Plato's Problem and Recursiveness in English Word Stress Theory: The Case of *SPE* [*]

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1．Introduction

In this paper, I will give a brief overview of an approach to word stress in English in the generative tradition, focusing especially on Chomsky and Halle（1968）（hereafter *SPE*）.

In Section 2, I will review the goal of generative grammar and its view of language, addressing two points: "Plato's problem" in language acquisition and a "recursive procedure" within the system of language, i.e. the "recursiveness" of language. I will then examine the treatment of English stress in *SPE* in Section 3. Section 4 summarizes the discussions.

2．Generative Grammar

2.1．Its View of Language and Goal

It is often claimed that generative grammar has changed considerably over its sixty years of development. In fact, however, it has not. To substantiate this view, I will focus in this paper and in Yamada（2018）on two points: "Plato's problem" in language acquisition and a "recursive procedure" within

the system of language.

As mentioned retrospectively in Chomsky（1986: xxv）, Noam Chomsky seems to have long been intrigued by Plato's problem, paraphrased by Bertrand Russell as "How comes it that human beings, whose contacts with the world are brief and personal and limited, are nevertheless able to know as much as they do know?" This is also known as the "poverty of stimulus" issue. In other words, young children are able to acquire their mother tongue in a remarkably short period, compared with adult language learners, in a poor linguistic environment without instruction in any systematic, explicit grammar of the language they are exposed to. Further, the acquired language shows substantial uniformity among the language community, even though each child receives individual, distinct raw data as their linguistic "experience." This is the linguistic version of "Plato's problem."

What, then, is the most elementary property of language? According to Chomsky（2012: 17, 23）, "[language] [at its core] is a system of discrete infinity. Therefore it [= language] must incorporate a "recursive procedure" in some fashion." Chomsky uses the term "recursive procedure" here to introduce his idea of "Merge" in syntax. However, my understanding of the term as a phonologist is as follows: "A particular grammar of language is represented somewhere in a limited space in the brain in some fashion, since the brain itself is not limitless. The limited（or finite）grammar enables us to produce an infinite（i.e. limitless）number of expressions." Such a system may, in my view, be called a "recursive procedure."

To summarize briefly, in an explanation of the language acquisition of young children - which is one of the goals of generative grammar - we must account for "Plato's problem." Further, the acquired language must incorporate in its system a "recursive procedure." This is one of the fundamental views of language in generative grammar.

2.2．Basic Ideas

It is worth noting here that both the basic concept of Plato's problem and the recursive procedure were already expressed by Chomsky from the outset:

(1) a. "A speaker of a language has observed a certain limited set of ut-

terances in his language.　*On the basis of this finite linguistic experience he can produce an indefinite number of new utterances which are immediately acceptable to other members of his speech community*.　He can also distinguish a certain set of "grammatical" utterances, among utterances that he has never heard and might never produce.　He thus projects his past linguistic experience to include certain new strings while excluding others."　[Emphasis added]　　　　　　　　　　　　　　　（Chomsky（[1955] 1975: 61））

   b.　"Thus the process of transformational generation is *recursive* - infinitely many sentences can be generated."　[Emphasis added]
　　　　　　　　　　　　　　　　　　　（Chomsky（[1955] 1975: 74））

These are citations from Chomsky's earlier work.　In（1a）we see an early conception of "Plato's problem," where Chomsky states that "[o]n the basis of this finite linguistic experience he [the young child] can produce an indefinite number of new utterances which are immediately acceptable to other members of his speech community."

　The next citation（1b）shows directly the idea of recursion.　Therefore, we can state that in its fundamental concepts generative grammar has NOT changed over its sixty years of development.

2.3.　Innateness Hypothesis

　In an attempt to account for these two points, that is, "Plato's problem" in language acquisition and the most elementary property of language, recursion, the "innateness hypothesis" appeared in early form in Chomsky（1959）. This was subsequently advanced in Chomsky（1965）.　To paraphrase the hypothesis, as I understand it, Chomsky postulates that human beings have an innate theory（ability）, i.e. a language-acquisition device or universal grammar, incorporating a recursive procedure, that enables the young child in a matter of a few dozen months to acquire a particular grammar — for example of English, French, or Japanese — in spite of the linguistic poverty of his or her environment.　This concept, too, has not changed fundamentally in sixty years.

　Now that we have looked at the basic concepts of generative grammar, let

us examine how these affect the field of phonology, in particular the treatment of English stress in *SPE*.

3.　*SPE*

3.1.　Recursive Procedure

　SPE is the first and most significant study of English stress in the generative tradition.　In *SPE*, sets of ordered rules are postulated for English stress assignment, which are applied "cyclically" under the universal principle of a "transformational cycle," from the innermost constituents to the outermost. The principle represents the recursive procedure.

