors.
3. Pattern substitution in all verb types (alternating and non-alternating).
4. Pattern substitution in all verb types (alternating and non-alternating), and in inflection (tense and agreement).
5. No pattern substitutions, errors only in roots.

We propose a lexical retrieval model that accounts for these patterns in Katz and Friedmann (2021).

3.2. All alternating verbs are equal

The distinction between alternating and non-alternating verbs in the data is clear: some patients have morphological errors only with alternating verbs (patterns 1-2), while others have morphological errors in a much broader set of verbs (patterns 4-5). However, do all alternating verbs behave the same? In order

to answer this question we looked at all patients who had more than one alternant-substitution error in the sentence completion task with various alternations (20 patients out of 34 tested). We discovered that for the vast majority of patients, alternant-substitution errors were made across alternations (reflexives and causatives), valency (producing an intransitive over a transitive and vice versa), and morphological pattern (binyan).

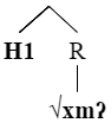
Alternations: All but two patients had at least one error in the causative alternating and one error in the reflexive alternation. The two remaining patients, RM and NX, had each two substitution errors with causatives, and no alternant-substitution errors with reflexives. RM had two substitution errors in the causative alternation, and, additionally, she had one pattern-substitution error in the reflexive alternation, but the result was not the alternant but a non-existing verb (raxac – 'wash$_{-TR}$' →*rixec), so this was disregarded. NX also made two substitution errors, bothwith causatives, but he additionally had a substitution error in the reciprocal alternation, which was not included in the final version of the experiment (hitkatvu – 'they corresponded' → katvu – they wrote). **Valency**: All patients except RM and NX had both valency reduction and valency expansion errors (i.e., they substituted the transitive with the intransitive in some cases, and the intransitive with the transitive in others). Since it may be proposed that in the reflexive alternation the intransitive is the more complex, or derived alternant, we ran the same comparison only for causatives, and we found that it still remains the case that patients who made more than one error had an error with both a lower valency and a higher valency alternant. RM produced two transitives in place of intransitives, and NX produced two intransitives in place of transitives. In his additional error with the reciprocal alternation, RN produced a transitive in place of an intransitive. **Pattern**: As mentioned above, alternating verbs can appear in a variety of pattern pairs. Some theories attribute semantic or syntactic importance to the identity of the patterns (Doron, 2003; Kastner, 2020). We found that all patients had errors in more than one pattern pair. NX's two errors in the causative alternations were both in the CaCaC-hiCCaC alternation, but his additional error with the reciprocal alternation was with the hitCaCeC-CaCaC alternation. It is of note that all of NX's errors resulted in a verb of the CaCaC form. Since he had a small number of errors, it is not clear if this is a coincidence or a pattern that needs to be accounted for. Looking at the group as a whole, pattern substitutions in alternating verbs occurred in all pattern pairs tested: CaCaC-hiCCiC (rakad – hirkid, 'dance'), hitCaCeC-CiCeC (hitkalkel-kilkel, 'damage'), niCCaC-CaCaC (niftax-patax, open), hitCaCeC-CaCaC (hitraxec-raxac, 'wash'), CaCaC-CiCeC (samax-sime'ax, 'cheer up'), niCCaC-hiCCiC (nirga-hirgi'a, 'relax'), and hitCCeC-hiCCiC (hitlabeš-hilbiš – dress). In 6 of the 7 pattern combinations, errors occurred with both alternants. No participant used CiCeC instead of CaCaC in the CaCaC-CiCeC alternation. Note, however, that this pattern pair is not common for verbal alternations in Hebrew, and was represented accordingly in the materials.

4. Discussion

In our study we discovered five distinguishable patterns of errors, that can be predicted by the patient's functional locus of impairment. We also found that errors with alternating verb were not confined to an alternation type, nor to some morphological forms. In Katz and Friedmann (in preparation) we provide a lexical retrieval model that accounts for this data in cognitive-neuropsychological terms. Here, we would like to focus on the possible implication of these results on linguistic theories of Hebrew verbal morphology. The main finding we would like to discuss in this paper, since we believe it may have major implications on linguistic theory, is that there exists a morphological impairment that affects only alternating verbs. Patients with this selective morphological impairment make pattern substitution errors in alternating verbs, but strikingly do not make the same errors with non-alternating verbs and pseudo-alternating verbs with exactly the same overt morphology. In order to appreciate the implications of the existence of such speakers, let us examine a simplified theory of language alternations in line with current theories of morpho-syntax in Hebrew and other languages. The theory assumes that morphological patterns are the spellout of a root's syntactic environment. The root is merged with a head (or heads) such as *v*, *Voice* or more idiosyncratic heads, which correspond to morphological patterns during vocabulary insertion. E.g., the non-alternating verb *hixmi* ('complement') is derived by merging the root, or an index to this root, with some functional head (H1). During vocabulary insertion H1 (in its local context)

provides the morphological pattern of the verb, *hiCCiC*. H1 may also have a (contextual) semantic interpretation. Arguments are disregarded for simplicity and generality.

