



Interlexical Relations in English Stress¹

FUMIKO KUMASHIRO & TOSHIYUKI KUMASHIRO*
Keio University

ABSTRACT

In this paper, we propose a cognitive, non-reductionist analysis of English stress as it pertains to interlexical relations, based on the usage-based model as proposed by cognitive grammar and on the connectionist interactive activation model. We claim that interlexical relations involved in English stress can felicitously be accounted for by employing actually-occurring expressions as constraints and that precise explication of these relations requires consideration of not only phonological but also semantic factors. In the course of making these claims, we attempt to demonstrate that cognitive grammar, being a usage-based, non-reductionist framework, can accommodate actually-occurring expressions as constraints in a coherent manner and further that the theory can naturally bring semantic factors to bear on phonological analyses, being a non-modular, unificational framework.

KEYWORDS: English stress, cycles, interlexical relations, cognitive grammar, usage-based model, interactive activation model.

* *Address for correspondence:* Fumiko Kumashiro. Keio University. 4-1-1 Hiyoshi; Kohoku-ku, Yokohama 223-8521; Japan. E-mail: fumiko@kumashiro.org. Toshiyuki Kumashiro. Keio University. 4-1-1 Hiyoshi; Kohoku-ku, Yokohama 223-8521; Japan. E-mail: toshiyuki@kumashiro.org.

I. INTRODUCTION

This paper proposes a cognitive, non-reductionist analysis of English stress as it relates to cycles or INTERLEXICAL RELATIONS. The traditional notion of “phonological cycle” is intended to capture the intuition that words are not merely built by linearly combining morphemes into a string, but can also be derived from independent words, yielding different phonological structures than those which do not contain such independent words. For instance, a monomorphemic word *Mamáronèck* carries primary stress on the antepenultimate syllable, whereas *général-ize*, which is identical to *Mamáronèck* in all relevant respects, is stressed on the initial syllable. This asymmetry can only be ascribed to the fact that *général-ize* is lexically related to *général*, which carries stress on the same syllable. More such pairs of examples are provided in (1).²

(1)	MONOMORPHEMIC		COMPLEX			
	<i>Saskátchewàn</i>	vs.	* <i>oxýgen-àte</i>	vs.	<i>óxygen-àte</i>	(cf. <i>óxygen</i>)
	<i>inventòry</i>	vs.	* <i>ínfirmàry</i>	vs.	<i>ínfirmary</i>	(cf. <i>ínfirm</i>)
	<i>mércantíle</i>	vs.	* <i>pércént-ìle</i>	vs.	<i>percént-ìle</i>	(cf. <i>percént</i>)

Note that not only the primary stress but also the secondary one can be affected by the stress patterns of lexically-related words. Observe the examples in (2). A monomorphemic word *àbracadábra* in (2)a, for instance, carries secondary stress on the initial syllable. In contrast, a complex word *orìginál-ity* in (2)b carries it on the second syllable despite it having a comparable syllable structure. Notice that the complex word in question has a related independent word that is stressed on the same syllable, i.e. *orìginál*; only this fact could possibly explain the contrast observed here.³

(2)a.	MONOMORPHEMIC		b. COMPLEX			
	<i>àbracadábra</i>		* <i>òrìginál-ity</i>	vs.	<i>orìginál-ity</i>	(cf. <i>orìginál</i>)
	<i>pàraphernália</i>		* <i>ìconoclást-ic</i>	vs.	<i>icònoclást-ic</i>	(cf. <i>icònoclást</i>)
	<i>Kìlimanjáro</i>		* <i>ànticipát-ion</i>	vs.	<i>anticipát-ion</i>	(cf. <i>anticipàte</i>)

Therefore, one may be inclined to conclude that those words which are derived from other related independent words are stressed exactly where the independent words are stressed. The facts,

however, are more complicated, and the above conclusion does not always obtain. That is, there are not a few words which carry stress on the syllables other than the ones on which their related independent words are stressed. Those words typically behave, at least with respect to stress, as if they were monomorphemic words. Observe the examples in (3) below:

- | | | | | |
|-------|---------------------|-----|-----------------------|------------------------|
| (3)a. | <i>infer-ence</i> | vs. | * <i>infér-ence</i> | (cf. <i>infér</i>) |
| | <i>réside-ence</i> | vs. | * <i>reside-ence</i> | (cf. <i>reside</i>) |
| | <i>protést-ant</i> | vs. | * <i>protést-ant</i> | (cf. <i>protést</i>) |
| b. | <i>parént-al</i> | vs. | * <i>párent-al</i> | (cf. <i>párent</i>) |
| | <i>solíd-ify</i> | vs. | * <i>sólid-ify</i> | (cf. <i>sólid</i>) |
| | <i>orígin-àte</i> | vs. | * <i>óorigin-àte</i> | (cf. <i>óorigin</i>) |
| | <i>demócrat-ize</i> | vs. | * <i>démocrat-ize</i> | (cf. <i>démocràt</i>) |
| c. | <i>im-píous</i> | vs. | <i>im-píous</i> | (cf. <i>píous</i>) |
| | <i>èlément-ary</i> | vs. | * <i>élement-àry</i> | (cf. <i>élement</i>) |

Examples in (3)a carry primary stress on the initial syllable, although their related independent words are stressed on the second. The converse is true for examples in (3)b: derived words are primarily stressed on the second syllable, whereas the source words are stressed on the initial. Some additional cases of similar mismatch are found in (3)c.

Any phonological theory, therefore, faces the extremely difficult task of providing a mechanism capable of encoding the interlexical relations as illustrated by (1) and (2) above and that of explaining at the same time why the relations do not hold for the words in (3). In the current paper, we attempt to propose an analysis that can in principle be successful with the tasks defined above, based on the usage-based model (Langacker, 1988) within the framework of cognitive grammar (Langacker, 1987, 1990, 1991, 1999), and on the connectionist interactive activation model (Elman & McClelland, 1984; Rumelhart & Zipser, 1985; Waltz & Pollack, 1985). More specifically, the current paper aims to make the following two claims: (i) interlexical relations involved in English stress can felicitously be accounted for by employing an actually-occurring expression as a constraint; and (ii) precise explication of interlexical relations requires consideration of not only phonological but also semantic factors. In the course of making these

claims, we also intend to demonstrate the following with respect to the framework: (i) cognitive grammar, being a usage-based, non-reductionist framework, can accommodate actually-occurring expressions in a coherent manner without employing ad-hoc mechanism; (ii) the theory can naturally accommodate semantic factors in phonological analyses, being a non-modular, unificational framework that employs in phonological analyses only those theoretical constructs which have already been proposed elsewhere for semantic analyses; and (iii) the theory, whose focus has primarily been on semantic analyses, is capable of offering a framework in which phonological phenomena can be successfully accounted for (cf. Farrell, 1990; Kumashiro, F., 2000; Kumashiro, T., 1990; Rubba, 1993).

The organization of the current paper is as follows. In Section II, the model, principles, and representations that would form the basis of the proposed analysis will be presented. Section III illustrates how cognitive grammar can handle prototypical cases of interlexical relations. Section IV deals with exceptional cases. Section V offers comparison with a comparable analysis in optimality theory.