　The diagrams in（2）show schematically how sets of rules are applied:

（2）　a.　$\{ (R_1, R_2, R_3, R_4), R_5, \ldots , R_{n-1}, R_n \}$
　　　b.　$[[[[xxx]_{A(c)} \ xxx]_{B(c)} \ xxx]_{C(c)} \ xxx]_{D(n)}$

（2a）displays sets of ordered rules.　Rule 1, i.e. R_1, to Rule 4, for example, consist of a cyclic block of rules, enclosed by parentheses.　A noncyclic block of rules is enclosed by braces, within which the cyclic rules are included.　The rules are linearly ordered from R_1 to R_n.　In the cyclic block, "the rules apply in a linear sequence to a minimal structure [i.e. constituent] …, then reapply in the same sequence to the next larger [structure]"（*SPE*: 20）; by contrast in the noncyclic block, rules apply only once when their condition for application is met.　This is shown in（2b）, where the same set of rules is applied cyclically at each stage, from the innermost constituent to the outermost.　Note that the subscript capital to the right of the square brackets in（2b）shows each lexical category, accompanied by "c" standing for "cyclic" and "n" for "noncyclic."

3.2.　Predictability of Stress

　As Shimizu（1978）notes, Daniel Jones stated in 1950 that the placement of stress in English would not be predictable（3a）; by contrast, Chomsky, Halle, and Lukoff（1956）claimed that stress placement was predictable（3b）:

（3）a. Jones（1950: 134–35）: "Stresses are essentially subjective activi-
ties of the speaker. ... [i]t is often difficult, and may be impossi-
ble, for the hearer to judge where strong stresses are."

(Shimizu（1978: 132）)

b. Chomsky, Halle, and Lukoff（1956: 77）: "[P]honetic differences
in stress are predictable in terms of the representation."

Based on this claim, Chomsky and Halle wrote *SPE*.

3.3.　Latin Rule

One of the major contributions of *SPE* was the discovery of the Latin（or
Romance）stress rule in English.　Although English is in origin a Germanic
language, the Latin or Romance rule is used in *SPE* to elaborate the Main
Stress Rule based on a new concept of "weak or strong cluster."

The Latin stress rule is described as follows: assign pitch accent to the an-
tepenultimate（i.e. third from right）vowel if the penultimate syllable ends
with a lax vowel; otherwise, assign pitch accent to the penultimate vowel.
Latin examples are given in（4a）in contrast with Germanic Old English ex-
amples in（4b）, where stress is placed on the first syllable of the stem:

（4）a. Latin examples: *ad-ván-tus* 'arrival,' *for-tū´-na* 'fortune,' *Cí-ce-rō*
'Cicero.'

b. Old English examples: *Hó-lo-fer-nus* 'Holofernus'（*Judith* 21）
（Halle and Keyser（1971: 88））, *Cón-stan-tī-nus* 'Constantine'
（*Elene* 79, 103, 1008）, *Híe-ru-sa-lem* 'Jerusalem'（*Elene* 273）
（Fujiwara（1990: 15））[1]

Note that the essence of the Latin stress rule is to count the vowel from the
end of the word.

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[1] Actually, the examples in（4b）are not in origin Germanic Old English words, but loan
words from Latin.　However, they show very clearly the stress assignment mechanism of
Old English, as described in Halle and Keyser（1971: 88）, "[the loan words receiving] ini-
tial stress regardless of their original accentuation."

3.4.　Weak or Strong Cluster

A "weak cluster" is defined as a string consisting of a lax vowel（i.e. non-
tense vowel）followed by not more than one consonant, i.e. $^{-}V(C)$.[2]　Any
other clusters are strong, i.e. $^{+}V(C_0)$ or VC_2.[3]

Now, let us consider actual examples from *SPE*:

（5）Nouns by cluster

I	II	III
*Cán.**ad**.a*	*ar.**óm**.a*	*ag.**énd**.a*
$^{-}V(C)$	$^{+}V(C_0)$	VC_2

Here in（5）, the dots indicate the cluster division.　These are nouns.　The
relevant clusters are shown by bold type.　At the bottom of each column, the
cluster type related to the penultimate vowel is shown.　The word in column
I contains a weak cluster in the penultimate position, while the words in col-
umns II and III contain a strong cluster at the same position.　Stress is as-
signed to the antepenultimate vowel in column I, and the penultimate in col-
umns II and III.