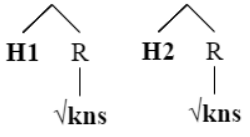
(5)



LI:
H1 → hiCCiC (/…)

In this theory, verbal alternations are not derived by a specialized theoretical component (e.g., a lexical operation or a special component in the syntactic derivation), but are a by-product of the possibility of one root to merge with different functional heads. For example, the alternating pair *nixnas*-*hixnis* ('enter'-'make someone/something enter') can be derived by merging the same root √kns with different functional heads:

(6)



LI:
H1 → hiCCiC (/…)
H2 → niCCaC (/…)

The first thing that comes to mind when trying to explain a selective morphological impairment in alternating verbs, is that it is related to the inventory of functional heads (which consists of H1 and H2 in this toy model). The deficit could be in the inventory of heads, in the selection of a head by a root (insofar as this is listed), or in the LI rules for these heads. However, it is easy to see that all of these possibilities cannot account for a selective deficit in alternating verbs. Since models such as the one presented here do not treat alternations as a primitive phenomenon, a deficit in each of these stages predicts morphological errors also in non-alternating verbs. To illustrate this, imagine that H1 is missing altogether from the inventory of heads of some speaker, that selectional information related to it is missing, or that the VI rule associated with it is missing or incorrect. This would correctly predict that the speaker would substitute the alternating verb *hixnis* with *nixnas*, but it would also (wrongly) predict that they will make a similar morphological substitution with a non-alternating verb such as *hixmi*.

One can suggest that the deficit is not in the inventory of functional heads, but in **selecting the correct functional head for a root that enables more than one.** This works for the two examples above: for the root √kns can select both H1 and H2, resulting in the two alternants. A speaker who has difficulty selecting a functional head could possibly produce the incorrect alternant. It also explains why the same speaker would not make a morphological substitution with a non-alternating verb such as *hixmi*, since the root √xmʔ can select only one functional head. There are two downsides to this proposal, one is conceptual, and the other is a more serious theoretical entailment of such proposal. The conceptual problem is that it is not clear why there would exist such an impairment. In order to explain the data, it must be said that the impairment is not in the functional heads themselves, but in selecting one functional head over the other. This could be reasonable if the same patients had other difficulties with selection, e.g., with selecting a T or C head. However, the difficulty of these patients in selection seems to be confined to the lexical-syntactic domain (see Biran & Friedmann, 2012, for a dissociation between impairment in lexical-syntactic information and syntactic abilities involving T and C).

The second, more serious problem has to do with pseudo-alternating verbs. As mentioned above, pseudo-alternating verbs appear in two patterns that alternate in other contexts, but in this case the verbs do not have a systematic relation is meaning or argument structure. In some cases, pseudo-alternating verb do not share any meaning, and the homophony of their root is an "accident" of the development of the language, e.g., *cava* – 'paint' ↔ *hicbi'a* – 'point', 'vote'. However, in other cases, while there is no systematic relation in meaning, there is still some relation, e.g., *hištalem* - 'pay off, be worthwhile' ↔ *šilem* 'pay', *maca* – 'find' ↔ *himci* – 'invent'. In these cases, if the two pseudo-alternants share a root and only differ in their morphological pattern (which is a spellout of a functional head), a model of the type sketched above would wrongly predict that the same participants who have errors with alternating verbs, who presumably have difficulty selecting the correct functional head for a root that enables more than

one head, would also have difficulty with pseudo-alternating verbs that share some meaning. This, as mentioned above, is not the case: there are patients in this study (AI, SN, HY and DV), and in previous studies (Hass, 2018) with a morphological impairment selective to alternating verb. In the test battery described above we specifically tested pairs of pseudo-alternating verbs, some of which have a relation in meaning. We found that patients with a selective difficulty with alternating verbs do not make any errors when producing pseudo-alternating verbs. The fact that pseudo-alternating verbs behave like non-alternating verbs poses an empirical problem for theories of the type sketched above even when the proposed deficit is a very restricted impairment in the selection the correct functional head for a root that enables more than one functional head.

One way around this problem is to give up on the idea that pairs of pseudo-alternating verbs with shared sound (and sometimes also meaning) share an abstract root. This would explain why patients with a selective impairment in alternating verbs do not have errors with non-alternating verbs, but at the price of claiming that the shared sound and meaning of pseudo-alternating pairs is a coincidence.

5. Conclusion

The goal of this paper was to describe the possible impairments that affect verbal morphology, and to discuss the implication of these results on linguistic theory. We showed that alongside a general deficit in verbal morphology, there are patients who have selective difficulties with alternating verb, that do not affect other aspects of verbal morphology. We also showed that alternant substitution occur regardless of alternation type, morphological pattern or valency. We suggest that a behavior specific to alternating verbs implies that alternating verbs are not an epiphenomenon of root that appear in different patterns, and that there must be a special theoretical component in their derivation, lexical or syntactic, not found in the derivation of non-alternating verbs. We proposed that theories that do not adopt this assumption into their models may still be able to account for the data from impairments, but at the price of giving up on the assumption that non-alternating verbs that share a consonantal root and are related in meaning are derived from the same abstract root. This contribution from people with aphasia and other language disorders provide constraints on theoretical models of verbal morphology.

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