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A Metalinguistic Character of the "Irregular" Past Tense Forms in English

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Abstract: There is only a limited number of Past Tense verb forms such as *win-won, cut-cut, think-thought* that do not follow the rules of Past Tense /+(e)d/ formation and, thus, today these forms are considered to be irregular in Modern English. However, historically, these forms were part of the productive system in Old English. A sign-oriented phonological analysis of these "irregular" forms uncovers not only the systematic phonological and even iconic quality of the "irregular" Past Tense forms with an Internal Vowel Alternation (IVA), but also reveals the efficiency of the former productive conjugation system of the "irregular" Past Tense in Old English, thus showing that the IVA of the so-called irregular verbs, in fact, is a good example of the result of the efficient communication of human beings. Moreover, the semiotic analysis of the different types of the "irregular" verbs in terms of the theory of phonology/language as human behavior depicts and explains the behavior and cognitive aspects that might have been affected the retention of these so-called irregular forms in Modern English and preserved them from moving to the so-called regular (adding of the suffix *+ed/d*) Past Tense system.

Key words: communication, "irregular" verbs, past tense, phonology

> *… it is not up to language to conform to the edicts of linguistics, it is up to linguists to adapt their methods if they do not do full justice to the language being studied.* (Martinet, 1955, pp. 125–126)

> *The autonomy of linguistics and the use of the comparative method were suited to the task of describing and cataloguing the units and patterns in language. But in the 20th century linguists have started to ask why these units and patterns exist, i.e., they seek explanations for, not just descriptions of linguistic structure. We have reached the point where the continued re-working of the patterns in language no longer gives us answers to our questions.* (Ohala, 1983, p. 232)

1. Introduction

There is only a limited number of Past Tense verb forms such as *win-won, think-thought* and today these forms are considered to be irregular in Modern English, i.e., they do not follow the rules of Past Tense /-(e)d/ formation. However, historically, these forms were part of the productive system in Old English. A sign-oriented phonological analysis of the "irregular" verbs reveals not only the phonologically systematic and iconic quality of these forms, but also uncovers the efficiency of the former productive conjugation system of the Past Tense in Old

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English, thus showing that the so-called irregular verbs, in fact, is a good example of the result of an efficient system of language used by human beings to communicate. Furthermore, the semiotic analysis of different types of the "irregular" Past Tense formations in terms of the theory of *phonology/language as human behavior* depicts and explains the behavior and cognitive aspects that might have been affected the retention of these so-called irregular forms in Modern English and preserved them from moving to the so-called regular (adding of the suffix *-ed/d*) Past Tense system.

In the current study, I present the phonological analysis of one hundred "irregular" verbs of different types out of 307 "irregular" verbs recorded, for example, in *Oxford Advanced Learner's Dictionary*. The different types of the "irregular" verbs, such as: (1) syncretism, i.e., in which the Non-Past and Past Tense forms are identical; (2) forms in which a devoicing of the final apical stop is the Past Tense marker; (3) Past Tense formation by different kinds of Internal Vowel Alternations (IVAs), etc., are the remnants of the former conjugation systems in Old English. However, as the study of these "irregular" forms, following the theory *Phonology as Human Behavior* (PHB) reveals, all of these different types of Past Tense formation prove to be an efficiently constructed phonological system.

The theory of PHB was first developed by William Diver (1979) in the study of the initial consonant clusters in English and then, developed by Tobin (1997), in the theoretical and clinical analyses of different phonological systems and the phonological components of commonly used inflectional and derivational morphological systems in a large variety of languages. The PHB principles are based on the synergetic principle that *language represents a constant struggle between the communication and the human factors*. That is, the PHB theory explains the behavioral and cognitive aspect of human beings in the creation of the sound system of the language, the result of which is a linguistic system that is rich and economical enough to fulfill the communicative needs of the speakers, i.e., to be exploited in a proficient way and to be easily and quickly learned: "maximum communication with minimal effort" (Tobin, 1997).

2. Phonology as Human Behavior: Theoretical Tenets

> *The general question that confronts us is, how far will such well-known traits of human behavior penetrate into the structure of language? Our only answer lies in the skewed distributions, and the skewings we have been looking at suggest that, in the case of phonology at least, they penetrate very deeply indeed.* (Diver, 1979, p. 179)

This study explores the metalinguistic aspect of the phonologically efficient structure of the so-called irregular Past Tense conjugation system in English in terms of the human behavior and human physiology. The observed phonological quality of the "irregular" forms is explained in terms of the principles of the theory "Phonology as Human Behavior" (PHB) that underlie the analysis of the grammatical and phonological systems and non-random distribution of sounds in language and the major concept of which is a synergetic struggle: *the desire to create maximum communication with minimal effort* by taking into account the different roles of encoders and decoders needed to produce efficient communication (Tobin, 1997). Following the PHB theory, it is possible to explain the distribution of sounds within the particular speech signal, or as Tobin (2006, p. 64) claims: "it tells us why the distribution of phonemes within a language is not random but motivated". The earlier studies by Even-Simkin and Tobin (2013) of the "irregular" Past Tense formations with IVAs demonstrated the systematic feature of the IVA which: (1) performs specific communicative functions that are semantically motivated — the

communication factor; and (2) is systematically expressed by the individual forms found in the IVA phonological processes which can be efficiently identified, classified and remembered — the human factor. The current paper further studies the systematic phonological character of the "irregular" Past Tense forms, in general, and of the IVA forms, in particular. Indeed, the quantitive analysis of the phonotactic-phonological features of the "irregular" forms, presented in the next section, confirms the non-random distribution of phonemes not only in the IVA forms, but also in other types of the so-called irregular Past Tense forms. The next sections present a phonological analysis of the systematic and efficient distribution of the linguistic signs in these Past Tense forms that are examined and explained in terms of the PHB theory which is based on the synergetic principle that language represents a constant struggle between the *human* and the *communication* factors: i.e., human beings strive to achieve maximum communication through the use of minimal effort by a trade-off or compromise between the opposed forces of both of these factors in language (Tobin, 1997).

3. PHB Analysis of the "Irregular" Past Tense Forms in English

3.1 Data Corpus

As it was already mentioned earlier, "irregular" verbs present a very heterogeneous group that may be classified into various subgroups like: syncretism; devoicing of the final apical stop /d/; and the IVA subgroups, such as: [I], [ai], [æ]→[ʌ]; [Ii], [I], [æ], [aI]→[ɔ:]+ final voiceless /t/; [I]→[æ]; [Ii]→[ɛ] + (/t/); [ai]→[au]; [ɔ:], [əu], [aI], [ei]→[ʊu]; [æ], [eI] before /k/ or /nd/→[ʊu]. These nine types of the "irregular" verbs that will be discussed in this chapter are presented in Table 1, below:

Table 1 Types of the "Irregular" Past Tense Forms

Group	Non-Past	Past
A: Syncretism	beat	beat
	beset	beset
	bet	bet
	bid	bid
	broadcast	broadcast
	burst	burst
	cast	cast
	cost	cost
	cut	cut
	fit	fit
	hit	hit
	hurt	hurt
	knit	knit
	let	let
	put	put
	quit	quit
	wet	wet
	rid	rid
	set	set
	shed	shed
	shut	shut
	slit	slit
	split	split

(Table 1 to be continued)

(Table 1 continued)

	spit	spit
	spread	spread
	thrust	thrust
	upset	upset
	wed	wed
B: Devoicing of the final apical stop /d/	bend	bent
	build	built
	lend	lent
	spend	spent
	send	sent
C: IVA- **[I], [aI], [æ] → [ʌ]**	sling	slung
	sting	stung
	string	strung
	swing	swung
	wring	wrung
	fling	flung
	dig	dug
	spin	spun
	stick	stuck
	hang	hung
	strike	struck
	win	won
	ding	dung
D: IVA- **[Ii], [I], [æ], [aI]→ [ɔ:]** voiceless+ /t/ sound	think	thought
	teach	taught
	seek	sought
	fight	fought
	catch	caught
	buy	bought
	bring	brought
	see	saw
E: IVA - **[I]→[æ]**	drink	drank
	ring	rang
	shrink	shrank
	sing	sang
	sink	sank
	spring	sprang
	stink	stank
	swim	swam
	begin	began
F: IVA- **[Ii] → [ɛ]** + (/t/)	breed	bred
	creep	crept
	deal	dealt
	feed	fed
	feel	felt
	flee	fled
	keep	kept
	kneel	knelt
	lead	led
	leap	leapt
	leave	left

(Table 1 to be continued)

(Table 1 continued)

	mean	meant
	meet	met
	plead	pled
	sit	sat
	sleep	slept
	speed	sped
	sweep	swept
	weep	wept
	bleed	bled
	read	read
G: IVA- **[ai]→ [aʊ]**	find	found
	grind	ground
	wind	wound
	bind	bound
H: IVA- **[ɔ:], [əʊ], [aI], [eI] → [ʊu]**	draw	drew
	grow	grew
	know	knew
	throw	threw
	slay	slew
	fly	flew
	blow	blew
I: IVA- **[æ]**, **[ei]** before /k/ or /nd/ → **[ʊu]**	shake	shook
	take	took
	stand	stood
	understand	understood
	forsake	forsook

3.2 Phonemic Characterization of English in Terms of the PHB Theory

The phonologically-phonotactic analysis of the above presented corpus of the "irregular" verbs examines the non-random distribution of the phonemes in the "irregular" Past Tense forms following the theoretical and methodological tenets of the PHB theory. Thus, to study the phonemic system of the "irregular" verbs in English language, first, it is important to present and define the phonemic inventory of English (Table 2) and the phonetic characterization by stricture and airflow (Table 3) following the PHB approach.