Notice that if we disregard the final cluster of the nouns in（5）above, we
obtain the identical relationship, i.e. cluster type, as in（6）below:

（6）Verbs by cluster

I	II	III
*astón.**ish***	*maint.**áin***	*coll.**ápse***
$^{-}V(C)$	$^{+}V(C_0)$	VC_2

In column I, stress is placed one syllable left of the final cluster, while in
columns II and III stress is placed on the strong cluster itself.　In the case of
adjectives below（7）, we find an identical relationship to（6）:

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[2] In this paper, a lax vowel is represented by a capital V with a superscript minus before
it, while a capital "C" or "C_0" enclosed by parentheses shows that the use of C, i.e. a single
consonant "C" or more consonants "C_0", is optional.

[3] ^{+}V = a tense vowel;（C_0）= optional zero or more consonants; V = any vowel; C_2 = two
or more consonants.　Hereafter, for ease of exposition, I use slightly different symbols and
notations to *SPE*.

(7) Adjectives by cluster

I	II	III
*sól.**id***	*supr.**éme***	*abs.**úrd***
$^{-}V(C)$	$^{+}V(C_0)$	VC_2

It is interesting that in the case of adjectives with certain types of derivational affixes (8), we find the same relationship as in the nouns in (5) above:

(8) Certain types of derivational affixes by cluster

I	II	III
*pérs.**on**.al*	*anecd.**ót**.al*	*dial.**éct**.al*
$^{-}V(C)$	$^{+}V(C_0)$	VC_2

We term the "final extraneous edge-related segments" an edge phenomenon. Further, in (9), nouns with a final *tense* vowel behave like the verbs or adjectives of column II:

(9) Nouns (= Type II Nouns) by cluster

*reg.**íme***	*bar.**óque***	*pol.**íce***	*broc.**áde***	*kangar.**óo***
$^{+}V(C_0)$	$^{+}V(C_0)$	$^{+}V(C_0)$	$^{+}V(C_0)$	$^{+}V(C_0)$

3.5. Main Stress Rule

After considering all of these data, Chomsky and Halle put forward the following Main Stress Rule in (10):

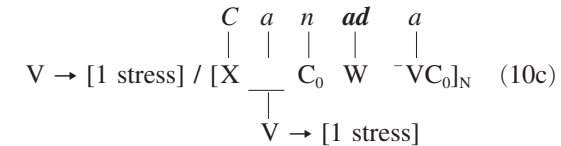(10) Main Stress Rule (Relevant parts only; simplified version)

    a. $V \rightarrow [1 \text{ stress}] / [X\_\_\_C_0W + \text{affix}]_{NA}$[4]

    b. $V \rightarrow [1 \text{ stress}] / [X\_\_\_C_0 + \text{affix}]_{NA}$

    c. $V \rightarrow [1 \text{ stress}] / [X\_\_\_C_0W \ ^{-}VC_0]_N$

    d. $V \rightarrow [1 \text{ stress}] / [X\_\_\_C_0 \ ^{-}VC_0]_N$

    e. $V \rightarrow [1 \text{ stress}] / [X\_\_\_C_0W]$

    f. $V \rightarrow [1 \text{ stress}] / [X\_\_\_C_0]$

The rule in (10) is a very simplified version, with only the relevant parts displayed. Notice that the rules in (10a–f) are "linearly" ordered, and ap-
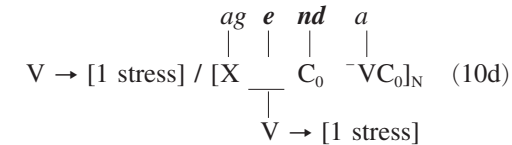
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[4] Here, "+affix" = certain types of affix: i.e. *-al*, *-ant*, *-ous*, *-ent*, etc.

plied "cyclically" from the innermost constituent to the outermost in "cyclic" domains. Further, this cyclic block of rules is ordered "disjunctively," meaning that if a rule applies in a cyclic domain, the remaining rules will not apply in that cycle. The applicability of the rules is "linearly" checked from (10a) to (10f) according to each condition for application.

Now, let us show how these rules are applied to words.

