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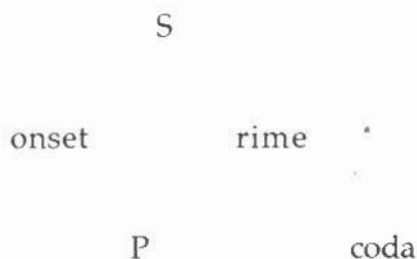
SYLLABLE STRUCTURE AND EXTERNAL EVIDENCE

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Abstract: To determine what psycholinguistic evidence (or external evidence) such as slips of the tongue, monosyllabic word blends, and novel word games reveals about syllable structure, this investigation focuses on psycholinguistic research on the English and German syllable. English and German in particular provide a good testing ground for the evaluation of external evidence because much external evidence has been interpreted as revealing the internal organization of the syllable for both languages. After a review of the external evidence, I argue that psycholinguistic evidence does not reveal syllable structure but rather how the linguistic processor organizes syllable-internal segments.

Psycholinguistic Evidence for the Onset and Rime

Psycholinguistic evidence seems to suggest a hierarchical syllable structure with an onset/rime division (MacKay 1972, Fallows 1981, Mohanan 1982;1986, Treiman 1983;1986;1988;1989, Berg 1989, Yaniv, Meyer, & Gordon 1990, Levitt, Healy & Fendrich 1991, Fowler, Treiman, & Gross 1993, Treiman, Fowler, Gross, & Berch 1995). Summing up psycholinguistic evidence for syllable structure, Levitt, Healy, & Fendrich (1991:339) state that "most of the evidence for the hierarchical division of the syllable into an onset and rime, and possibly into a nucleus and coda, comes from studies that present stimuli auditorily and require subjects to focus closely on phonological structure of the stimuli in order to play novel word games or perform segment interchanges." Although some psycholinguistic evidence reveals the peak and coda as subrime units, this investigation focuses primarily on the more accepted onset/rime structures. *The syllable as a hierarchical structure including the peak and coda is given below.*



Psycholinguistic Evidence for the Onset/Rime Division in German Syllables

MacKay (1972) examined German speech errors that involved the blending of two words with roughly the same meaning. Such blends are referred to as synonymic intrusions. Working from a data base consisting of synonymic intrusions, MacKay (1972:215) discovered that most of the "breaks within syllables immediately preceded the vowel" while few breaks immediately followed the peak. Concerning the behavior of vowels and post vocalic consonants, MacKay (1972:219) states that "final consonant(s) must form another group with the vowel since breaks rarely fell between final consonant(s) and the vowel."

Berg (1989) supports MacKay's (1972) findings. Also focusing on speech errors in German, Berg (1989:205) finds onsets were switched with onsets, suggesting an onset unit, and rimes were switched with rimes, suggesting a rime structure. Berg (1989:250) finds that "initial tongue slips occur almost five times as often as final errors". In sentence 1 below, an example of an onset-onset slip is offered. In 2, a coda-coda slip is given.

1. Ich befürchte, wir winden - finden nichts.
I'm afraid we won't find anything.
2. Ein Schluck. Stock- Stop!
A sip. Stop! (my translation)

Important about these findings is that speech errors occur more predictably after syllable initial consonants than before syllable final consonants. Syllable final consonants presumably do not break off from the rest of the syllable as readily because they belong to the subsyllabic structure, the rime. Syllable initial consonants break off more often in speech errors because they constitute an independent unit, separate from other subsyllabic structures.

Further speech error evidence for the independence of the onset and rime in German speech is offered below. Berg (1989) finds that the syllable onset rarely functions with the peak in cluster exchanges. Sentence 3 below exemplifies a CV tongue slip and sentence 4 demonstrates a VC slip.

3. Wir nehmen den höchsten Hörer an. -- den nächsten Hörer.
We put the next listener on the line.
4. Es ist nicht einfach, ihn wieder ins zweite Glück-Glied
zurückzubefördern.
It is not easy to move him from his top position one step back down the ladder.

In 3, the CV string *nä* - [ne:-] was replaced by the CV string *hö* - [hø-]. In 4, the VC *-ied* [-it] was replaced by the VC *-üek* [-yk]. Statistically more VC slips occurred than CV errors, suggesting that the VC combination is more cohesive than the CV combination. This evidence argues for the VC to constitute a unit rather than the CV because VC strings were found to pattern together more often than CV combinations.