Table 2 Phonemic Inventory of English

	Labial	Apical	Palatal	Velar	Glottal
Nasal	**m**	**n**		**ŋ**	
Stop	**p b**	**t d**		**k g**	
Affricate		**ʧ ʤ**			
Fricative	**f v**	**ɵ ð s z**	**ʃ ʒ**		**h**
Lateral		**l**			
Approximants	**w**	**ɹ**	**j**		

	Front	Central	Back
Close	**Ii**		**ʊu**
Close-mid	**eI I**	**ə**	**oʊ ʊ**
Open-mid	**ɛ æ aI**	**ɔI ʌ**	**aʊ ɔ**
Open		**a**	

Table 2 presents the phonemic inventory of English for the analysis of the phonemic system of the "irregular" verbs in English following the traditional and neo-traditional categories, such as: place and manner of articulation, introduced earlier in PHB studies (e.g., Diver, 1979; Davis, 1987, 1984; Tobin, 1997).

Table 3 Phonetic Characterization by Stricture and Airflow

Stricture	Phonemes	Airflow
0º	**p b t d k g**	0º: stopped
0º	**m n ŋ**	2º: nonturbulent
0º-1º	**ʧ ʤ**	0º-1º: stopped, then turbulent
1º	**ɵ ð f v s z ʃ ʒ**	1º: turbulent
2º	**l j ɹ w Ii ʊu**	2º: nonturbulent, potentially turbulent
3º	**I eI oʊ ə ʊ**	3º: nonturbulent
3.5º	**aI au ɔI**	3.5º: nonturbulent
4º	**æ ɛ ɔ ʌ**	4º: nonturbulent
5º	**a**	5º: nonturbulent

Table 3 presents thirty-eight phonemes of English, in which different functions of fifteen phonemes of aperture (vowels) and twenty-three phonemes of constriction (consonants) are defined. This classification of the consonants and vowels by stricture and airflow, as earlier was proposed by Tobin (1997, p. 59) allows "the establishment of a single hierarchy for all phonemes based on a fixed set of parameters of stricture and airflow — what underlies the traditional category of manner of articulation". In other words, this Table presents and explains the way these thirty-eight phonemes of English are phonetically characterized by six types of airflow as well as six hierarchically different degrees of stricture. This type of phonemic categorization, as will be further shown, may explain a metalinguistic connection of phonological system and the distribution of the phonemes within this system in terms of the human physiology and behavior.

3.3 Analysis

This study presents a sign-oriented linguistic analysis of the "irregular" verbs that do not conform to the "regular" Past Tense formation in English (the adding of the suffix *-d/ed* to the verb) following the theoretical and methodological tenets of the theory *phonology as human behavior*. This novel approach to the commonly considered irregular forms in Modern English, first, depicts the systematic character of the phonological variations in the Non-Past — Past Tense formation of the verbs. Second, the current analysis of the so-called irregular forms presents a further phonological explanation to the phonemic system in terms of the PHB theory, in general, and to the phonotactically systematic and efficient distribution of phonemes in the "irregular" verbs, in particular.

However, it is crucial to point out that, although these "irregular" verbs do not conform to the "regular" rules of the Modern English Past Tense formation, it does not directly imply the arbitrary nature of these so-called irregular forms. Indeed, most "irregular" verbs exist as remnants of historical conjugation systems (Even-Simkin & Tobin, 2013). In other words, what is considered to be an exception nowadays, a long time ago was a prevalent and productive conjugation system of Past Tense formation. According to Hulbert (1963, p. lvi), the general classification of the Old English verb system was as the following:

The two comprehensive classes of verbs are:

(1) Strong Verbs, those which form the Principal Parts with a variation of the radical vowel (Ablaut); and (2) Weak Verbs, those which (without ablaut) form the Preterit and Past Participle in **d**(**t**).

Moreover, as the further presented phonological analysis of the "irregular" verbs demonstrates, the rules that are disused today confirm the "paradigmatic systems of phonemes and the non-random syntagmatic patterns of their distribution[, which] directly reflect the axiom that language represents a constant search for maximum communication with minimal effort" (Tobin, 1997, p. xvii), and which will be discussed in the next sections.

3.3.1 Phonemes of Aperture

Following Davis (1987, 1984, p. 72): "[a]perture brings respite from constriction", and as Tobin (1997, pp. 84–85) further elaborates: "phonemes of aperture allow for maximum airflow and compose the nucleus of syllables in human speech. This central role in communication also implies that the collocation of phonemes of aperture is freer with respect to neighboring phonemes than that of constriction". That is, the phonemes of aperture are greatly influenced by the phonemes that come before or after them.

An interesting finding concerning *developmental phonology* from an evolutionary point of view (in terms of PHB) is the following:

> three patterns of coarticulation (similar to assimilation processes in developmental phonology) have been found in infants during the babbling period and in earlier periods (Davis & MacNeilage, 1994, 1995; Zlatic et al., 1987) and in languages (MacNielage et al., 2000) on the intra-cyclical (intra-syllabic) and the inter-cyclical (inter-syllabic) level (MacNielage & Davis, 1999, pp. 7–9):
> (a) coronal (PHB = apical) consonants /t, d, n/ favor front vowels;
> (b) dorsal (PHB = posterodorsal) /k, g/ consonants favor back vowels;
> (c) labial consonants /p, b/ favor central vowels. (Tobin, 2011, p. 181)

That is, following the PHB approach and the study of *Evolutionary Phonology*, in particular, coronal (apical) consonants /t, d, n/ might favor front vowels. Since the final phonemes of constriction in the verbs of the groups A and B are either /t/, /d/ or /nd/, /nt/, consequently, we may predict a tendency in favoring the front phonemes of aperture with these phonemes. Not surprisingly, in Table 4 we can see the considerable favoring of the front vowels before the apical consonants: /d, t, n/.

Table 4 "Irregular" Verbs of Groups A and B

Phoneme of Aperture / Group	**Ii**	**I**	**ɛ**	**ʊ**	**ɔ**	**a**	**ə**	**ʌ**	Total Number of Front Vowels	Total	The Percentage of Front Vowels
A	1	9	8	1	1	2	2	3	18	27*	67%
B	1	0	4	0	0	0	0	0	5	5	100%

The results of Table 4 confirm our prediction, i.e., there are five instances (100%) out of the group B and eighteen instances (67%) out of the group A with the front vowels before the apical consonants /t/, /d/ and /n/. Such absolute appearance of the front vowels before these apical consonants in the group B and a slight favoring of the front vowels before the consonants /t/, /d/ and /n/, (which are, indeed, the apical stops) depict the non-random distribution of sounds in language.

It is worth noticing that in nine instances (with the non-front vowels) out of twenty-seven "irregular" verbs of the group A, there are six verbs in which the final phonemes of constriction (consonants) /t, d/ are not in the strict neighboring to the phonemes of aperture (vowels), since there are other apical consonants, i.e., /r/-(retroflex) or

* In this study, the discussion of the phonemes of aperture refers to the vowels that come right before the final phoneme of constriction of the verb under study. That is, I present the analysis of the phonological character of the final syllables of the verbs that have been chosen for the hereby proposed analysis in terms of the PHB theory.