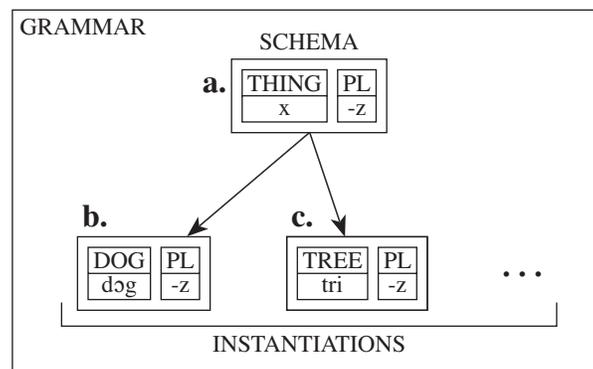
II. MODEL, PRINCIPLES, AND REPRESENTATIONS

II.1. The Usage-Based Model

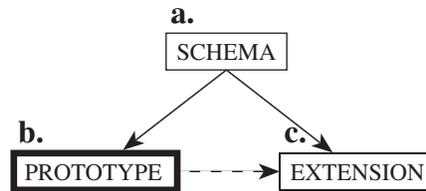
The model to be used to account for the data related to English stress in question is based on the usage-based model, proposed within the general framework of cognitive grammar. The theory views grammar as a structured inventory of conventional linguistic units. That is, it is essentially a “bottom-up, non-reductionist, maximalist” approach, in which the grammar is viewed as storing every conventionalized expression (INSTANTIATION) as well as generalizations (SCHEMAS) that may have been schematized by language users from actually-occurring concrete expressions.⁴ Therefore, there is no fundamental difference in theoretical status between actually-occurring expressions and generalizations, which only differ in terms of degree of specificity. This situation is illustrated in Fig. 1 (adapted from Langacker, 1988: 131). Provided in Fig. 1b is the representation for a plural noun *dogs* and in Fig. 1c that for *trees*. Notice that the words are

morphologically complex and can be decomposed into parts: *dogs* into *dog* and *-s*, and *trees* into *tree* and *-s* (in the diagram, these expressions are placed in separate boxes). Furthermore, every linguistic expression is BIPOLAR and can be separated into the SEMANTIC and the PHONOLOGICAL POLE: *dog* into the semantic pole [DOG] and the phonological pole [dɔg], *tree* into [TREE] and [tri], and the plural suffix into [PL] and [-z] (capital letters are used to represent the semantic pole).⁵ As there are numerous other plural nouns in the grammar (symbolized by “elliptical” three dots in the diagram), which share the same internal structure, it is reasonable to assume that the language user has extracted a SCHEMA (given in Fig. 1a) which has exactly the same internal composition as *dogs* and *trees*, but has a noun stem whose semantic and phonological poles are characterized only SCHEMATICALLY.⁶

Fig. 1: Organization of Grammar



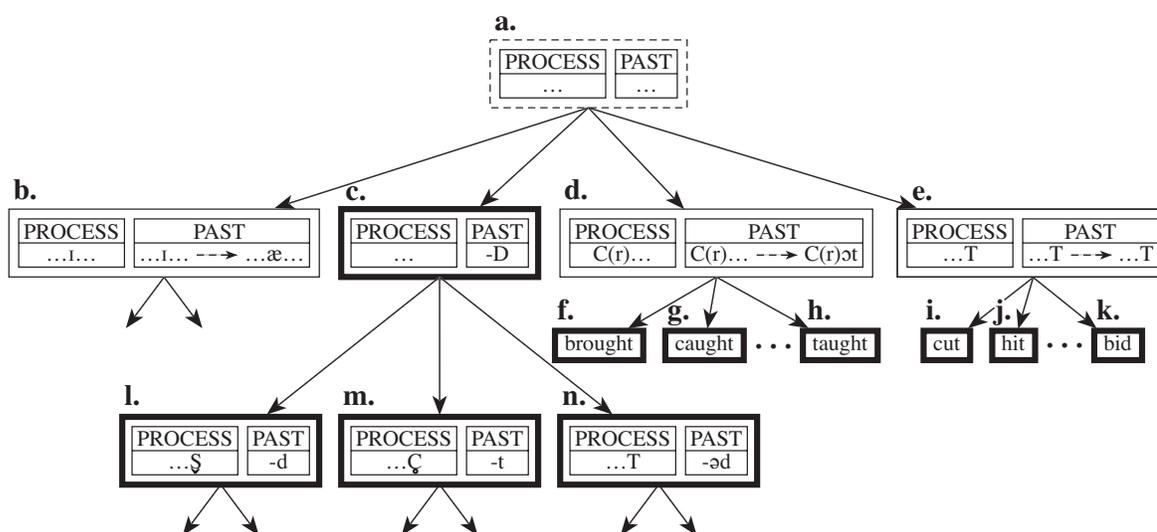
Furthermore, conventionalized linguistic units are not merely “listed” in the grammar but they are also “structured”. A typical structure takes the form described in Fig. 2 (adapted from Langacker, 1988: 140). For any type of linguistic category, there is a PROTOTYPE, which is a central member of the category.⁷ There are other peripheral members of the category, which resemble or overlap with the prototype to various degrees (EXTENSIONS). One can usually posit a SCHEMA which has all and only the properties common to both the prototype and the extensions and thus is schematic with respect to them.

Fig. 2: Categorization

Furthermore, the grammar, in addition to containing those entries or nodes, specifies the relations holding among them. There are two types of such relationships: SCHEMATIZATION and EXTENSION. The relation of extension (symbolized by a dashed-line arrow) implies some conflict in specifications between the basic and extended values; hence $[A] \text{ --- } \rightarrow [B]$ indicates that $[B]$ is incompatible with $[A]$ in some respect, but is nevertheless categorized by $[A]$. The relation of schematization, on the other hand, holds between a schema and a structure that elaborates or instantiates the schema. Symbolized by a solid-line arrow, e.g. $[A] \longrightarrow [B]$, the relationship amounts to one of specification: $[B]$ conforms to the specification of $[A]$, but is characterized with finer precision and detail. In this fashion, conventionalized units form massively connected networks for each relevant cognitive domain.

Let us now examine what a typical network looks like. Described in Fig. 3 is a network for the English past-tense morpheme (adopted from Langacker, 1988: 155). Described in Figs. 31-n at the bottom are the most frequently used past-tense forms, representing the regular patterns: $[-d]$, $[-t]$, and $[-\text{əd}]$ suffixations. Notice these schemas contain not only the structures for the suffixes themselves, but also the schematic characterizations of the stem verbs. For example, the schema for the $[-d]$ suffix (Fig. 31) contains a schematically characterized verb stem, of which the phonological pole only stipulates that the stem ends in $[\text{S}]$ (a voiced segment), while the semantic pole only has the specification “PROCESS”, which is the highly schematic semantic value common to all verbs, encompassing both stative and perfective verbs. Likewise, the schema for past-tense forms with the suffix $[t]$ stipulates that the stem ends in $[\text{C}]$ (a voiceless consonant) at the phonological pole; and the schema for $[-\text{əd}]$, that the stem ends in $[\text{T}]$ (an alveolar stop neutral with respect to voicing).

Fig. 3: English Past Tense



Described in Fig. 3c is the higher schema extracted from the above-mentioned three concrete schemas. Being schematic over a wide range of verb stems, the phonological pole of the stem is almost vacuous and simply stipulates that there be some phonological content ([...]). The phonological pole of the suffix itself is simply specified as [-D] (phonological content neutral with respect to voicing and the presence of a schwa). Depicted in Fig. 3b is the schema encompassing verbs whose past-tense forms involve the substitution of some vowel by [æ] (e.g. *rang*, *sank*, *swam*, *sat*).⁸ Described in Fig. 3d is the schema for past-tense forms containing [ɔt] at the end, and in Fig. 3e is the schema for past-tense forms that end in an alveolar and are identical to the infinitival forms. Recall that cognitive grammar is a “maximalist” approach, which lists not only schemas but also expressions that actually occur in the grammar; this is why *brought*, *caught*, *taught*, *cut*, *hit*, *bid*, and abbreviated many others are listed under their respective schemas. Finally, in Fig. 3a is the super schema covering all the past-tense forms. Its wide-range applicability makes it highly schematic; the phonological and the semantic pole simply stipulate that there be some content ([...]).

Also described in Fig. 3 is the cognitive salience of each schema and each actually-occurring expression. The schemas in Figs. 3l, m, and n for the prototypical plural forms with the suffixes

[-d], [-t], and [-əd], respectively, and the higher-level schema in Fig. 3c for these lower schemas are accorded high cognitive salience (symbolized by bold-line boxes) because they represent most common types of past-tense forms. The actually-occurring expressions (such as *brought* in Fig. 3f and *cut* in Fig. 3i) are given high cognitive salience as well because they are concrete expressions and occur more frequently than regular verbs. The super schema in Fig. 3a enjoys only low salience (symbolized by a dashed-line box) because it is almost void of semantic and phonological contents. All the other schemas are accorded an intermediate degree of salience.