Psycholinguistic Evidence for the Onset/Rime Division in English Syllables

In a series of experiments and in reports on psycholinguistic evidence involving word blends and novel word games, Treiman (1983;1984;1986;1988;1989;1995) examines the behavior of segments within the English syllable. In blend manipulation tasks, subjects tend to blend nonsense words according to the onset/rime division. In addition, novel word games were more easily and more accurately learned if the rules corresponded to the onset/rime structures.

In nonsense word blend tasks, Treiman (1988) had subjects combine two syllables into one response by joining part of the one syllable that was presented with part of another syllable. For example, subjects had to combine the two syllables /klum/ and /swauš/ into one response. The blending of the onset /kl-/ of syllable /klum/ with the peak /-auš/ of syllable /swauš/, was considered an O/PC (onset/peak-coda) response. Relevant to syllable structure, O/PC responses suggest that the peak and coda form a unit separate from the onset. The blending of the onset and peak of one syllable with the coda of another syllable was recorded as an OP/C response. An OP/C blend of the /klum/-/swauš/ example would be /kluš/. Instructions for the word blending task were to combine the two nonsense syllables into one by taking "part of the first syllable, starting from the beginning, followed by part of the second syllable to form one new syllable" (Treiman 1988:227). For each subject, the order of the stimulus pairs was chosen randomly. Subjects preferred O/PC blends over combinations that broke up the onset or rime structures such as OP/C blends.

In teaching novel word games, Treiman (1983:49) finds that subjects "preferred rules that referred to" the onset and rime structures "over rules that referred to other units." Furthermore, they learned rules that kept the onset and rime intact more easily than rules that divided these units" (p.49). To learn about the behavior of prevocalic consonants, Treiman (1983) had subjects add the onset of a CVC form to /æz/, the onset of a CCVC form to /-æz/ and add the first phoneme of the CCVC form to /-æz/. Specifically,

"rule A states /-æz/ is added to the onset of the stimulus and that the remainder of the stimulus follows" while "rule B states that /-æz/ is added to the first phoneme of the stimulus and that the remainder of the stimulus follows" (p.54). Examples of the CVC and CCVC forms are given below.

<u>CCVC: Rule A</u>	<u>CCVC:Rule B</u>	<u>CVC: A or B</u>
<u>s</u> kɛf --> æz -->/skæz/ /ɛf/	<u>s</u> kɛf--> æz -->/sæz/ /kɛf/	<u>k</u> lg -->æz-->/kæz/ /lg/
<u>g</u> lɔʃ --> æz -->/glæz/ /ɔʃ /	<u>g</u> lɔʃ --> æz -->/gæz/ / lɔʃ /	<u>t</u> ɛp --> æz--> /tæz/ ɛp/
<u>t</u> wʌl --> æz -->/twæz/ /ʌl/	<u>t</u> wʌl--> æz -->/tæz/ / w ʌl/	<u>n</u> ol --> æz-->/næz/ /ol/

For the CVC syllables both rules yielded the same results. Of interest was the behavior of the rule on CCVC forms. Subjects generalized the rule that divides the CVC string into C/VC to apply to CC/VC. Subjects preferred "the rule that refers to the onset over the rule that refers to just the initial consonant" (Treiman 1983:56).

Treiman (1983) carries out further experiments testing for the possibility of other subsyllabic units that "are involved in the processing of speech" (p.49). Other possible subsyllabic units targeted by manipulation tasks included: C/VC, CV/C, CV/CC, CC/VCC, CCV/CC, and CCVC/C. Subjects tended to learn rules more accurately and quickly that divided the syllables in C/VC or CC/VCC structures, suggesting a hierarchical onset/rime division of the syllable. Treiman (1983:70) concludes that "the rule that divided the onset was more difficult to learn than the rule that kept the onset intact. In addition, the rules that divided the rime (i.e., the CCV/CC and CCVC/C rules) were more difficult to learn than the CC/VCC rule which kept the rime."

Although in general I accept the results from the series of experiments, I offer a critique of the interpretation of the C/CVC units. An underlying assumption is that CVC of the C/CVC string does not form a unit because the VC string /-æz/ does not replace it. The VC string may not easily replace the CVC string because the units are not of the same shape. A CVC may have replaced the CVC of the C/CVC string more readily, thus suggesting that the initial consonant of a CC cluster may not be closely related to the second consonant of the cluster. Such a result would question the hypothesis that prevocalic segments form a cohesive subsyllabic unit separate from the rest of the syllable.