/s/-(fricative) that interfere between the vowel and the word-final apical consonant: /t/ or /d/. Moreover, in nine instances with non-front vowels before the coronal consonants /t, d, n/, there are two instances with the central vowel which is, in fact, the most common vowel across languages — /a/ (Davis, 1987, 1984; Stemberger, 1992; Tobin, 1997). The unpredicted appearance of the phoneme of aperture /a/ before the apical consonants may be explained by its features and a manner of articulation, i.e., it is an open and a central vowel, and the "maximal aperture is favored" (Davis, 1987, 1984, p. 78), thus, supporting the notion that the easiest sounds are favored in search for maximum communication with minimal effort (Tobin, 1997) following the theory *Phonology as Human Behavior*.

As in groups A and B, in the verbs out of groups C-I we may point out the non-random distribution of phonemes. However, a slightly different criterion differentiates these groups (C-I) from the previously discussed ones (A and B). That is, the verbs in the groups C-I share the same morphophonemic process of the IVA: the variation of the phoneme of aperture in the word-medial position of a verb. Table 5, given below, presents seven groups (C-I) with the different types of this IVA process.

Table 5 "Irregular" Verbs — Groups C, D, E, F, G, H and I

IVA / Group	Non-Past Tense Form	Past Tense Form
C	I/ aI/ æ	ʌ
D	I/ Ii/ aI/ æ	ɔ
E	I	æ
F	Ii	ɛ
G	aI	au
H	ɔ/əʊ/aI/ eI	ʊu
I	eI/ æ	ʊu

The analysis of the presented data reveals either a considerable or a slight backing process of a vowel-stem in the formation of Past Tense in the "irregular" verbs, earlier proposed in the study of the "irregular" IVA-ablaut Past Tense forms in Even-Simkin (2011, 2012). For example, in the group C we may point out the alternation of a vowel from a front vowel or lowering diphthong [I]/[aI]/[æ] to the central vowel [ʌ] in the Past Tense form. Indeed, in thirteen instances out of thirteen "irregular" verbs of group C (100%) we may observe the backing process of the IVA in the Past Tense forms. That is, we may witness a complete confirmation of the phonological backing process of the IVA in this group: from the front vowels (with front articulator — anterodorsum) in the Non-Past Tense form to the central vowels (with a more back articulators — mid-dorsum) in the Past Tense form. Unsurprisingly, the data presented in the rest of the groups also support the innovative findings concerning a systematic phonological character of the IVA, originally presented in Even-Simkin (2011).

In the next group (E), we may find the same backing process of the IVA of a different degree: from the high front vowel in the final syllable of the Non-Past Tense form [I] to the low front [æ] in the Past Tense form, thus again pointing to the backing process, since "[I] being more front than [æ]" (Ladefoged, 1993, p. 190). In fact, likewise in this group (E), in the other groups (D, F, G, H and I) presented in Table 5, we observe a precise and consistent indication of the systematic backing process of the IVA in the "irregular" verbs: in 100% of the instances of the "irregular" verbs we find the analogous backing process of the IVA in the Past Tense forms of different degrees. In all five groups, given in Table 5, we witness the following backing process: from mid-high

lax front, low front, rising high-front diphthong and lowering low-central mid-high-front diphthong [I]/[æ]/[Ii]/[aI], correspondingly, to low back [ɔ] in the Past Tense formation in the verbs of group D; from rising high-front diphthong [Ii] to mid-low-front [ɛ] in the verbs of group F. It should be noted that following the study of Acoustic Phonetics [I] and [i] are more front than [ɛ][1], thus once again confirming the systematic phonological character of the IVA in the so-called irregular Past Tense forms in English.

Moreover, it is important to admit the high efficiency of the vowel alternations found in the "irregular" verbs, of the above examined groups in terms of the *human factor*, that may be explained by "the principle of least effort" (Tobin, 1997, p. 16). Martinet, who studied the role of the human factor in the sound change and a non-randomness in the distribution of the sounds in language, in particular, claims that it is "the principle of 'least effort' … as well as that of internal organization thanks to which a balance is stuck between the fundamental antinomic tendencies he observed between 'man's need to communicate and express himself' and 'his tendency to reduce to a minimum his mental and physical activity'" as Le Roy (1967, pp. 71–72) points out. Consequently, it is reasonable to conclude that one phoneme (the vowel) is favored over two (diphthong) and that, indeed, we can observe in the vowel alternations discussed above, thus supporting "the axiom underlying PHB: the striving for maximum communication with minimal effort" (Tobin, 2005, p. 8).

In the next three groups G, H and I, this phonological systematic backing character of the IVA is more prominent and precise. A clear and even extreme phonological backing process of the IVA is evident in the vowel alternations to the mostly extreme high-back vowel or diphthong, respectively, [u] or [[ʊu]. In group G, we may point out an alternation of the lowering diphthong [aI] (which is combined out of low-central vowel /a/ and mid-high-front vowel /I/) to the lowering diphthong [au] (which is formed by the fusion of low-central vowel /a/ and high-back vowel /u/). As mentioned above, an apparent regularity of the systematic backing process of the IVA, thus, further supports the non-random and not irregular character of the so-called irregular verbs. This systematic phonological backing feature appears to be an extremely efficient in terms of the communication factor in "providing the extreme and most efficient communicative distinction" (Tobin, 1995, 1994, p. 316). Furthermore, it is worth pointing out the efficiency of the use of the low-central vowel /a/ in both diphthongs: [aI] and [au], in terms of the communication factor, i.e., it is "the most common vowel across languages" (Tobin, 2005, p. 13), since it is the easiest phoneme of aperture to make because "among apertures, maximum aperture is favored" (Davis, 1987, 1984, p. 78), thus providing clear distinctions and oppositions for a better communication.

Not surprisingly, in the next two groups H and I we observe the similar backing process of the IVA in the Past Tense forms of the "irregular" verbs. In group H, for example, we find various degrees of the backing process: from low-back [ɔ], lowering mid-central high-back diphthong [[əu], low-central high front diphthong [aI] and mid-front high-front diphthong [eI] to high-back diphthong [ʊu]. As can be seen in Table 5, almost all instances of the IVA demonstrate the backing process: from mid-central high-back diphthong, low-central high front diphthong and mid-front high-front diphthong to a rising diphthong composed of high-back vowels; and there is only one IVA form that does not show an apparent backing process: from low-back [ɔ] to high-back diphthong [ʊu], but which retains its phonological backing feature in the Past Tense form. Furthermore, the different instances of the various degrees of the backing process may be explained in terms of the communication factor, since naturally

[1] Following Ladefoged's (1993, p. 190) study of *Acoustic Phonetics*: "there is a better correlation between the degree of backness and the distance between the first two formants, which are far apart in front vowels and close together in back vowels". In fact, the distance between the first and second formants of /I/ and /i/ are far apart than of /ɛ/. Consequently, following the acoustic analysis, the vowel /ɛ/ is more back than two other vowels /I/ and /i/.

clear distinctions and oppositions provide a better communication, following the PHB theory. The most back and high vowel /u/, being the one of the mostly extreme sounds in the vowel system, is favored due to its distinctive features which provide the communicative oppositions[2]. In other cases we may point out a more apparent backing process: from the low-central high front diphthong [aI] and mid-front mid-high-front diphthong [eI] to the high-back diphthong [ʊu]. All these examples comprise 100% of the instances with the phonological backing process of the IVA, thus further supporting the systematic character of the IVA in the so-called irregular verbs.

The IVA observed in the final group (I), also evidently exhibits an obvious backing process, i.e., there is 100% of the instance of the backing process of the IVAs: from low-front [æ] or the lowering mid-front mid-high-front diphthong [eI] to the rising high-back diphthong [ʊu], thus again sustaining the communication factor, since the more distinct oppositions provide us with better communication. If to compare the last two groups (H and I), presented in Table 5, we may point out the similar vowel alternation in the "irregular" verbs out of these groups to the high-back diphthong [ʊu] in the Past Tense forms. However, it is also worth noticing one remarkable difference between these groups H and I, i.e., the diphthong [ʊu] appears in word-final position in group H and before the consonant in group I. This distinction between groups H and I also explains the sub-classification of the verbs in these groups, which, indeed, is significant for the further analysis of the distribution of the phonemes of constriction in the "irregular" verbs and which will be discussed in the next sections.