It should be apparent from the diagram that cognitive grammar does not rely on such theoretical constructs as rules and rule ordering, and that all the generalizations are instead stated in the form of schemas. This is required by the highly restricted principle of the theory, namely the CONTENT REQUIREMENT, which permits in grammar only “(1) phonological, semantic, or symbolic structures that actually occur in linguistic expressions; (2) schemas for such structures; and (3) categorizing relationships involving the elements in (1) and (2)” (Langacker, 1987: 53-54). Therefore, the well-formedness of an expression cannot be determined by whether it can be generated by rules; it is instead determined by whether it is categorized by a schema. Relevant principles for determining such well-formedness are discussed below.

II.2. Well-formedness principles

Langacker (1988: 153) proposes the principles in (4) as a working hypothesis for determining the well-formedness of an expression:

(4) a. Uniqueness

When an expression is assessed relative to a grammatical construction, a single node (from the network representing the construction) is activated for its categorization; if this “active node” is schematic for the expression, the latter is judged well-formed (conventional).

b. Selection

The likelihood that a given node will be chosen as the active node for categorizing a target expression correlates positively with its degree of entrenchment and cognitive salience, and negatively with its “distance” from the target, i.e. how far the target diverges from it by elaboration or extension.

Note that the selection principle in (4)b entails that the notion of well-formedness is not categorical but gradient. Furthermore, the uniqueness and selection principles in (4) are compatible with the connectionist interactive-activation model of language processing. However, in order to make the two principles more harmonious with the model, we propose the following revisions, based on proposals made by T. Kumashiro (1990) and F. Kumashiro (2000):

(5) a. Access

When a given candidate expression is assessed relative to a certain subpart of the grammar, i.e. a function, units (from the network representing the subpart) that categorize the expression are activated and sanction the expression.

b. Activation

The total “activation”, i.e. conventional motivation/sanction, of a candidate expression is the sum of the activation values obtained from all of the categorizing units. Each such value correlates positively with the degree of entrenchment and cognitive salience of the unit, and negatively with the expression’s “distance” from the unit, i.e. how far it diverges from its categorizing unit by elaboration or extension.

c. Uniqueness

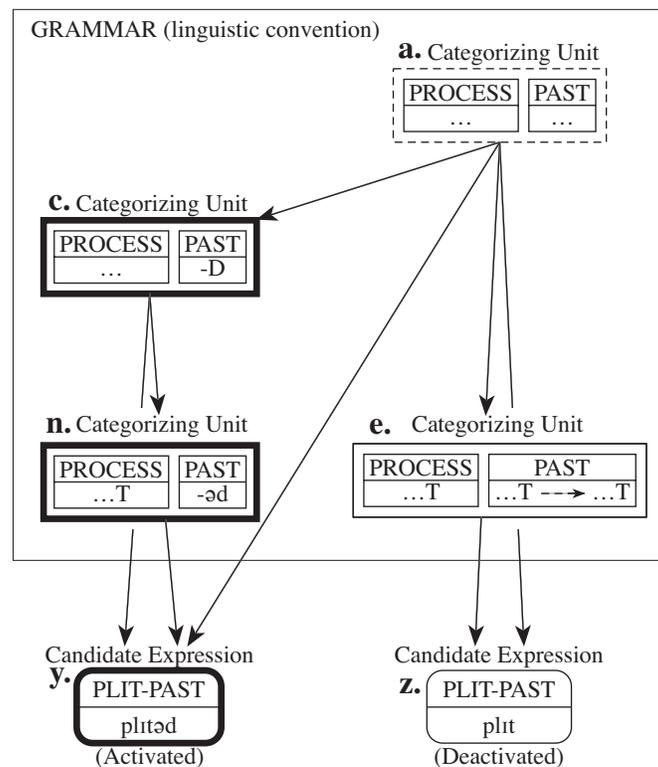
When there are multiple candidate expressions, all but the one with the highest activation value are deactivated.

d. Well-Formedness

The degree of well-formedness of a candidate expression correlates with its final activation value.

Note that Langacker's proposal in (4) and ours in (5) are essentially equivalent, despite ostensible differences. In Langacker's formulation, the task of the speaker is to choose among "schemas", whereas in ours, the selection is made among possible "candidates".⁹

Let us provide a specific example to illustrate these principles. Part of the network in Fig. 3 that represents English past-tense formation is provided in Fig. 4.¹⁰ Given a novel verb such as *plit* [plɪt], several candidate expressions with the function of its past-tense form are conceived: *plitted* [plɪtəd], *plat* [plæt], *plaught* [plɔt], and *plit* [plɪt]. In what follows, the competition between the two most plausible candidates, i.e. *plitted* [plɪtəd] and *plit* [plɪt], is examined. The candidate expression *plitted* in Fig. 4y is categorized as an instantiation not only of the lower-level categorizing unit in Fig. 4n but also of the higher-level ones in Figs. 4c and a. Then, in accordance with the access principle in (5)a, all the three categorizing units are activated and sanction *plitted*, but to different degrees. According to the activation principle in (5)b, the total activation value of *plitted* is the sum of the activation values obtained from the categorizing units in Figs. 4n, c, and a. Likewise, the candidate expression *plit* in Fig. 4z is categorized as an instantiation not only of the lower-level schema in Fig. 4e but also of the higher-level one in Fig. 4a. Both units are activated and sanction *plit*, and the total activation value of *plit* is the sum of those obtained from the categorizing units in Figs. 4e and a.

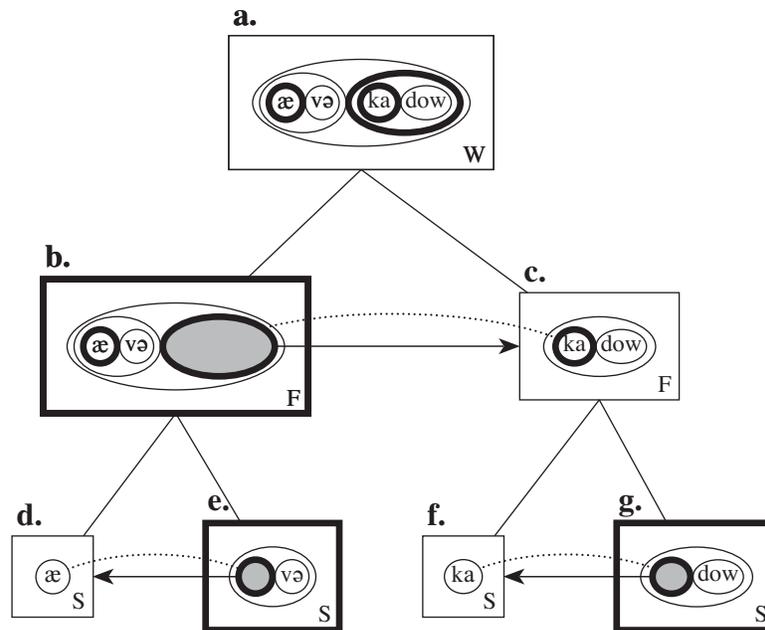
Fig. 4: Past-Tense Form of Novel Verb *plit*

Next, we need to compare the total activation value of *plitted* in Fig. 4y against that of *plit* in Fig. 4z, in order to determine which candidate expression is the most activated. Both candidate expressions are categorized by the categorizing unit in Fig. 4a; from the unit, they obtain effectively the same activation values because the difference in the distance from the unit is negligible, if any. As for other categorizing units, the distance from the unit in Fig. 4n to the candidate expression in Fig. 4y the unit categorizes as an instantiation is essentially equal to that between the unit in Fig. 4e and the candidate expression in Fig. 4z the unit categorizes because the phonological poles of the stems of the two units are identical ([...T]). Therefore, the distance criterion of the activation principle in (5)b does not play a role in determining which is higher of the value the candidate expression in Fig. 4y obtains from the categorizing unit in Fig. 4n and that the candidate in Fig. 4z obtains from the unit in Fig. 4e. Instead, the decision hinges on the cognitive salience criterion of the principle. As can be observed in the networks in Figs. 3 and 4, the

categorizing unit in Fig. 4n, as a prototypical schema representing a regular pattern, is far more salient than that in Fig. 4e. Therefore, the candidate expression in Fig. 4y obtains a higher activation value from the categorizing unit than the value the candidate in Fig. 4z obtains from the unit in Fig. 4e. Moreover, the candidate expression in Fig. 4y obtains an additional activation value from the categorizing unit in Fig. 4c. Therefore, the candidate has a higher total activation value than the one in Fig. 4z. As a result, the uniqueness principle in (5)c allows the candidate to remain active, but deactivates the one in Fig. 4z. In sum, the well-formedness principles in (5) successfully predict that as the past-tense form of a novel verb *plit*, *plitted* is judged well-formed, but *plit* is not.