Another critique concerns the nature of the data. The data reveal that the prevocalic consonants break off from the rest of a monosyllabic form. It is not clear whether subsyllabic structures are revealed by the data or

sublexical/morphemic structures of the form word initial consonants + word remainder are revealed by the data. Davis (1989:211) notes that "evidence from speech errors and word games actually does not support the division of the syllable into onset and rhyme ... because such evidence is based on monosyllabic words." The behavior of speech errors and word games such as Pig Latin in polysyllabic words shows that word initial consonants rather than syllable onsets separate from the remainder of the word, suggesting sublexical structures rather than subsyllabic structures. Drawing on data from Fromkin (1973), Davis (1989:212) offers the following speech errors (Spoonerisms) and data from Pig Latin.

Spoonerisms

helf lemisphere for left hemisphere

Yoman Rokobson for Roman Jakobson

Word Game: Pig Latin

atinley for Latin

iminalcrey for criminal

In these Spoonerisms, the initial consonants or prevocalic word onsets switch. The rest of the polysyllabic words remains unaffected by the speech error. In the Pig Latin data, the initial consonant detaches from the word and is added to the end of the word followed by *-ey*. Important here is that much psycholinguistic data relevant to subsyllabic structures is ambiguous. The data may actually reveal sublexical structures of the form word initial consonants + word remainder, rather than the subsyllabic structures, onset and rime.

Moreover, subsyllabic units are not convincingly revealed in monosyllables due to word edge effects. Word edge effects refer to the word initial consonant(s) breaking off from the rest of the word in multisyllabic and presumably monosyllabic forms. To get positive evidence for the onset/rime structures, researchers targeted syllables in polysyllabic forms. Fowler et al. (1993) looked at disyllabic nonwords and trisyllabic nonwords to find out if onsets and rimes can be detected in syllables of multisyllabic nonwords. Phoneme shift tasks (visual stimuli) and novel word games (auditory stimuli) were used to target subsyllabic structures in polysyllabic forms. The disyllabic stimuli took the form of C_1VC_2/C_3VC_4 . The trisyllables were $C_1V/C_2VC_3/C_4VC_5$. The slash indicates a break between syllables.

In the disyllabic forms, C_2 and C_3 could not be syllabified in the same syllable due to English phonotactic constraints. Stimuli involved two disyllables which were presented visually. The second disyllable contained a capital letter. For example, the stimuli would be *mupnav leFbok*

pronounced as /mʌpɪnæv/ /ɛfbak/. These stimuli prompted subjects to shift C₂ of the second disyllable to C₂ of the first disyllable resulting in the form /mʌfɪnæv/. In other shift tasks, C₃ was targeted as well as CV and VC strings. For disyllables, Fowler et al. (1993) found no evidence for subsyllabic onset/rime structures.

In a novel word game and in phoneme shift tasks, Fowler et al. (1993) tested trisyllabic nonsense words of the form C₁V/C₂VC₃/C₄VC₅. Slashes indicate syllable breaks due to the phonotactics of English syllabification. Medial syllables were CVC and were always stressed. Onsets, rimes, codas, and CV's were targeted. Onset/rime response times involving the manipulation of the onset/rime structures were faster and more accurate than response times involving the manipulation of codas, and CV strings. The accuracy and speed associated with the manipulation of onsets/rimes in medial syllables suggests the validity of onsets and rimes. Experiments involving disyllables and trisyllables lead Fowler et al. (1993:115) to the conclusion "that both word structure and syllable structure characterize spoken words."

Treiman et al. (1995) also investigated disyllables and trisyllables using novel word games to distinguish between word-based structure and syllable-based structure. Treiman et al. (1995:132), incorporating Fowler et al. (1993) conclude "that both syllable structure and word structure play a role in the processing of spoken words." Important about Fowler et al. (1993) and Treiman et al. (1995) is that they offer evidence for the validity of onset/rime as subsyllabic units. The nature of these units, however, is misinterpreted as syllable structure.