(11) *Cán.**ad**.a*

$$C \quad a \quad n \quad \mathbf{ad} \quad a$$
$$V \rightarrow [1 \text{ stress}] / [X\underline{\quad} C_0 \quad W \quad ^{-}VC_0]_N \quad (10c)$$
$$V \rightarrow [1 \text{ stress}]$$

For this word, rule (10c) applies because its condition for application is first met in the linear sequence of rules. The last vowel "a" of the word corresponds to "a lax vowel" (^{-}V), and the cluster in bold is weak. Thus, main stress is placed on the antepenultimate vowel, i.e. the third from right. In (12) below, on the other hand, stress is assigned to the penultimate syllable of the strong cluster in bold by rule (10d):

(12) *ag.**énd**.a*

$$ag \quad e \quad \mathbf{nd} \quad a$$
$$V \rightarrow [1 \text{ stress}] / [X\underline{\quad} C_0 \quad ^{-}VC_0]_N \quad (10d)$$
$$V \rightarrow [1 \text{ stress}]$$

The next diagram in (13) shows how all the canonical data shown previously are accounted for by the Main Stress Rule in (10):

(13)

Word Types	Case Applied by MSR
Derivational Affixes I (8I)	(10a)
Derivational Affixes II, III (8II, III)	(10b)
Nouns I (5I)	(10c)
Nouns II, III (5II, 5III)	(10d)
Verbs I (6I), Adjectives (7I)	(10e)
Verbs II, III (6II, III), Adjectives II, III (7II, III), Nouns (9)	(10f)

For example, Derivational Affixes I of (8I) are accounted for by (10a).

3.6.　Cyclic Application of Rules

Let us proceed to a case with a cyclic application of rules (14):

(14)　a.　*còndênsátion* (< *condénse*)

　　　b.　　　　　　$[_N$ $[_V$ kāndens$]_V$　At + i ⁻Vn$]_N$

1st cycle		1			(10f)
		2	1		(10c)
		3	1		Rule [108][5]
	2	3	1		Rule [107b]
2nd cycle	3	4	1		Rule [63]

The derivation in (14) shows an analysis of the word *còndênsátion*, derived from the verb *condénse*. Note that tertiary stress is shown in this paper by a circumflex accent. In the first cycle, rule (10f) is applied to the innermost constituent, that is, the verb *condénse*, giving stress on the ultimate vowel in "*dénse*", i.e. the final vowel in this cycle. We then go on to the second cycle, where rule (10c) is applied, giving stress to the penultimate vowel, as in "*còndênsátion*," followed by other rules that are irrelevant here. There is no problem with this account.

3.7.　Problems with *SPE*

In (15), however, we meet a problem.

(15)　a.　*ìnformátion* (< *infórm*)

　　*b.　　　　　　$[_N$ $[_V$ inform$]_V$　　At + i ⁻Vn$]_N$

1st cycle		1			(10f)
		2	1		(10c)
		3	1		Rule [108]
	2	3	1		Rule [107b]
2nd cycle	3	4	1		Rule [63][6]

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[5] The numbers in square brackets refer to the original reference number(s) in *SPE*.

[6] In *SPE*, *tertiary* stress is expressed by the numeral 4.

The word *ìnformátion* is considered to have a similar morphological structure to *còndênsátion*, since *ìnformátion* is supposed to be derived from the verb *infórm*. Thus, here we will apply the same analysis as in (14); however, this gives an incorrect stress pattern. In other words, although *ìnformátion* does NOT in fact show any stress on the second syllable "for," derivation (15) predicts an incorrect tertiary stress on the second syllable in the second cycle (15b). Therefore, as shown in (16), in *SPE* the *ìnformátion* word type is assumed "exceptionally" to have a "flat structure" lexically, without any internal morphological structure:

(16)　a.　*ìnformátion* (< *infórm*)

　　　b.　　　　　$[_N$ infərmAšən$]_N$

		1		(10d)
	2	1		Rule [102c]
1st cycle	3	1		Rule [63]

This kind of treatment is ad hoc with regard to the natural morphological structure of the word, which is derived from the verb.

In addition to this ad hoc treatment of certain types of words, another weakness of *SPE* concerns Plato's problem.

3.8.　Plato's Problem in *SPE*

In Chapters 7, 8, and 9 in *SPE*, Chomsky and Halle attempted to establish the features for English from the viewpoint of "universal phonetics" based on the actual articulators of us humans, and to establish the relationship between them. The view shows their concern with "Plato's problem," since it deals with a universal aspect of language. However, as for the stress assignment of words in English, which was the main issue in *SPE*, they elaborate only the stress assignment mechanism of a speaker of that particular language, without showing any relations to a universal mechanism of stress assignment. In other words, they show the stress rules of English as a fixed set already given to native speakers of English. "Principles and parameters" are thus absent. This point is taken up more fully by Halle and Vergnaud (1987), which will be examined in Yamada (2018).

4.　Summary

I have attempted to show that, in its foundations, generative grammar has not changed over sixty years. We have seen how "recursiveness" is account-ed for or taken account of in *SPE*. I have also shown that "Edge interpreta-tion" plays an important role in *SPE*, and found that the conflict between the *còndênsátion* and *ìnformátion* word types is an unsolved problem in *SPE*.

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