II.3. Prosodic representations

Before presenting an analysis of English stress involving complex words, it is appropriate to present the cognitive grammar representation of prosodic structure at the word level. Described in Fig. 5 are different levels of prosodic representation for the noun *àvocádò*. Depicted in Figs. 5d-g at the bottom is the syllable-level organization, where *àvocádò* is shown to be comprised of four syllables: [æ], [və], [ka], and [dow].¹¹ In this example, the initial syllable [æ] is strong with respect to the antepenult [və]. A strong syllable is considered AUTONOMOUS as it can occur “in full, unreduced form—approximately as if it were pronounced in isolation” (Langacker, 1987: 331). A weak syllable, on the other hand, is DEPENDENT because it is “compressed along such phonetic parameters as time, amplitude, and pitch range” (loc. cit.), and to be implemented with such properties, it “must be pronounced in combination with an autonomous one” (loc. cit.). That is to say, the prosodic representation for a weak syllable at the lexical level should include a schematic reference to a strong one as part of its inherent characterization. The diagram for the weak syllable [və] in Fig. 5e thus includes the phonological specifications for two syllables: the elaborated, weak syllable on the right (a circle is used to represent syllablehood) and the schematic, strong syllable on the left (a bold line is used to represent prosodic prominence). In a similar fashion, the phonological characterization of the weak syllable [dow] includes the specifications for a schematic strong syllable and an elaborated weak syllable.

Fig 5: Prosodic Structure of *àvocádo*

At a higher level of organization illustrated in Fig. 5b, the two syllables [æ] and [və] are integrated to form a foot. This integration is effected by the equation (symbolized by a dotted line) of overlapping phonological specifications at the syllable level—i.e. the schematic syllable in Fig. 5e is equated with the elaborated one in Fig. 5d. As a result, the schematic syllable gets elaborated by the corresponding, elaborated syllable. In the same manner, the strong penult [ká] and the weak ultima [dòw] are integrated into the foot [ká.dòw]. Notice that there is discrepancy in phonetic prominence between the two feet, i.e. [æ.və] and [ká.dòw], comparable to that between the strong syllables [æ] and [ká] on one hand and the weak syllables [və] and [dòw] on the other: [ká.dòw] is strong vis-à-vis [æ.və]. As in the case of syllables, the phonological specification for a weak foot includes the schematic characterization of a strong foot. The two feet are integrated to form a word at the next higher level, in the same manner the foot-level integration is effected, as illustrated in Fig. 5a.

As the result of these integrations at the foot and the word level, the prosodic representation of the word [æ.və.ká.dòw] as a whole involves three layers: the syllable, foot, and word levels

(from inside out). Furthermore, each layer specifies the relative prominence of their components. Notice that specifying the level of each component and its relative prominence at the given level is sufficient to determine the relative prominence of all syllables at the word level: the most prominent syllable at the word level is the syllable that is strong at the foot level and is contained in the strong foot, and the least prominent syllable is the one that is the weak syllable of the weak foot. Thus, the penult [ka] is the most prominent one at the word level because it is strong within the foot [ká.dòw], which is in turn strong within the word [æ.və.ká.dòw]. The antepenult [və] is the least prominent syllable, as it is weak within the foot [æ.və], which is weak within the entire word. The initial syllable [æ] is of intermediate prominence, for it is contained in the weak foot [æ.və] although it is strong itself within the foot. The final syllable [dow] is also accorded intermediate prominence because it is a weak syllable itself, albeit contained within the strong foot [ká.dòw].