Psycholinguistic Evidence and Linguistic Processing

In this section I argue that the external evidence reviewed in this investigation 1) reveals how the processor organizes intrasyllabic constituents and 2) is not directly relevant to the representation of knowledge of intrasyllabic organization. First, external evidence such as speech errors is shown to be directly relevant to the representation of processing structures involved in the production and perception of the subsyllable. Shattuck-Hufnagel (1987:17) states "most models of the speech production planning process assume that the word or lexical item is a processing unit; i.e., that the word is a language element that is manipulated during the planning of an utterance. Speech error data support this view, showing that individual words and morphemes are sometimes reshuffled during processing to create errors." Moreover, Shattuck-Hufnagel (1987:18) continues, "some of the structural subunits of the syllable do find support in error data in the form of errors that

involve movement or replacement of whole onsets, rhymes, nuclei and codas..." External evidence reviewed in this investigation demonstrates that onsets and rimes are processing units according to "models of the speech production planning process" because they are 1) reshuffled or moved through processing to create onset-onset and rime-rime, and onset-rime slips of the tongue (MacKay 1972; Berg 1989), 2) manipulated during the planning of an utterance in attempts at blending two monosyllables (Treiman 1988), and 3) replaced by like structures such as VC's for VC's in novel word games (Treiman 1983).

Moreover, linguistic processing theories identify prevocalic consonant(s) and the nucleus + post vocalic consonant(s) to be processing units. Node Structure theory exemplifies the point. In Node Structure theory, nodes represent "theoretical processing units" (MacKay 1992:42). Relevant to onset and rime structures, "lexical nodes prime specific phonological nodes, representing syllables (e.g., pre)" and "phonological compound nodes (e.g., pr)..." which are smaller than the syllable but larger than the phoneme. Specifically, the processing units called phonological compound nodes refer to an "initial consonant group" and/or "vowel group" (MacKay 1992:43), which precisely correspond to the O/PC and CC/VCC units revealed in Treiman (1988;1983) and the onset-onset, VC-VC exchanges in Berg (1989). The so-called onset/rime structures are actually processing units. (For a detailed description of Node Structure theory see MacKay (1987;1992)).

Because the onset and rime are processing structures directly involved in processing the subsyllable, they can not be directly relevant to the representation of knowledge of the internal organization of the syllable. Theorists concerned with linguistic processing view production and perception as skills not knowledge. In fact, theories that address language production are concerned with the underlying mechanisms and cognitive processes associated with skills in general. MacKay's (1987;1992) Node Structure theory, which incorporates language processing exemplifies the point. This theory was originally developed "not just to explain speech errors or even language production, but to address much more general issues: the mechanisms underlying sequencing and timing in behavior, the effects of practice on behavior, the speed-accuracy trade-off in the perception and production of skilled behavior, asymmetries in the ability to perceive as opposed to produce skilled behavior, the perception of ambiguous inputs, the use of perceptual feedback in monitoring skilled behavior, and the effects of delayed and amplified auditory feedback on the production of speech and other cognitive skills" (MacKay 1992:41). The onset and rime processing structures should not be used as evidence for representing knowledge (of the internal organization of the syllable) since processing structures are associated with skilled behavior not knowledge.

Organization of the Syllable and Internal Evidence

External evidence reveals how the linguistic processor organizes subsyllabic segments, but does the processor determine syllable structure? If so, knowledge of the internal organization of the syllable may turn out to be hierarchical. Moreover, what is the nature of the relationship between the representation of processing syllable internal segments and the representation of knowledge of the organization of intrasyllabic segments? (For a representation of the interface between subsyllabic processing and knowledge see section: An Interface Model: External Evidence, Internal Evidence and Processing Subsyllabic Knowledge.)

Linguistic knowledge in this paper refers to I(nternalized)-language (Chomsky 1986;1995). Representing I-language or "knowledge of language in informal usage" (Chomsky 1986:28) refers to the mental representation of rules in a system of rules that underlies the processing of speech (Chomsky 1986:27&41) . (For a discussion on I-language and knowledge of language see Chomsky (1986:1-50)).

Evidence from linguistic rules internal to the system of rules in language (internal evidence) suggests that the syllable is actually flat rather than hierarchical. Internal evidence for syllable structure incorporates intrasyllabic distributional constraints and stress assignment rules. A diagram of the syllable as a flat structure is given below.



Flat Syllable Structure and Evidence from Distributional Constraints

Distributional constraints of intrasyllabic segments argue directly against an onset/rime view of the syllable in both English and German. Well known cooccurrence restrictions on intrasyllabic segments for the English syllable are offered in Clements and Keyser (1983) and Davis (1982). This evidence suggests that the prevocalic segment(s) and the peak of the syllable pattern together as a unit. Clements and Keyser (1983:20) claim that "cooccurrence restrictions holding between the nucleus and preceding elements of the syllable appear to be just as common as cooccurrence restrictions holding between the nucleus and the following elements." Examples of onset-nucleus (coda) restrictions given below (Clements and Keyser 1983:20-21) suggest a close relationship between a) the onset and peak, and b) the onset and the peak plus post vocalic consonants.