From the above observed data, we may conclude that the IVA process in the so-called irregular Past Tense formations is not just non-random, but rather phonologically systematic and follows various degrees of the backing process. Another important observation, previously discussed in Even-Simkin (2011), is that this backing process is iconic. As Tobin (2005, p. 18) claims: "iconic holistic connection between the signal and meanings in … [the] lexical-grammatical systems (Contini-Morava & Tobin, 2000) … serve[s] as an economical mnemonic memory-saving device of linguistic classification". It is precisely the phonological backing process of the IVA that emphasizes a metaphorical movement backwards in time, thus confirming the systematic character of the IVA in the "irregular" verbs.

Nowadays, the so-called irregular verbs do not follow the grammatical rule (-ed/d) and, thus, have to be memorized by the speakers of English language, though in Old English these "irregular" forms were part of the prevalent and productive grammatical system, as mentioned above. As a matter of fact, the iconicity of the backing process, as a memory saving device, emphasizes and explains the non-random distribution of the IVA process in the Past Tense formation. These observations underline an intrinsic link between the phonological system (the IVA) and the lexical-grammatical system (the Past Tense formations of the "irregular" verbs) further highlighting the semiotic property of language as a system that may be further defined as:

> a system of systems that is composed of various subsystems (revolving around the notion of the linguistic sign) that are organized internally and systematically related to each other and that is used by human beings to communicate. (Tobin, 1997, pp. 18–19)

In this section I have outlined the semiotic analysis of the "irregular" verbs following the theory: *Phonology as Human Behavior* by studying the systematic phonetically-phonological character of the phonemes of aperture

[2] According to the IPA chart, the vowels of the triangle composed out of the most extreme high front, high back and low central vowels: /I/, /a/ and /u/ provide the most extreme, but at the same time the most efficient communicative distinctions following the communication factor.

of these verbs which univocally follow the *backing process* "where the dorsum (or other *back articulators*) replaces the apex (or other *front articulators*)" (Tobin, 1997, p. 204 [My italics]). In the next sections I will further discuss the systematic character of the so-called irregular verbs by examining the phonemes of constrictions, i.e., the consonantal system of these verbs.

3.3.2 The Number of Syllables per Verb

Additional quantitative data on the non-random distribution of the phonemes in language, in general, and on the non-arbitrary distribution of phonemes in the "irregular" verbs[3] in English, in particular, are presented in the next nine Tables 6–14. The results of these Tables 6–14 present the number of syllables per verb for each group of the "irregular" verbs.

Table 6 The Number of Syllables per Verb for Group A

Number of Syllables	Number of Verbs	%
One	25	89
Two	3	11
Three	0	0
Four	0	0
Total	28	100

Table 7 The Number of Syllables per Verb for Group B

Number of Syllables	Number of Verbs	%
One	5	100
Two	0	0
Three	0	0
Four	0	0
Total	5	100

Table 8 The Number of Syllables per Verb for Group C

Number of Syllables	Number of Verbs	%
One	13	100
Two	0	0
Three	0	0
Four	0	0
Total	13	100

Table 9 The Number of Syllables per Verb for Group D

Number of Syllables	Number of Verbs	%
One	8	100
Two	0	0
Three	0	0
Four	0	0
Total	8	100

[3] This study proposes the phonological analysis of one hundred "irregular" verbs presented in groups A-I. Thus, in discussion of the "irregular" verbs, I will refer to the "irregular" verbs given in these nine groups (A-I).

Table 10 The Number of Syllables per Verb for Group E

Number of Syllables	Number of Verbs	%
One	8	89
Two	1	11
Three	0	0
Four	0	0
Total	9	100

Table 11 The Number of Syllables per Verb for Group F

Number of Syllables	Number of Verbs	%
One	21	100
Two	0	0
Three	0	0
Four	0	0
Total	21	100

Table 12 The Number of Syllables per Verb for Group G

Number of Syllables	Number of Verbs	%
One	4	100
Two	0	0
Three	0	0
Four	0	0
Total	4	100

Table 13 The Number of Syllables per Verb for Group H

Number of Syllables	Number of Verbs	%
One	7	100
Two	0	0
Three	0	0
Four	0	0
Total	7	100

Table 14 The Number of Syllables per Verb for Group I

Number of Syllables	Number of Verbs	%
One	3	60
Two	1	20
Three	1	20
Four	0	0
Total	5	100

The results that summarize the number of syllables per verb in all "irregular" verbs of the above presented nine groups are given in Table 15.

Table 15 The Number of Syllables per Verb for Groups A-I

Number of Syllables	Number of Verbs
One	94
Two	5
Three	1
Four	0
Total	100

From Table 15, a straightforward favoring of monosyllabic words (ninety-four) over bi-syllabic (five), tri-syllabic (one) words and apparent disfavoring of polysyllabic words (the absence of any polysyllabic "irregular" verb) is clearly evident. These results, i.e., a radical decrease in the number of verbs, from monosyllabic to polysyllabic words, may be explained by "a clear-cut synergetic favoring of maximum communication with minimal effort, …[that] is reflected in child language acquisition (one word — one syllable utterances) as well as *in human communication in general*" (Tobin, 1997, p. 153 [My Italics]). Thus, the results depicted in Tables 7, 8, 9, 11, 12 and 13, present 100% of monosyllabic "irregular" verbs in groups B, C, D, F, G and H, and we may point out only three group: A, E and I in Tables 6, 10 and 14, correspondingly, with the bi-syllabic and tri-syllabic verbs beside the monosyllabic ones. However, although there are only 20% of the bi-syllabic and 20% of the tri-syllabic verbs in group I, in groups A and E the remarkable favoring of the monosyllabic verbs (89%) is evidently obvious. Moreover, the complete absence of polysyllabic words further supports the non-random distribution of the sounds, in general, and in the "irregular" verbs, in particular, thus confirming the synergetic principle of the PHB theory: favoring of maximum communication with minimal effort.

3.4 Stress Skewings

This section confirms the non-arbitrariness of the word stress similarly to the non-arbitrary nature of the syllabic division that has been demonstrated in the previous section. Table 16 that presents the distribution for word-initial, word-medial, and word-final stress for the non-monosyllabic verbs given in nine groups (A-I), demonstrates that there is only one out of six verbs (approximately 17%) with *initial stress*; there is no any word with the *medial stress*; and five out of six words (approximately 83%) with *final stress*. These results are not so much surprising, since the most important grammatical role of a verb beside the lexical aspect is the tense marking. That is, verbs have to convey the time frame of the action, which grammatically usually appears word-finally in English. For example, the "regular" Past Tense is formed by adding the suffix (*-(e)d*) to the verb. Moreover, there is a number of "irregular" verbs which form the Past Tense by the adding of the voiceless stop (*-t*) word-finally, likewise in the verbs of groups D and F. Consequently, the word-final position of a verb is especially important, thus the word-final stress is one of the most efficient ways to highlight the grammatical information carried out by the verb. Not surprisingly, the expected tendency in favoring of the final stress may be observed in 83% cases (Table 16), since it carries the grammatical aspect, which is particularly necessary for the efficient communication. That is, we may point out the predominant number of the word-final stress: in five out of six non-monosyllabic verbs (83%) besides the only one verb (17%) that has word-initial stress, thus pointing to the particular favoring of the word-final stress.

Table 16 Stressed Syllables of the "Irregular" Verbs

Word Position	Number of Verbs	%
Initial Stress	1*	17
Medial Stress	0	0
Final Stress	5*	83
Total	6	100

*bi-syllabic and tri-syllabic words

The similar tendency may be found in the textual structure of a text, in which the final paragraphs usually carry out the most important information of the text in a concise form — a conclusion. Thus, the reader is expected to get the information concerning the general idea in a more refined and succinct form in the text-final or initial position. However, as one may notice, if to compare the introductory and the concluding paragraphs, the latter contains the more advanced and updated data concerning the results/outcomes. These observations emphasize an essentially significant role of the final paragraph in the text similarly to the final syllable in the word-final position that carries the Past Tense marker. However, as it may be observed in Table 16, there is one instance of word-initial stress. Since, as it was mentioned earlier, the grammatical marking is on the final syllable, even though "the regular English words containing more than one syllable – … favor initial stress" (Tobin, 1997, p. 154), there is a remarkable tendency for the word final stress in the non-monosyllabic "irregular" verbs. Moreover, the results shown in Table 16, demonstrate an absolute disfavoring of medial stress (0%), which as Tobin (1997, p. 155) argues "also reflects human short-term memory". Thus, we may conclude that there is a great tendency in favoring the final stress in non-monosyllabic "irregular" verbs in comparison with the initial stress and there is a complete exclusion of the medial stress. This planning of stress skewing may be also related to organization and planning of the air, probably, because "[p]eople prefer to save their energy and air and exploit them where it counts to elicit more efficient communication" (Tobin, 1997, p. 155).