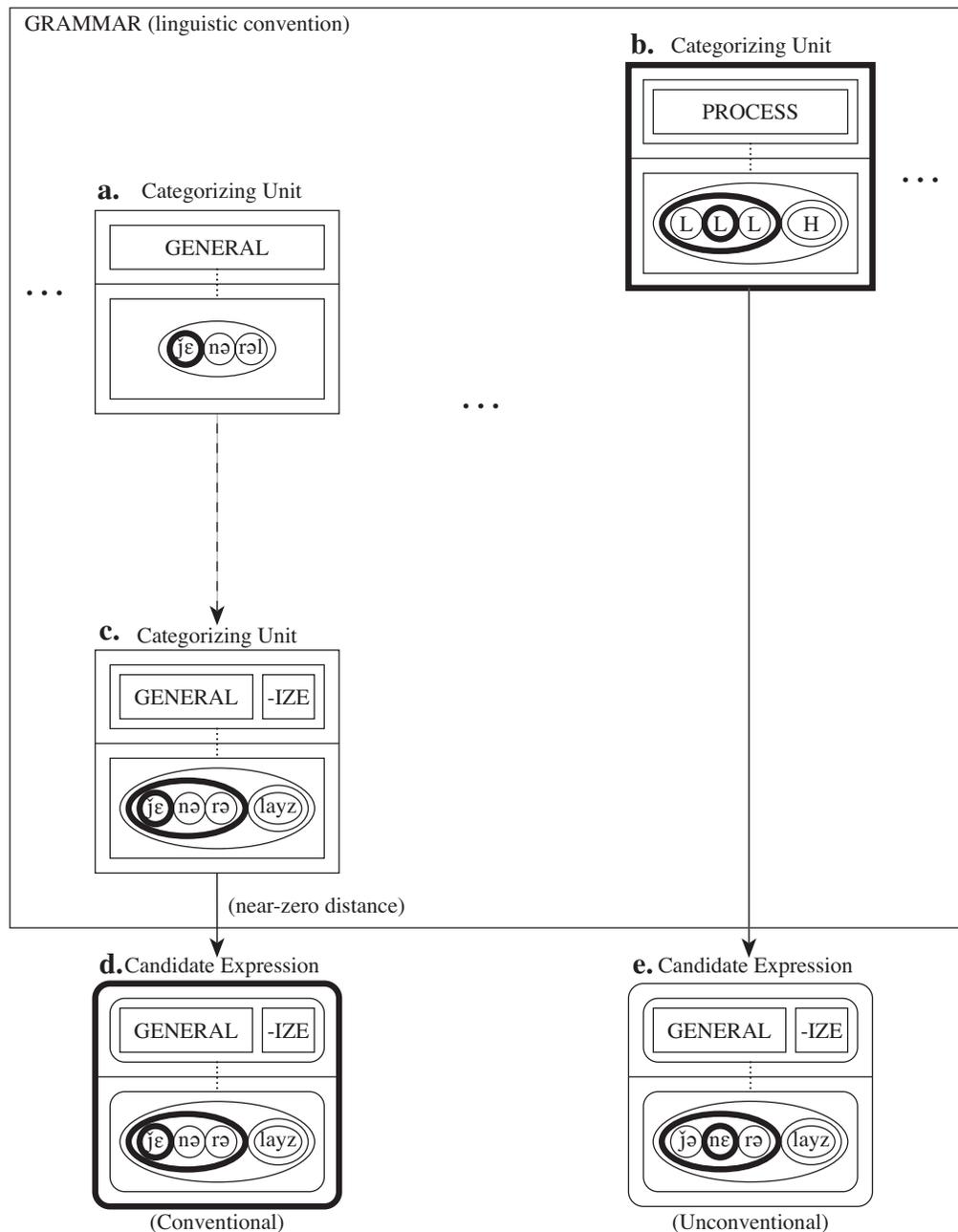
III. INTERLEXICAL RELATIONS IN COGNITIVE GRAMMAR

Now that we have discussed the usage-based model, the well-formedness principles, and the prosodic representations, we are ready to present the analysis of the stress patterns of lexically complex words in English. Described in Fig. 6 is the network of schemas relevant for the determination of the phonological well-formedness of the lexically complex verb *general-ize*. The representation for the verb itself is provided in Fig. 6c. Notice that the representation is comprised of two parts, the semantic pole (at the top) and the phonological pole (at the bottom), which stand in a symbolic relationship (represented by a dotted line).¹² Provided at the phonological pole are the phonological specifications: the word consists of the strong foot [jɛ.nə.rə] and the weak foot [layz]. The former consists of the strong syllable [jɛ] and the weak syllables [nə] and [rə], while the latter contains only one syllable, [layz]. Just as the phonological pole has complex internal structure, so is the semantic structure: the semantic specifications for *generalize* include those for the root word *general* and the affix *-ize*; and the existence of specifications for the root word *general* in the complex word *generalize* is readily recognized, i.e. the language user is very likely to be aware of the existence of such substructure. Sketched in Fig. 6a is the adjectival lexical unit *general*. This

unit categorizes *généralize* in Fig. 6c as an extension from it with some negligible conflict in specification, apart from the conflict caused by the addition of the semantic and phonological structure for the suffix *-ize* (thus a dashed-line arrow, not a solid-line one for instantiation, is used to connect the two nodes in the diagram).¹³ Sketched in Fig. 6b is the schema extracted from verbs which have an initial strong foot consisting of three light syllables with the middle one strong, combined with a final weak foot comprised only of one heavy syllable.¹⁴

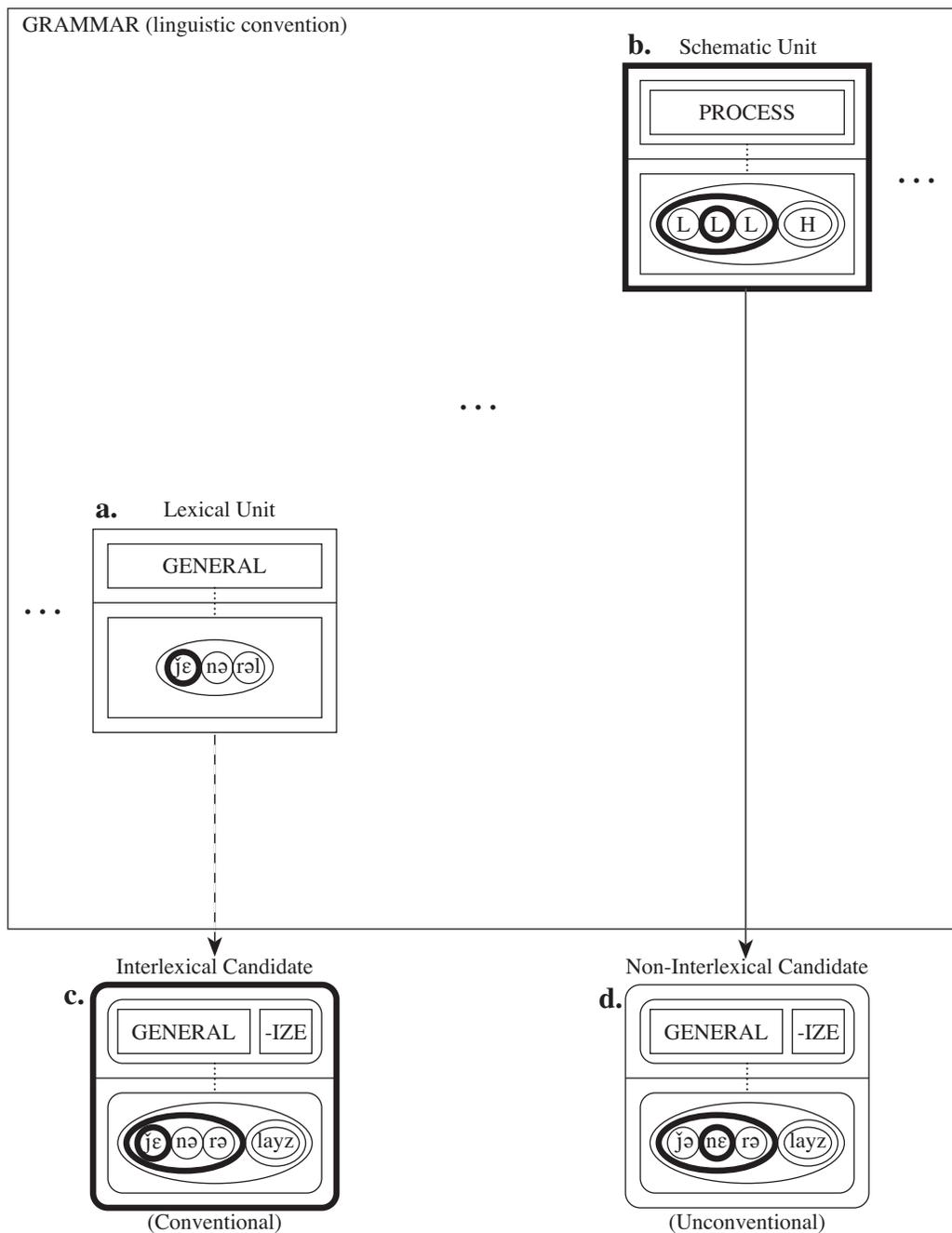
All of the three nodes explained so far—for the lexical units *généralize* in Fig. 6c and *général* in Fig. 6a, and for the schema in Fig. 6b—are all included in the grammar as “conventionalized” linguistic expressions. What is to be noted here is that the lexical units and the schema are on a equal footing and both serve as categorizing units, which is how interlexical relations are coded in the current analysis. However, they differ in terms of prominence. The schema in Fig. 6b is to be considered more cognitively salient than either of the nodes for the lexical units *généralize* in Fig. 6c and *général* in Fig. 6a for its ease of activation (the cognitive salience of the schema is symbolized by the use of a bold line for the enclosing box).

Fig. 6 also includes two candidate expressions at the bottom, i.e. the conventional candidate *généralize* in Fig. 6d and the unconventional candidate in Fig. 6e. The former is categorized by the node for *généralize* in Fig. 6c as an instance, and the latter by the schema in Fig. 6b. When a speech-act participant attempts to choose one of the two candidates as the prevailing candidate, s/he assesses them against the grammar, and does so against the above three nodes in particular, according to the well-formedness principles in (5). However, the process of selecting the prevailing candidate is “trivial” in the case of a conventionalized expression such as *généralize*, because the grammar already contains it as a conventional expression (Fig. 6c) and the cognitive distance between the candidate expression in Fig. 6d and the conventionalized expression is completely negligible, if not zero. As a result, the candidate expression conforming to the conventional pattern (Fig. 6d) always wins out over ones that do not (e.g. Fig. 6e) without exceptions.