1. Voiced fricatives and /Cl/ clusters are excluded before /ʊ/
2. Anterior fricatives /f,v,s,z,θ,ð/ are excluded before /u:r/
3. Stop plus /w/ clusters are excluded before /u:,ʊ,ʌ, aw/
4. /Cr/ clusters are excluded before /er,or,ar/

Pike & Pike (1947:87) describe prevocalic consonant(s)-nucleus cooccurrence restrictions in the Mazateco syllable.

1. The vowel *o* may not be preceded by the consonant *v* or clusters with *v*.
2. The vowel *e* may not be preceded by the consonant *ʃ*.
3. The vowel *i* may not be preceded by the consonant *ñ*.
4. The nasalized vowels have the same limitations, and in addition may not be preceded by *v, y, l, r*, or their clusters, nor by *m, n, ñ*.

Restrictions between the prevocalic consonant(s) and post vocalic consonant(s) hold for the German syllable. Hall (1992:43-4) includes earlier work by Twaddel (1939-40) and Augst (1971) to illustrate the distributional constraints.

*pf+vowel+velar stop

*s/ʃ + [-cor] obstruent + vowel + obstruent, where the pre- and post vocalic obstruents share the same place features.

Flat Syllable Structure: Evidence from Stress Assignment

Davis (1982;1988) argues against the hierarchical onset/rime organization of the syllable and for a flat structure by using evidence from stress assignment rules. To posit a flat syllable based on stress assignment rules, combinations of intrasyllabic segments need to be important to the stating of the environmental conditions relevant to stress assignment. Under this view, the nucleus + post vocalic consonant(s) can not be considered more closely related to each other if the combinations pre + post vocalic consonant(s) and prevocalic consonant(s) + nucleus can also provide an environment in which stress rules may operate.

It is well known that the nucleus and/or nucleus + post vocalic consonant(s) are important to stress assignment in many languages (Halle and Vernaud 1980). However, other languages make use of prevocalic consonants in stress assignment. Offered in Davis (1988), "Western Aranda (an Arandic language of Australia) has a stress rule that places main stress on the initial

syllable if it begins with a consonant; otherwise stress falls on the second syllable" (Davis 1988:1). Pirahã is also analyzed as having onset-sensitive stress rules, and for "Madimadi, Italian and English data ... stress shift rules and destressing rules can be onset-sensitive" (Davis 1988:16).

In addition to the onset and nucleus + post vocalic consonant(s), the combinations onset + nucleus and onset + coda can also provide the environment for the statement of stress assignment rules. Citing Dixon (1977:40), Davis (1982:7-8) offers the following stress assignment rule from the Australian language Yidinŷ. "Stress is assigned to the first syllable involving a long vowel. If there is no long vowel, it is assigned to the first syllable of the word." Moreover, "if the third syllable of a trisyllabic word is closed and begins with a stop or w, and if the second syllable is open and begins with a lateral or rhotic, then vowel length and stress are likely to shift from second to third syllable." The long vowel provides the environment for stress in the initial statement for stress assignment. In addition, the combination pre + post vocalic consonant of the third syllable in a trisyllabic word are important to stating the environment for stress assignment together with the combination prevocalic consonant + nucleus of the second syllable. If the closed syllable represents a long rime similar to a long vowel, then this datum provides evidence for the combination prevocalic consonant + remainder of syllable, suggesting the prevocalic consonant is closely related to the rest of the syllable.

Summing up the argument for a flat syllable structure where no one subsyllabic element is more closely related to any other, Davis (1982:3) notes that cooccurrence restrictions and language specific rule-environmental conditions demonstrate relationships between the "onset and peak as well as onset and coda...". Together with intrasyllabic distribution evidence, the fact that 1) the vocalic segment, 2) the vocalic segment + post vocalic consonant(s), 3) the prevocalic consonant(s), 4) the prevocalic consonant(s) + vocalic segment, and 5) the prevocalic consonant(s) + post vocalic consonant(s) are all important to stating the environment for stress assignment is interpreted as evidence suggesting that the nucleus is no more closely related to either the prevocalic or post vocalic consonant(s).