3.5 The Disfavoring of Additional Articulators in Word-Initial Position and Word-Final Position

Since lexically — the highest communicative effect is in the word-initial position, and grammatically — as we have seen in the "irregular" non-monosyllabic verbs is in the word-final position, it is reasonable to assume that most of the effort and/or subtle organization of the phonemes might be found in these word-initial and word-final positions. Unsurprisingly, the analysis of the distribution of the phonemes in the word-initial and word-final positions supports our prediction of the non-random distribution of the phonemes in word-initial and word-final positions, i.e., in these positions we may observe that additional articulators are disfavored. In fact, the results of Tables 17, 18 and 19 confirm the remarkable disfavoring of the additional articulators for the following pairs in word-initial and word-final positions:

/p b/
/t d/
/k g/
/f v/
/ɵ ð/
/s z/
/ʃ ʒ/
/ʧ ʤ/

As it can be observed in Table 17, seventy-six "irregular" verbs of groups A-I begin with pairs of phonemes of constriction where voicing is a phonemic distinctive feature. As it is expected, phonemes of constriction that require the activation of two sets of articulators are greatly disfavored (there are only twenty-two verbs out of seventy-six, 29%), whereas the phonemes of constriction that require the activation of just one set of articulations are evidently favored (there are fifty-four out of seventy-six verbs, 71%).

Table 17 Voicing in Word-Initial Position in "Irregular" Verbs

+/- Mobile Pairs	+/- Stable Pairs	Totals	%
p 2 **t** 2 **k** 7	**f** 9 **θ** 3 **s** 27 **ʃ** 4 **ʧ** 0	54	71
b 15 **d** 5 **g** 2	**v** 0 **ð** 0 **z** 0 **ʒ** 0 **ʤ** 0	22 76	29 100

Table 18 presents the analysis of the word-final position of Non-Past Tense forms of the "irregular" verbs, which also confirms the great disfavoring of additional articulators in the word-final position. It is worth noticing relatively a more limited number of phoneme pairs in the word-final position of these infinitival (Non-Past Tense) forms in comparison to the number of phoneme pairs that we have seen in the word-initial position of these "irregular" verbs. That is, the pairs of the phonemes that may be found in the word-final position of these words are:

/p b/
/t d/
/k g/
/f v/
/ʧ ʤ/

Table 18 Voicing in Word-Final Position in the Infinitival/Non-Past Tense Form of the "Irregular" Verbs

+/- Mobile Pairs	+/- Stable Pairs	Totals	%
p 6 **t** 26 **k** 11	**f** 0 **θ** 0 **s** 0 **ʃ** 0 **ʧ** 2	45	63
b 0 **d** 23 **g** 2	**v** 1 **ð** 0 **z** 0 **ʒ** 0 **ʤ** 0	26 71	37 100

The results given in Table 18, once again support the notion of non-random distribution of phonemes, in general, and confirm our prediction that the Non-Past Tense forms of "irregular" verbs that end with pairs of phonemes of constriction requiring the activation of just one set of articulators are strongly favored (there are 45/71 verbs, 63%), over the phonemes of constriction that require the activation of two sets of articulators (there are only 26/71 of verbs, 37%) for which voicing is a phonemic distinctive feature. In Table 19, we may point out the similar tendency for disfavoring of activation of two sets of articulators (there are 20/77 verbs, 26%) over activation of only one set of articulators (there are 57/77 verbs, 74%) in word-final position in the Past Tense form of the "irregular" verbs. This typical disfavoring of activation of two sets over one set of articulators in both word-initial and word-final positions is directly related to human physiology and behavior. For example, Tobin (1997, p. 156) compared "the control of two sets of articulator to the childhood game of trying to pat your stomach and rub you head at the same time", thus pointing to the intrinsic relation between language and human behavior that motivates a non-random distribution of phonemes, which is explained by communication and human factors.

Table 19 Voicing in Word-Final Position in the Past Tense Form of the "Irregular" Verbs

+/- Mobile Pairs	+/- Stable Pairs	Totals	%
p 0 **t** 48 **k** 9	**f** 0 **ɵ** 0 **s** 0 **ʃ** 0 **ʧ** 0	57	74
b 0 **d** 18 **g** 2	**v** 0 **ð** 0 **z** 0 **ʒ** 0 **ʤ** 0	20 77	26 100

3.6 The Disfavoring of Additional Articulators in Adjacent Phonetic Environments

Numerous studies (for instance, Diver, 1979; Davis, 1987, 1984; Tobin, 1997) have shown that the additional articulators in the phonemic inventories across languages and the additional articulators in adjacent phonetic environments for consonant clusters are disfavored. As presented below, twenty-four phonemes of constriction in English entail the following number of sets of articulators:

(1) Voiceless (active articulators only) - (0): /p, t, k, f, s, h, ɵ, ʃ, ʧ/

(2) Voiced (active oral articulator(s) + vocal folds) - (+1): / b, d, g, ʤ, ð, v, z, ʒ, l, j , ɹ, w/

(3) Nasal (active oral articulator(s) + vocal folds + uvula) - (+2): / m, n, ŋ/

To test the above stated prediction that suggests a considerable disfavoring of the exploitation of additional articulators in adjacent phonetic environment, it is important to study the sets of articulators that are used in adjacent phonetic environments in monosyllabic and polysyllabic verbs. As presented in Table 20, verbs may be divided into the following syllables: CC or CCC (consonant clusters) or CVC (consonant-vowel-consonant syllable).

Table 20 The Disfavoring of Additional Articulators in Adjacent Phonetic Environments in the Non-Past Tense Form of the "Irregular" Verbs

	Monosyllabic	**Polysyllabic**	**Sum.**
CC	17 (out of 49)	3 (out of 6)	20
CCC	0 (out of 6)	0 (out of 1)	0
CVC	34 (out of 84) 51 37% (out of 139)	7 (out of 11) 10 56% (out of 18)	41 61

In Table 20, we may observe the numbers of monosyllabic and polysyllabic verbs in the Non-Past Tense form of the "irregular" verbs, in which there is the repetition of the same number of sets of articulators in adjacent phonetic environment. Indeed, there are 51 instances that show the exploitation of the same sets of articulators in the monosyllabic words. These 51 syllables out of 139 (CC, CCC and CVC) syllables of the "irregular" verbs (of 94 monosyllabic verbs) in the Non-Past Tense form, represent 37%, thus indicating an evident disfavoring of the use of the same sets of articulators in the adjacent phonetic environment. Moreover, it is interesting to note a great disfavoring of the repetition of the same number of articulators in CC (seventeen consonant clusters) and CCC (zero tri-consonant clusters) in comparison with syllables of CVC type (thirty-four consonant-vowel-consonant clusters), thus confirming a clear disfavoring of the more adjacent collocation of the similar sets of articulators.

Not surprisingly, we can also find the same tendency for the disfavoring of the exploitation the additional sets of articulators in the adjacent environment in the polysyllabic words. That is, as demonstrated in Table 20, there are ten syllables with the same sets of articulators out of eighteen syllables of CC, CCC and CVC types (of the "irregular" verbs of the groups A-I), which apparently present 56% (out of six polysyllabic words), thus indicating the tendency for a more adjacent environment in words of more than just one syllable. But, if to compare the CC and CCC with CVC syllables of the polysyllabic words, the tendency for the use of the additional sets of

articulators in the adjacent environment in the syllables with CVC (seven consonant-vowel-consonant syllables) rather than in CC (three consonant clusters) and particularly in CCC (zero number of tri-consonant clusters) is evident. As Tobin (1997, p. 165) points out:

> Kurtz (1992) attributes the disfavoring of the collocation of consonants that entail the simultaneous excitation of two or more sets of articulators in adjacent environments to the human factor. The simultaneous control of two sets of articulators, particularly the vocal folds, over an extended period of time requires a great deal of effort. She compares the disfavoring of additional articulators in adjacent environments to doing sit-ups. The first sit-up is relatively easy, but, as one continues, the exercise becomes harder because the same set of muscles is being used continuously without enough time to relax.

In other words, the more adjacent the environment, the more effort is needed in order to articulate such consonant clusters. This is the reason that may explain the results discussed above (see Table 20) as well as the results presented in Table 21, which illustrate an apparent disfavoring of the additional articulators in adjacent phonetic environment.