Fig. 6: *généralize*

Therefore, if one wishes to examine the “predictability”, in the commonly-used sense of the word, of the network respect to the well-formedness of a given expression, one must assume that the expression in question is not conventionalized. One can easily create this situation by simply

removing the node for the expression from the grammar. The case of *generalize* with this modification is described in Fig. 7. Here the process of selecting the prevailing candidate is no trivial and requires dynamic calculations of phonological distances between the candidates and their categorizing units. First, the node for the adjective *général* in Fig. 7a categorizes the conventional INTERLEXICAL CANDIDATE *généralize* in Fig. 7c as an extension with some negligible conflict other than what is caused by the suffixation with *-ize*. The negligible conflict in question is in the phonological pole: the ultima of [ʃɛ.nə.rəl], i.e. [rəl], is a heavy syllable having [l] as the coda, whereas the corresponding syllable in [ʃɛ.nə.rə.layz], i.e. the penult [rə], lacks the coda. However, the degree of extension caused by the conflict is minimal: the structure of a tri-syllabic foot constituting the phonological pole of *général* is found intact in *généralize*. Next, the schema in Fig. 7b categorizes the unconventional NON-INTERLEXICAL CANDIDATE *genéralize* in Fig. 7d. This stress schema is extracted from those verbs which have an initial strong foot consisting of three light syllables with the middle one strong and a final weak foot comprised only of one heavy syllable. It is reasonable to posit a schema like this in light of a number of verbs which conform to the above phonological specifications (e.g. *inóculàte*, *accómodàte*, *affiliàte*). In order to determine which candidate should prevail, we need to compare the activation value the interlexical candidate *généralize* in Fig. 7c obtains from the lexical unit *général* in Fig. 7a against the value the non-interlexical candidate *genéralize* in Fig. 7d receives from the schematic unit in Fig. 7b, according to the activation principle in (5)b. In terms of cognitive distance, the distance between the former pair of nodes is determined to be far smaller than that between the latter pair, because the specifications in the lexical unit *général* in Fig. 7a for the internal structures of the semantic and the phonological pole are more elaborate than those in the schematic unit in Fig. 7b. In terms of salience, the schematic unit in Fig. 7b is considered more salient than the lexical unit in Fig. 7a because it directly categorizes a large number of expressions. However, the lexical unit's far smaller distance from the interlexical candidate in Fig. 7c more than compensates its lesser degree of salience; as a result, the interlexical candidate obtains a higher activation value from the lexical unit in Fig. 7a than what the non-interlexical candidate in Fig. 7d does from the schematic unit in Fig. 7b.

Fig. 7: *généralize* (Hypothetical)

Therefore, the network would correctly predict that when *généralize* and *genéralize* are put in competition, as alternative pronunciations for an unconventional word would be in the course of

time, the former should win out. In sum, the network predicts that, provided a high degree of both phonological and semantic decompositionality, the stress pattern analogous to the root word, not one analogous to the monomorphemic word, should prevail.

IV. NON-INTERLEXICAL CASES

We observed that a high degree of phonological and semantic decompositionality results in the prevalence of the interlexical candidate exhibiting a stress pattern comparable to the root word. Notice, however, that this statement entails that a lesser degree of either phonological or semantic decompositionality would affect the distances between the categorizing units and the candidate expressions, thereby changing the dynamics of the network and the predictions it makes.

IV.1. Phonological Opacity

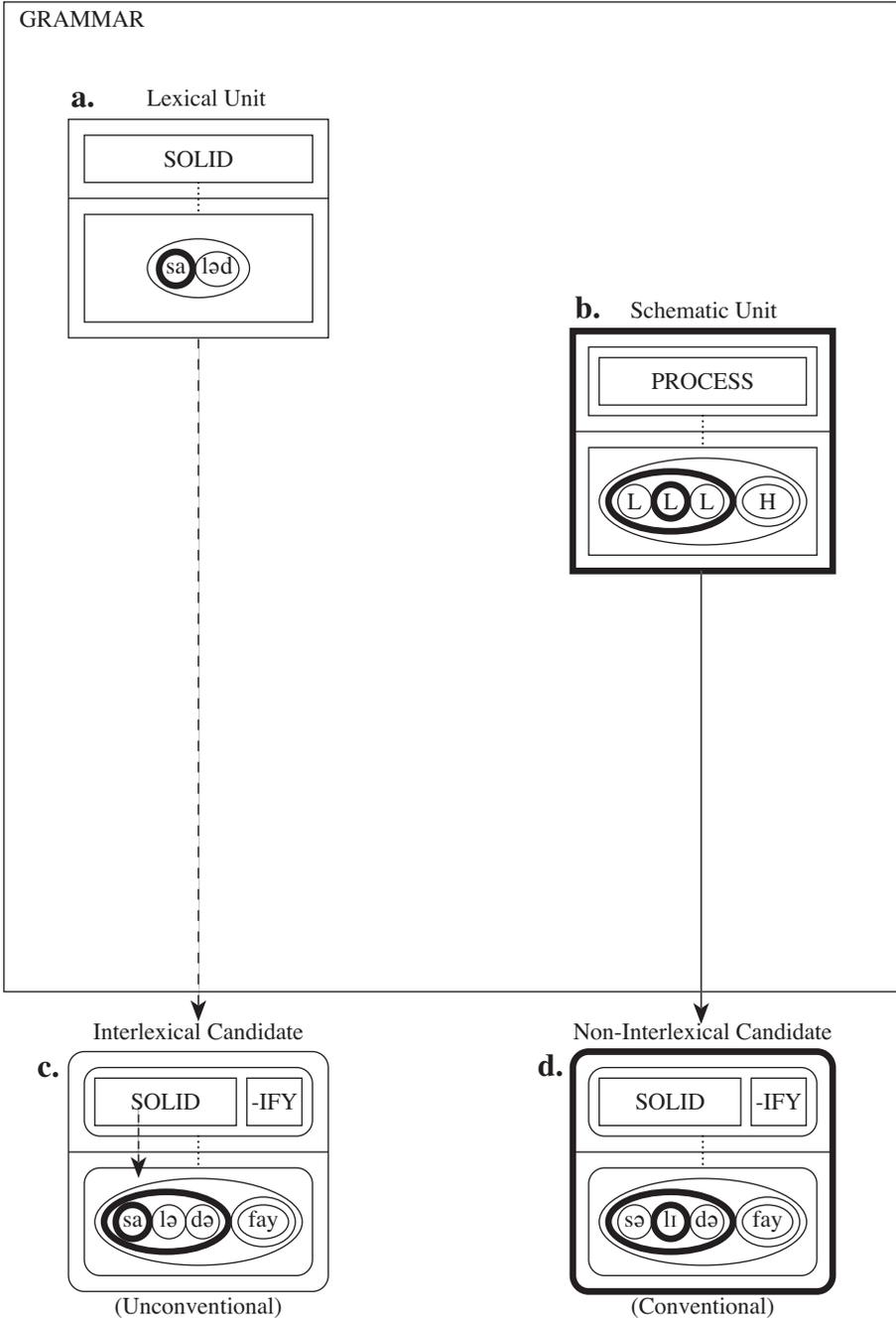
To see a case of decreased phonological decompositionality, or phonological opacity, affecting the stress pattern, let us consider the case of *solidify*, illustrated in Fig. 8. In this case, the non-interlexical *solidify* prevails over the interlexical *sólidify* because of the phonological opacity of the latter. There are two candidates in Fig. 8: the interlexical yet unconventional candidate *sólidify* in Fig. 8c and the non-interlexical but conventional candidate *solidify* in Fig. 8d. The latter candidate is categorized by the schematic unit in Fig. 8b, which is identical to the one in Fig. 7b. The former is categorized by the lexical unit *sólid* in Fig. 8a as an extension with some noticeable conflict. Notice here that the distance between the lexical unit *sólid* in Fig. 8a and the unconventional interlexical candidate *sólidify* in Fig. 8c is considered greater than that between the schematic unit in Fig. 8b and the conventional non-interlexical candidate *solidify* in Fig. 8d, because the phonological decomposability of the interlexical candidate *sólidify* in Fig. 8c into *sólid* in Fig. 8a is lower than that of *generalize* in Fig. 7c into *general* in Fig. 7a. The phonological opacity observed here stems from conflict in foot-internal structure. In the *general/generalize* case, the adjective *general* (Fig. 7a) forms a single foot consisting of three syllables ([jɛ.nə.rəl]), and in

the verb *généralize* (Fig. 7c), a comparable tri-syllabic foot ([ʃɛ.nə.rə]), is found. In the *sólid/sólidifý* case, on the other hand, the adjective *sólid* (Fig. 8a) forms a bi-syllabic foot ([sa.ləd]), but in *sólidifý* (Fig. 8c), the comparable foot contains three syllables ([sa.lə.də]). This greater distance between the lexical unit *sólid* in Fig. 8a and the interlexical unit *sólidifý* in Fig. 8c results in the prevalence of the non-interlexical candidate *solidifý* in Fig. 8d, which follows the stress pattern of comparable monomorphemic words.