An Interface Model: External Evidence, Internal Evidence and Processing Subsyllabic Knowledge:

A coherent picture of the external (and internal) evidence reviewed in this study begins to emerge if we consider the syllable to be flat but processed hierarchically. Under this assumption, external evidence would reveal hierarchical structures and be relevant to the representation of the processing

of linguistic knowledge. Conversely, internal evidence would reveal a flat syllable structure and would be relevant to the representation of knowledge of the organization of intrasyllabic segments. The following considers one representation of the interface between knowledge of the internal organization of the syllable and the processing of that knowledge.

S

[onset]	[N	coda]
PB'o PB'o	PB'r	PB'r

P(rocessing) B(racekts) are associated with the flat representation of the syllable. PB'o(nset) applies to prevocalic consonants and PB'r(ime) operates on the nucleus + subsequent consonants. PB'o corresponds to the phonological compound node "initial consonant group" and PB'r corresponds to the "vowel group" in Node Structure theory. During linguistic processing relevant to subsyllabic segments, prevocalic consonant(s) are grouped together or organized by PB'o. Similarly, the nucleus and coda are organized by PB'r. Processing, then, gives the illusion of a hierarchical syllable structure because PB'o and PB'r chunk the syllable into two subsyllabic processing units. It is the processing units (the result of the application of the processing brackets) that interact in word blends, novel word games and slips of the tongue. It only appears that the nucleus and coda form a unit because they are chunked together for purposes of the production and perception of linguistic knowledge.

The interface model allows for arguments from processing theory that claim that processing units are revealed in speech error data (Shattuck-Hufnagel 1987:18) of the form prevocalic consonant(s) and nucleus + post vocalic consonant(s) (MacKay 1992: 43). In the model processing phenomena, onsets and rimes, are the result of the application of PB'o and PB'r on subsyllabic constituents. The interface model also shows how external evidence relevant to the subsyllabic level reveals hierarchical structures of the form onset and rime. Onset/rime breaks reported in MacKay (1972) and Berg (1989) and the onset/rime results in blend manipulation tasks that required subjects to form one syllable out of two (Treiman 1988) are explained in the following way. First syllable-internal segments are organized by the processing brackets which gives the illusion of hierarchical syllable structure. Then an error in the serial placement of the processing units yields subsyllabic breaks found in the external evidence. The relative ease of acquisition of novel word games that required onset/rime substitutions is explained by the shape of the units being manipulated. The substitution strings were easily processed

because they respected the boundaries of the processing brackets. When the substitutions took on other shapes such as C/CVCC or CCVC/C (non-processing units), acquisition became more difficult and less accurate (Treiman 1983). Under this view, acquisition can be facilitated if the structures being learned precisely coincide with processing architecture.

At this point in its development, the interface model is offered as an initial illustration of how the linguistic processor organizes syllable-internal segments. Processing may have to be hierarchical in nature due, in part, to speed constraints of on-line processing. The internal organization of the syllable may have to be flat to allow for all possible intrasyllabic relationships necessary for all possible segmental distributions and all possible environments for phonological rules relevant to the subsyllable. This model is not offered as a complete worked out representation of intrasyllabic processing. Many questions remain. For example, how are processing brackets applied/assigned? Why does one set only target consonants while the other set includes a vocalic segment? Does (degree of) sonority interact with processing brackets? Also, what is the nature of the relationship(s) between PB'o, PB'r and the articulatory mechanisms and comprehension strategies?

Conclusion

Many psycholinguistic studies have attempted to reveal syllable structure. Typically used in these studies are word blend tasks, novel word games, and speech error evidence. Noting "recent psycholinguistic evidence" from English, Levitt et al. (1991:337) state that such "evidence has suggested that the English syllables are organized hierarchically, divided first into an onset (consisting of the initial consonant or consonant cluster) and the rime (consisting of the following vowel and any additional consonants), with the rime further divided into a peak or nucleus (consisting of the vowel) and a coda (consisting of the remaining consonants)." I have argued that this is a misinterpretation of the external evidence. Rather than being "organized hierarchically," syllables are processed hierarchically.

The external evidence reflects the behavior of the units formed by the application of processing brackets. It is these units that interact in slips of the tongue, word blends, and novel word games. These units give the illusion of hierarchical syllable structure because they organize the syllable into two processing parts, the onset and rime. Moreover, external evidence is not directly relevant to the representation of knowledge of the internal organization of the syllable (in the sense of I-language) because such evidence reveals processing behavior, which is skilled behavior necessary to the production and perception of linguistic knowledge.

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