Table 21 The Disfavoring of Additional Articulators in Adjacent Phonetic Environments in the Past Tense Form of the "Irregular" Verbs

	Monosyllabic	Polysyllabic	Sum.
CC	24 (out of 56)	3 (out of 6)	27
CCC	0 (out of 6)	0 (out of 1)	0
CVC	38 (out of 86) 62 42% (out of 148)	7 (out of 11) 10 56% (out of 18)	45

A further support for the tendency of the disfavoring the additional articulators in adjacent phonetic environments may be obtained in the Past Tense forms of these "irregular" verbs (see Table 21). As a matter of fact, there are 62 syllables within the monosyllabic "irregular" verbs in the Past Tense form in which the same sets of articulators are exploited, i.e., there are 62 syllables out of 148 syllables (CC, CCC and CVC) of these monosyllabic "irregular" Past Tense forms (in 94 monosyllabic verbs in the Past Tense form) which represent 42%, thus indicating a slight disfavoring of such collocation. Unlike in the monosyllabic verbs, in the polysyllabic verbs we find a slight tendency for the exploitation the same number of sets of articulators in a more adjacent environment in words of more than one syllable. That is, as shown in Table 21, there are 10 syllables with the same sets of articulators out of 18 syllables of CC, CCC and CVC type in the Past Tense form of the "irregular" verbs (out of six polysyllabic verbs), which represent 56%. However, if to compare the monosyllabic and polysyllabic Past Tense forms, it is worth noticing another interesting observation, i.e., a similar disfavor in the use of the same sets of articulators in the syllables of the type: CC (24 in monosyllabic and 3 in polysyllabic verbs) and CCC (0 in monosyllabic and 0 in polysyllabic verbs) rather than of the CVC type (38 in monosyllabic and 7 in polysyllabic verbs). As Tobin (1997, p. 318) points out:"the ideal syllable is CVC, with the vowel serving as a nucleus (with a free movement of air) and separating two consonants (which constrict the airflow)". Thus, the CVC syllable needs less control and effort than, for example, the CCC or even the CC type, in which the same set of articulators are produced in adjacent environments. These data are consistent with the above observations further strengthening the non-random distribution of phonemes in the so-called irregular forms in English.

3.7 The Disfavoring of the Same Articulators in Adjacent Phonetic Environments

As it was discussed in the previous studies by Tobin (1997), Davis (1987, 1984), Diver (1979) and many other scholars "[t]he principle of the disfavoring of the same articulators in adjacent phonetic environments was

found to be the strongest principle for initial consonant clusters in English, and it has also been confirmed in all the other languages studied as well" (Tobin, 1997, p. 166). Unsurprisingly, in the analysis of the Non-Past and Past Tense forms of the "irregular" verbs the similar tendencies for the disfavoring of the repetition of the same active articulators within the consonant clusters of the polysyllabic and monosyllabic verbs are indeed observed.

Table 22 The Distribution of the Same Articulators in Adjacent Phonetic Environments in the "Irregular" Verbs

Word Position of the Consonant Clusters / Type of the Syllable	Consonant Clusters in a Word- Initial Position	Consonant Clusters in a Word-Medial Position	Consonant Clusters In a Word-Final Position in the Non-Past Tense Form	Consonant Clusters In a Word-Final Position in the Past Tense Form	Total	Apical Clusters
Monosyllabic	12	0	15	16	43	43
Polysyllabic	0	3	1	1	5	5

In Table 22 we may observe that there are 43 consonant clusters (approximately 51%) out of 84 consonant clusters within monosyllabic "irregular" verbs that exploit the same active articulators, which, as it should be noted, are produced by the same active articulator — an apex. Such phenomenon, i.e., the exploitation of the apex that is considered "the most adroit of the active articulator" (Tobin, 1997, p. 166) is compared by Diver, for example, to "the preference of right-handed people for using the right hand to perform difficult tasks" as Tobin (1997, p. 166) notes. Indeed, five out of eight consonant clusters within polysyllabic "irregular" verbs (approximately 62%), as the results show, exploit the same articulator and in all of these five cases the active articulator is the apex (100%), thus indicating the strong favoring of the use of the apex as the active articulator.

However, it is worth pointing out that there are forty-eight verbs out of one hundred words (that is 48%), in which the same active articulator is used in the adjacent environment. These results indicate a slight disfavoring in exploitation the same musculature for a longer period of time and that may be explained by the major PHB principle of the *mini-max* struggle to achieve *maximum communication with minimal effort*. In addition, it is worth noticing a slight disfavoring of the use of the same articulators in adjacent phonetic environments in the word-initial position in comparison to the word-final position in monosyllabic and polysyllabic "irregular" verbs. In other words, there are no any instances of the consonantal clusters in the word-initial position (0%), but there is one consonant cluster in the word-final position in the Non-Past Tense form (20%) and one consonant cluster in the word-final position in the Past Tense form (20%) in polysyllabic "irregular" verbs that exploit the same articulator in adjacent phonetic environment. There are also 12 consonant clusters (roughly 28%) in the word-initial position of monosyllabic verbs, but 15 consonantal clusters (roughly 35%) in the word-final position in the Non-Past Tense form of the monosyllabic "irregular" verbs and 16 consonant clusters (about 37%) in the word-final position in the Past Tense form of the monosyllabic "irregular" verbs. Thus, we may conclude that the low percentage of the exploitation of the same articulator, in general, and in the initial position in comparison with the final position, in particular, in the monosyllabic and polysyllabic verbs further supports the PHB principle concerning the disfavoring of the same articulators in adjacent environments further pointing to the non-random distribution of the phonemes in the "irregular" verbs.

3.8 The Disfavoring of the Same Phoneme in Adjacent Phonetic Environments

We have just seen in the previous section that the distribution of the same articulator in adjacent phonetic environment is slightly disfavored. In this section, we will see a more radical disfavoring of the same phoneme in

adjacent phonetic environments. Indeed, there are no any cases of repetition of the same phoneme in the monosyllabic (0%) and in bi-syllabic (0%) verbs in the Non-Past Tense and Past Tense forms of the "irregular" verbs. Moreover, there is only one polysyllabic verb — *understand*/*understood*, in which the same phoneme /d/ (the apical phoneme of constriction) is repeated in the word-medial and word-final positions both in the Non-Past Tense and the Past Tense form of this verb. Another important observation that should be pointed out in this example is that there is a reiteration of two phonemes in the Non-Past Tense Form: the cluster of the *nasal* + *apical* consonant /*nd*/, thus further supporting the principle of disfavoring the same articulators in adjacent phonetic environment, discussed in the previous section. It is also not surprising that the active articulator of the reiterated phonemes is apex, which is "the easiest active articulator to control" (Even-Simkin, 2012, p. 1408; Diver, 1979) and which is especially favored because of its efficiency in terms of the human and communication factors. As has been shown previously, the less effort and control of musculature is required for the articulation of the sound, the more frequently it is exploited in the language, thus further supporting the view of language as a human behavior that can be seen as a mini-max struggle in desire to create maximum communication with minimal effort (Tobin, 1997). As a preliminary conclusion we may admit the following: there is not only a non-random distribution of the phonemes of aperture, as originally proposed in Even-Simkin (2011), Even-Smkin and Tobin (2013), but also there is a non-random distribution of the phonemes of constriction in the so-called irregular verbs. That is, the phonotactic-phonological study of the "irregular" verbs (that are considered to be just arbitrary formed because the rules are neither preserved nor transparent in Modern English) indicates the non-arbitrary distribution of the phonemes within these "irregular" forms that may be directly explained by the human factor. That is, although these "irregular" forms have to be memorized by the speakers of English and that requires the particular effort of the encoder because of *Memory limitations: [h]uman beings have large but limited memories that can be related to human intelligence and human efficiency* (Tobin, 1997, p. 20), this effort may be compensated, for example, by "specific avoidance of the same phoneme in adjacent phonetic environment" (Tobin, 1997, p. 100) — the principle of ease of articulation.

3.9 Active Articulators: The Favoring of Apical Consonants

The study of the consonant system of the "irregular" verbs in English, presented herein, supports the claim that the apex — "the most adroit and easily controlled of the active articulators — is the most highly favored articulator" (Tobin, 1997, p. 105). From the variety of phonemes observed in the word-initial position (see Table 23), one may assume that there is an almost free distribution of apical and labial phonemes of constriction. However, as the results of Table 23 illustrate, there is a noticeable favoring of apical (forty-nine out of ninety-nine words, 50%) over labial (thirty-three out of ninety-nine, 33%) phonemes. Then, in the descending order we can see the disfavoring of dorsal (thirteen out of ninety-nine, 13%) and, finally, the remarkable disfavoring of laryngeal (four out of ninety-nine, 4%) phonemes.