In sum, when phonological opacity is observed, the non-interlexical candidate whose stress pattern is distinct from the root word but analogous to comparable monomorphemic words is predicted to be prevalent, in contrast to the *généralize* case illustrated in Fig. 7, which exhibits the opposite pattern, involving a higher level of phonological decomposability. More examples involving phonological opacity are provided in (6). Note that in all these examples, the root words form bi-syllabic feet, but the corresponding feet in the unconventional interlexical candidates are all tri-syllabic.

(6)		TRISYLLABIC	BISYLLABIC
	<i>infer-ence</i>	vs. * <i>infér-ence</i>	(cf. <i>infér</i>)
	<i>réside-ence</i>	vs. * <i>resíde-ence</i>	(cf. <i>resíde</i>)
	<i>prótest-ant</i>	vs. * <i>protést-ant</i>	(cf. <i>protést</i>)
	<i>parént-al</i>	vs. * <i>párent-al</i>	(cf. <i>párent</i>)

Fig. 8: Phonological Opacity (sólidify)

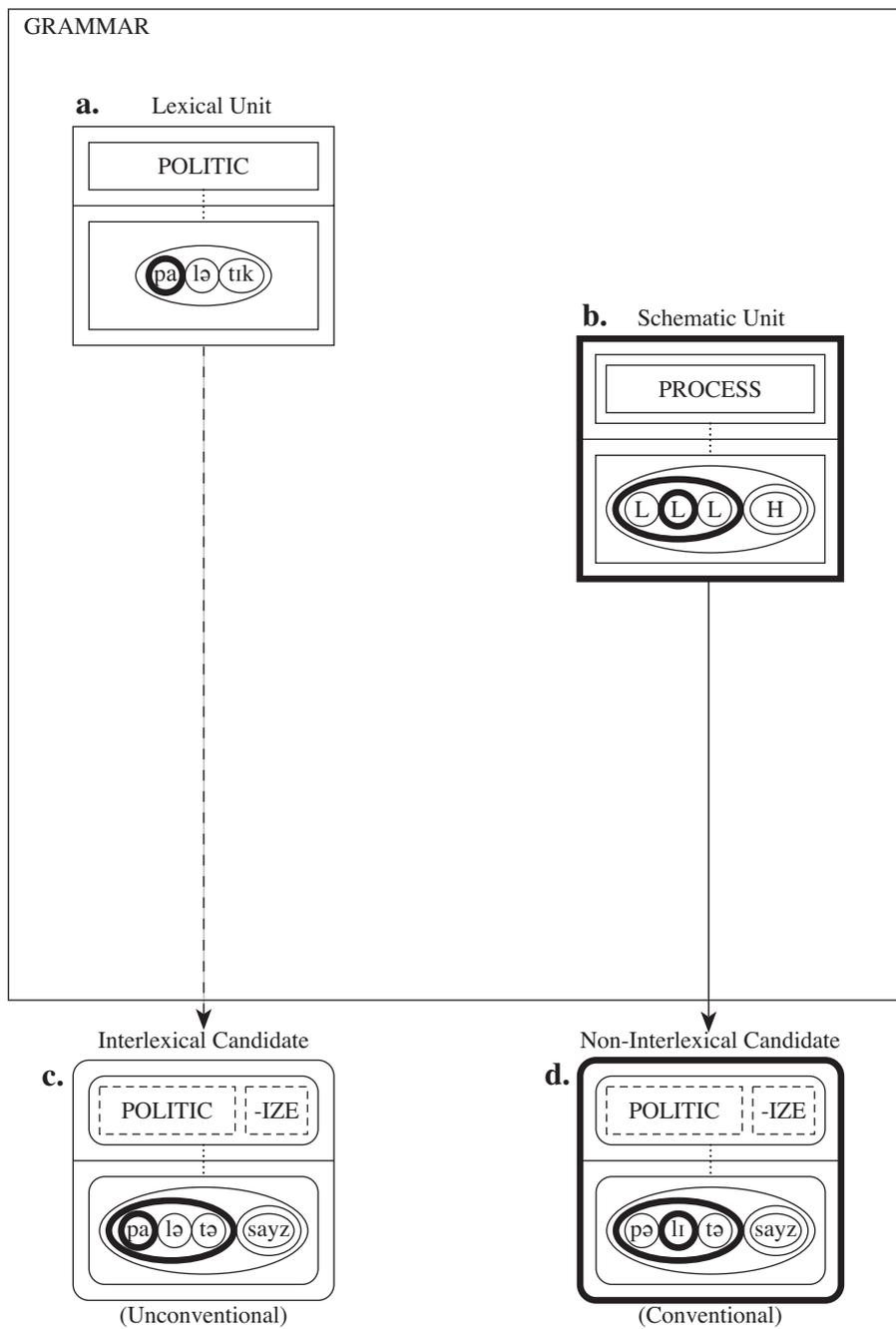


IV.2. Semantic opacity

Next, let us examine the case of decreased “semantic” decomposability, or semantic opacity, resulting in the prevalence of the phonological structure analogous to comparable monomorphemic words. Consider the case of *politicize*, depicted in Fig. 9. In this case, the non-interlexical *politicize* prevails over the interlexical *póliticize* because of semantic opacity. The configuration of the network for *politicize* in Fig. 9 is exactly the same as that for *solidify* in Fig. 8. However, there is some difference in the nature of the cause for the greater distance between the lexical unit (*pólitic* in Fig. 9a) and the interlexical candidate (*póliticize* in Fig. 9c); the cause is the decreased “semantic”, rather than “phonological”, decomposability. That is, the semantic pole of *pólitic*, which is used to describe characteristics not necessarily related to politics, is not as readily recognizable in that of *politicize*, as *général* is in *généralize*. More similar examples involving decreased semantic decomposability are provided in (7):

- (7) *élément-ary* vs. **élément-àry* (cf. *élément*)
origin-àte vs. **óorigin-àte* (cf. *óorigin*)

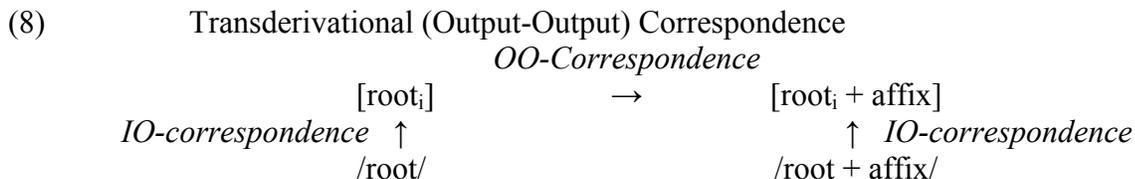
Fig. 9: Semantic Opacity (*politicize*)



V. INTERLEXICAL RELATIONS IN OPTIMALITY THEORY

Since Chomsky & Halle (1968), many generative phonologists attempted to explain interlexical relations between independent words, as observed in (1) above, by deriving one from another using the notion of “cycle”.¹⁵ In this type of “cyclical” approaches, the effect of the metrical structure of the smaller word on that of the larger is automatic, for the latter structure is literally “built from” the former. In terms of the representation systems employed, there have been basically two different approaches; namely, the tree theory (Hayes, 1982, 1984; Kiparsky, 1979, 1982; Liberman & Prince, 1977) and the grid theory (Halle & Vergnaud, 1987; Prince, 1983; Selkirk, 1984). The most recent addition to this tradition is optimality theory, which abolishes rules and derivation, and instead relies on simultaneous evaluation of competing constraints. In what follows, we will see how interlexical relations are handled in the theory.

In optimality theory, interlexical relations are formulated as constraints on the correspondence between one output and another (Benua, 1997, 2000, 2004). Such an analysis is illustrated in (8) (Benua, 1997: 27):



Benua, following the tradition of lexical phonology, proposes to categorize English affixes into two classes: those which mostly ignore the stress patterns of the root words (Class 1) and those which preserve them (Class 2):

- (9) Types of English Affixes
 Class 1: *-al, -ate, -ic, -ity, -ous, -in*, etc.
 Class 2: *-able, -er, -ful, -ist, -ness, un-*, etc.

(10)a illustrates the output to output constraint for Class 1 affixes, and (10)b, that for Class 2 affixes. Both constraints state that the second output must be similar to the first one, but with

differing strength: the constraint imposed by Class 1 affixes ranks lower than that by Class 2 affixes.

(10) Two OO-correspondence Relations

- a. Class 1: OO₁-Identity
- | | | | | | | | | | | | | | | |
|----------|---|---|---|---|---|---|---------------|---|---|---|---|---|---|---|
| ó | r | í | g | i | n | → | o | r | i | g | i | n | a | l |
| ↑ | | | | | | | ↑ | | | | | | | |
| /origin/ | | | | | | | /origin + al/ | | | | | | | |
- b. Class 2: OO₂-Identity
- | | | | | | | | | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|------------------|---|---|---|---|---|---|---|---|---|---|
| ó | b | v | i | o | u | s | → | ó | b | v | i | o | u | s | n | e | s | s |
| ↑ | | | | | | | ↑ | | | | | | | | | | | |
| /obvious/ | | | | | | | | /obvious + ness/ | | | | | | | | | | |
- c. OO₂-Identity >> OO₁-Identity

The tableau representations are provided in (11) and (12). Note that Benua has to have two recursions in each of which the same set of constraints must be evaluated. In the *ó*igin/*o*riginal case represented in (11), the stress pattern of *ó*igin is determined in the first recursion. This pattern does not play a role in the determination of that of *o*riginal taking place in the second recursion because the weak constraint imposed by Class 1 affix *-al* (OO₁-Identity) is outranked by the regular stress-determining constraint (Align-R). In the *ó*bvious/*ó*bviousness case depicted in (12), the strong constraint imposed by the Class 2 affix *-ness* (OO₂-Identity) is ranked higher than the regular stress-determining constraint (Align-R), and thus the stress pattern of *ó*bviousness determined in the second recursion is affected by the stress pattern of *ó*bvious determined in the first recursion.

(11) Recursion (A)

/origin/	NONFINAL	ALIGN-R	OO ₁ -IDENTITY	>>
a. o(rí.gin)	*!			
b. σ (ó.ri)gin		*		
c. (ó.ri)gin		*		

Recursion (B)

>>	/origin + al/	NONFINAL	ALGIN-R	OO ₁ -IDENTITY
	a. o(rí.gi)nal		**	
	b. \mathcal{E} o(rí.gi)nal		**	*
	c. (ó.ri)gin.nal		***!	

(12) Recursion (A)

/obvious/	NONFINAL	OO ₂ -IDENTITY	ALGIN-R	>>
a. ob(ví.ous)	*!			
b. (ób)vi.ous			**	
c. \mathcal{E} (ób)vi.ous			**	

Recursion (B)

>>	/obvious + ness/	NONFINAL	OO ₂ -IDENTITY	ALGIN-R
	a. ob(ví.ous)ness			**
	b. ob(ví.ous)ness		*!	**
	c. \mathcal{E} (ób)vi.ous.ness			**

There are some problems with this optimal theoretic analysis that should be pointed out. First, there is no explanation provided of the fact that there are complex words with a Class 1 suffix that retain the stress patterns of the root words (e.g. *óxygen-àte*). Second, the analysis makes use of an output-to-output constraint involving recursive application in a framework that supposedly dispenses with “derivation”. Tableau in (11) undoubtedly involves a process metaphor, and these recursions are simply cycles in a modern disguise. Third, there is no straightforward way to bring semantic information to bear on a phonological process (although in Section IV.2 we demonstrated that the contrast between *demócratize* and *généralize* can only be explained by the different degrees of semantic decomposability involved).

VI. CONCLUSION

In this paper, we have shown that the theory of cognitive grammar, whose focus has primarily been on semantic analyses, is capable of offering a framework in which a phonological phenomenon such as interlexical relations in English stress can successfully be accounted for.¹⁶ In Section III, we specifically observed that one can successfully account for interlexical relations by treating actually-occurring expressions as constraints and that cognitive grammar, being a usage-based, non-reductionist framework, can do so in a coherent manner by giving no inherent distinction between actually-occurring expressions and the schemas that are extracted from them. Optimality theory, on the other hand, can accommodate interlexical relations, but only with some fundamental theoretical incongruity, i.e. forcing an output to influence another output.

In Section IV.2, we further observed that if one wishes to offer a precise account of interlexical relations, one should employ semantic factors in addition to phonological ones. Optimality theory may well be able to incorporate semantic factors in phonological analyses, but only with significant conceptual or organizational difficulty. Cognitive grammar, in contrast, can naturally bring semantic factors to bear on phonological analyses because it employs only those theoretical constructs which have already been proposed elsewhere for semantic analyses. This demonstrates that unlike modular theories of grammar, cognitive grammar achieves theoretical unification, employing the same set of constructs to explain structures at both the phonological and semantic poles.

NOTES

1. We thank Matthew Chen and Ron Langacker, who gave valuable comments on earlier versions of this paper. We are also grateful to the editor of this volume and anonymous referees for their helpful comments. All the remaining errors are of course ours. The work reported in this paper was partially supported by the Keio Gijuku Academic Development Funds.

2. Words with certain affixes (e.g. *-able*, *-ful*, *-ness*) are always faithful to the stress patterns of the root words. In this paper, we will only be concerned with those affixes which would affect the stress patterns of at least some, if not all, root words.

3. For an illustration of various types of interlexical relations that affect the stress patterns of complex words, see Chen (1989).

4. Therefore, cognitive grammar is in a sharp contrast with generative frameworks, which are characterized as “top-down, reductionist, and minimalist”.
5. American pronunciation and American phonetic notation, not the IPA, will be used throughout this paper to follow the notation of Langacker (1988), to which the current paper owes much.
6. The semantic pole [THING] is to be taken as the semantic value common to all types of nouns, and the phonological pole [x] simply stands for any phonological content.
7. For discussions of the linguistic importance of the notion of prototype and its definition, the reader is referred to Lakoff (1987) and Geeraerts (1989, 1997), among others.
8. There are subschemas below the schema in question, but they are abbreviated for the sake of simplicity.
9. We believe that the range of data that are explainable by the two proposals are identical; one only needs to translate between selection among schemas and that among candidates. One can of course choose between the two models on the basis of “psychological reality”; however, the relevant mental activities that are involved are highly abstract, which leads us to believe that it is not possible to detect any decisive differences. We propose (5) here because it is more congruous with the interactive activation model and it is easier to mentally manipulate concrete entities (such as candidate expressions) than abstract entities (such as schemas).
10. In the figure, linguistic units listed in the grammar, i.e. conventionalized expressions, are enclosed in a rectangular box (the categorizing units in Figs. 4a, c, e, and n) and those not, i.e. unconventionalized expressions, listed in a box with round corners (the candidate expressions in Figs. 4y and z).
11. In the current paper, we adopt the “maximal onset” principle (Kahn 1976) for syllabification. There are other syllabification rules that treat “v” in *avocado* as the coda of the initial syllable or as “ambisyllabic”, which can easily be accommodated in the current analysis only with minor representational modifications.
12. This symbolic relation always holds between the semantic and the phonological pole of any expression. However, these relationships were suppressed in Fig. 1 above for expository purposes, although they are actually present.
13. The exact nature of the negligible conflict will be described later in this section.
14. The details of this schema will be provided later in this section.
15. However, there have been some “noncyclical” approaches to English stress proposed within generative phonology. See Schane (1975, 1979), among others.
16. It would be due at this juncture to point out the limitations of the analysis presented in the current paper that should be addressed in future research. First, the range of data that are explained in the analysis is admittedly small, although we believe that they are representative and that the analysis can extend to a full range of data without significant modifications. Second, with respect to the activation principle in (5)a, objective methods to assess the degree of cognitive salience of a unit and the distance between a categorizing unit and a candidate are called for. Psycholinguistic experiments or simulation using a connectionist model could offer such methods.

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