Table 23 Distribution of Active Articulators in the Word-Initial Position in the "Irregular" Verbs

	Lips (/**p, b, f, w, m**/)	Apex (/**t, d, ɵ, ð, s, l, n, r**/)	A-P-Dorsum (/**ʃ, k**/)	Larynx (/**h**/)	Total
No.	33	49	13	4	99
%	33	50	13	4	100

Table 24 Distribution of Active Articulators in the Word-Final Position of the Non-Past Tense Form of the "Irregular" Verbs

	Lips (/b, p, v, m/)	Apex (/t, d, n, ʧ, l/)	A-P-Dorsum (/k, g, ŋ/)	Total
No.	8	58	26	92
%	9	63	28	100

Table 25 Distribution of Active Articulators in the Word-Final Position of the Past Tense Form of the "Irregular" Verbs

	Lips (/b, m/)	Apex (/t, d, n/)	A-P-Dorsum (/k, g, ŋ/)	Total
No.	1	70	21	92
%	1	76	23	100

If to compare the number and variety of the phonemes of constriction in the word-initial (see Table 23) and word-final positions (see Table 24 and Table 25), the apparent decrease in the use of phonemes of different types is evident: from 16 different phonemes (Lips: /p, b, f, w, m/, Apex: /t, d, ɵ, ð, s, l, n , r/, A-P-Dorsum: /ʃ, k/, Larynx: /h/) in the word-initial position to 12 phonemes (Lips: /b, p, v, m/, Apex: /t, d, n, l, ʧ/, Postero-Dorsum: /k, g, ŋ/) in the word-final position of the Non-Past Tense forms and 8 phonemes (Lips: /b, m/, Apex: /t, d, n/, Postero-Dorsum: /k, g, ŋ/) in the word-final position of the Past Tense forms. However, it is important to note a reversed ratio of: (1) the instances of the apical sounds in the word-initial, the word-final position in the Non-Past Tense forms and the word-final position in the Past Tense forms, and (2) the number of the different types of the phonemes used in these positions, as presented in Tables 23, 24 and 25. That is, in the word-initial position there are 49 instances of apical sounds and in the word-final positions in the Non-Past and Past Tense forms there are 58 and 70 instances, correspondingly. These results, summarized in Graph 1, depict a clear tendency in favoring the apical phonemes, in general, and in the word-final position, in particular, thus further confirming our prediction concerning the non-random distribution of the phonemes in the "irregular" verbs.

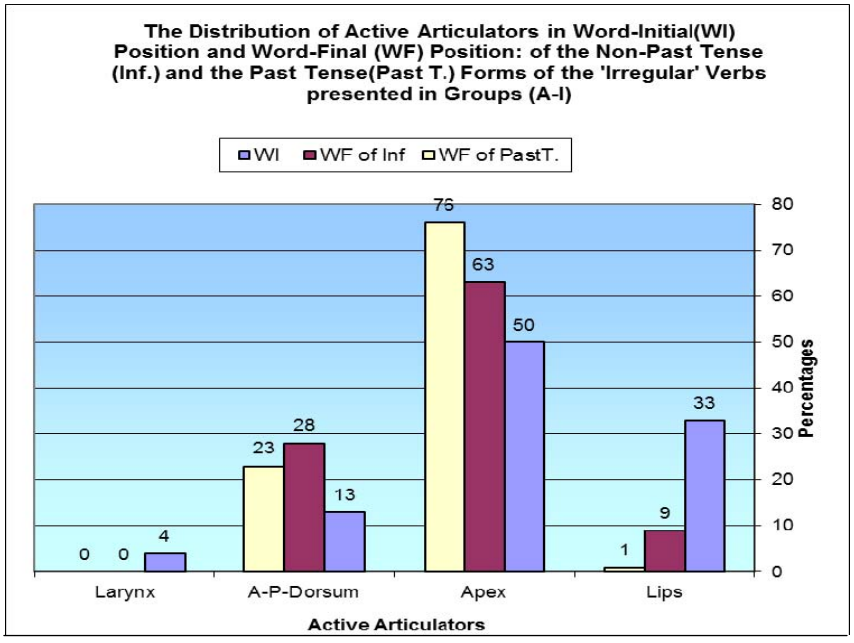

Figure 1 The Distribution of Active Articulators

As shown in Figure 1, there is an obvious favoring of the apical phonemes over the other articulators in the word-initial and the word-final positions of the "irregular" verbs and that is not much surprising. As it was previously mentioned, the highest *lexically* communicative load is in the word-initial position and the *grammatical aspect* of the Past Tense (characterized by the suffix *-(e)d*) appears rather word-finally in Modern English. This means that the word-initial and the word-final positions carry an essential communicative role, thus, explaining the non-random distribution of the phonemes in the word-initial and the word-final positions, in general, and the non-random distribution of the apical phonemes, in particular, since apex "is the easiest one to learn to control [and thus, it] is the one that is the most exploited by speakers of the language" (Tobin, 1997, p. 105). In the next section, we will further explore the non-random distribution of the phonemes in the "irregular" forms, i.e., the favoring of the labials in the word-initial position over A-P-Dorsum, thus confirming another major principle in the theory of phonology as human behavior that "visible phonemes are favored in initial position" (Tobin, 1997, p. 158).

3.10 The Disfavoring of Visible Phonemes in Word-Final Position in Comparison to Word-Initial Position

As the results of Tables 26, 27 and 28 present, labials (*visible* phonemes) are clearly favored over A-P-Dorsal phonemes in the initial position of the "irregular" verbs. To understand the reasons for that, we have to look at the interaction between the human and communication factors in the word-initial position. It is clear that "[p]honemes that can be seen as well as heard will make face-to-face communication easier and more efficient" (Tobin, 1997, p. 45). Thus, this tendency in favoring the visible phonemes in the word-initial position may be predicted in the "irregular" verbs. Indeed, "[i]t is common knowledge that labials-sounds that can be seen as well as heard-are best suited for lipreading because they appeal to both our senses of vision and hearing" (Garfunkel-Aloufy, 1992; Zeitchik, 1992; Tobin, 1997, p. 44).

Table 26 The Favoring of Visible Phonemes in the Word-Initial Position of the "Irregular" Verbs

	Visible	Non-visible			
	Lips/Teeth (/**p, b, f, w, m, ɵ, ð**/)	Apex (/**t, d, n, s, l, r**/)	A-P-Dorsum (/**k**, **g**, **ʃ**/)	Larynx (/**h**/)	Total
No.	36	46	13	3	98
%	37	47	13	3	100

Table 27 The Disfavoring of Visible Phonemes in the Word-Final Position in the Non-Past Tense Form of the "Irregular" Verbs

	Visible	Non-visible			
	Lips/Teeth (/**p, m, v**/)	Apex (/**t, d, n, l, ʧ**/)	A-P-Dorsum (/**k**, **g**, **ŋ**/)	Larynx (/**h**/)	Total
No.	8	58	24	0	90
%	9	64	27	0	100

Table 28 The Disfavoring of Visible Phonemes in the Word-Final Position in the Past Tense Form of the "Irregular" Verbs

	Visible	Non-visible			
	Lips/Teeth (/**m**/)	Apex (/**t, d, n** /)	A-P-Dorsum (/**k**, **g**, **ŋ**/)	Larynx (/**h**/)	Total
No.	1	70	21	0	92
%	1	76	23	0	100

As demonstrated in Table 26, in the word-initial position there are forty-six verbs (47%) with apical (non-visible) phonemes of constriction: /t, d, n, s, l, r/; thirteen verbs (13%) of antero- and postero-dorsum (non-visible) phonemes of constriction: /k, g, ʃ/; three verbs (3%) of larynx (non-visible) phonemes of constriction: /h/; and thirty-six out of ninety-eight verbs (37%) with visible phonemes of constriction: /p, b, f, w, m, θ, ð/. Since, as it was originally proposed by Tobin (1997, p. 159), "the apical fricatives /θ/and /ð/ have either the upper front teeth or the apex protruding between the upper and lower teeth as their dental passive receptor, thus making them apicodental fricatives", these phonemes are analyzed as being visible phonemes. Consequently, from the observed results, we may point out a slight favoring of the apical phonemes over the visible phonemes in the word-initial position which, as was discussed in the previous section, are the easiest sounds to make.

However, it is worth pointing out a greater tendency in favoring the visible sounds in comparison to the other non-visible ones in the word-initial position. Furthermore, if to compare all of the instances with the visible phonemes in the word-initial and the word-final positions, the tendency for the visible phonemes in the word-initial position is obvious. According to the results presented in Tables 26, 27 and 28, we may point out an apparent favoring of the visible phonemes in the word-initial position (37%) rather than in the word-final position (9% in the Non-Past Tense forms) and (1% in the Past Tense forms). As Tobin (1997, p. 106) puts it: "a tendency for the favoring of visible phonemes in initial positions — precisely where the largest number of clues are necessary for effective communication — should not be too surprising when we take the synergetic connection between the communication and the human factors into account".

3.11 Explosive Phonemes Are Favored in the Word-Final Position of the "Irregular" Verbs

As it was previously demonstrated, the distribution of the phonemes appears to be non-random in the "irregular" verbs, thus, pointing to an efficient phonotactic-phonological system that underlies the so-called irregular Past Tense forms. It is interesting to note another systematic aspect that may further support the phonological systematic character of the so-called irregular verbs. An almost total favoring of the explosive mobile phonemes of constriction /p, b, t, d, k, g/ over the stable non-explosive phonemes of constriction /f, v, θ, ð, ʃ, ʒ, s, z/ word-finally, once again points to the physiologically motivated skewing of the phonemes. Davis (1987, 1984, p. 67) notes that "[w]e would naturally suppose, in terms of the human factor, that combinations of gestures that are easier to learn to control will be preferred over combinations that are more difficult to learn to control". Bearing in mind that for the *mobile* phonemes of constriction, that is for "the stops there is an explosion of the pent-up air, and the lip, apex, and dorsum, respectively, are violently displaced" (Davis, 1987, 1984, p. 67), this implies that physiologically there is a radical closure/stop of the airflow in the production of the stops, thus making the word-final position to be more efficient in terms of the human factor. Indeed, the data obtainable in Table 29, clearly confirm the above presented observations, i.e., there are sixty-eight instances with explosive (mobile) phonemes out of sixty-nine verbs (99%) in the word-final position and only one verb with non-explosive (stable) phoneme (1%) in the word-final position in the Non-Past Tense form; and there are seventy-eight instances with explosive (mobile) phonemes out of seventy-eight verbs (100%) in the word-final position and none of the verbs with non-explosive (stable) phonemes (0%) in the word-final position in the Past Tense form. These results show a univocal favoring of the explosive (mobile) over non-explosive (stable) phonemes of constriction in the word-final position.

Table 29 The Favoring of Explosive Phonemes in the Word-Final Position of the "Irregular" Verbs

	Explosive: Mobile (/b, p, t, d, k, g/)	Non-explosive: Stable (/v/)	Total
Word-Final in Non-Past Tense Form	68	1	69
%	99	1	100
Word-Final in Past Tense form	78	0	78
%	100	0	100

Table 30 The Favoring of Explosive Phonemes in the Word-Final Position over the Word-Initial Position in the "Irregular" Verbs

	Explosive: Mobile (/p, b, t, d, k, g/)	Non-explosive: Stable (/f, v, s, θ, ð, ʃ/)	Total
Word-Initial	33	43	76
%	43	57	100

Conversely, in the word-initial position, we may find a slight tendency in disfavoring of explosive /p, b, t, d, k, g/ over non-explosive /f, v, s, θ, ð, ʃ/ phonemes of constriction in contrast to the word-final position in these "irregular" verbs. As depicted in Table 30, there are thirty-three of seventy-six verbs (43%) with the explosive phonemes of constriction in the word-initial position of the verb and forty-three of seventy-six verbs (57%) with non-explosive phonemes in the word-initial position. If to compare the results in both Tables 29 and 30, we may witness a considerable favoring of explosive over non-explosive phonemes of constriction in the word-final position and that is not by chance, since it is exactly the final position of a verb that carries the grammatical marking. That is, the phonological study of the functional inflectional morphology of a verb in English reveals that the explosive mobile phonemes of constriction, which "appear more frequently and are easier to produce than stable sounds [non-explosive phonemes of constriction], that is than fricatives … which require greater control of the musculature over time" (Tobin, 1997, p. 183) are favored in the verb-final position, thus further supporting the basic PHB principle of *Human Efficiency*, i.e., that "[h]uman beings invest minimal effort for maximal results in the semiotic communication process" (Tobin, 1997, p. 20).

4. Conclusion

The current study presents the analysis of one hundred "irregular" verbs in English language in terms of the theory *Phonology as Human Behavior* that is based on "the synergetic principle that language represents a constant struggle between the *human* and the *communication* factors: i.e., human beings strive to achieve maximum communication through the use of minimal effort" (Even-Simkin & Tobin, 2013, p. 9). By applying the PHB theory to the phonological inventory of the "irregular" verbs of English language, i.e., to the Non-Past Tense and Past Tense forms of these verbs, we observed that the principles of the theory were supported in favor of the structural nature of language, in general, and the phonologically systematic character of the "irregular" verbs in English, in particular, which, as were shown in the previous studies by Even-Simkin and Tobin (2013), are not only phonologically systematic but also share a semantically characterized feature. The above presented analysis further confirms the systematic character of the "irregular" verbs in English and maintains the following notion that:

the phenomenon of "irregular" verbs in English is certainly one which is open to further investigation and which may surprise us with its regularity or series of regularities when it is better understood (Tobin, 1993, p. 327).

References

Contini-Morava E. and Tobin Y. (2000). *Between Grammar and Lexicon*, Amsterdam/Philadelphia: John Benjamins.

Davis J. (1987 [1984]). "A combinatory phonology of Italian", *Columbia University Working Papers in Linguistics*, Vol. 8, pp. 1-99.

Diver W. (1979). "Phonology as human behavior", in: D. Aaronson & R. W. Reiber (Eds.), *Psycholinguistic Research: Implications and Applications*, Hillside, N.J.: Lawrence Erlbaum, pp. 161-186.

Davis B. L. and MacNielage P. F. (1994). "Organization of babbling: A case study", *Language and Speech*, Vol. 37, No. 4, pp. 341-355.

Davis B. L. and MacNielage P. F. (1995). "The articulatory basis of babbling", *Journal of Speech and Hearing Research*, Vol. 38, pp. 1191-1211.

Even-Simkin E. (2011). "Internal vowel alternations in nominal and verbal forms according to the sign-oriented theory and the theory of phonology as human behavior", Ph.D. dissertation, Ben-Gurion University of the Negev, p. 292.

Even-Simkin E. (2012). "Internal vowel alternation as a systematic phonological marker in English", *US-China Foreign Language*, Vol. 8, pp. 1405-1411.

Even-Simkin E. and Tobin Y. (2013). *The Regularity of the "Irregular" Verbs and Nouns in English*, Amsterdam/Philadelphia: John Benjamins Publishing Company.

Garfunkel-Aloufy S. (1992). "Sex differences in lip-reading among native Hebrew and native English speakers (in Hebrew)", M.A. thesis, Department of Communication Disorders, Speech, Language and Hearing, Sackler Faculty of Medicine, Tel-Aviv University.

Hulbert J. R. (1963). *Bright's Anglo-Saxon Reader*, Unites States of America: Holt, Rinehart and Winston, Inc.

Kurtz J. (1992). "Applying the theory of phonology as human behavior to two poems by Lewis Carroll", Department of English, Haifa University, Typescript.

Ladefoged P. (1993). *A Course in Phonetics* (3rd ed.), Fort Worth: Harcourt Brace Jovanovich College Publishers.

Le Roy M. (1967). *The Main Trends in Modern Linguistics*, Translated by G. Price, Oxford: Basil Blackwell.

MacNeilage P. F. and Davis B. L. (1999). "Evolution of the form of spoken words", *Evolution of Communication*, Vol. 3, pp. 3-20.

MacNeilage P. F., Davis B. L., Kinney B. L. and Matyear C. L. (2000). "The motor core of speech: A comparison of serial organization patterns in infants and languages", *Child Development*, Vol. 71, pp. 153-163.

Martinet A. (1955). *Économie des changements phonétiques: Traité de phonologie diachronique*, Berne: A. Francke.

Ohala J. J. (1983). "The phonological and justifies any means", in: S. Hattori and K. Inoue (Eds.), *Proceedings of the XIIIth International Congress of Linguists*, August 29-Seotember 4, 1982, Tokyo: Sanseido Shoten, pp. 232-243.

Oxford Advanced Learner's Dictionary, 1995, UK: Oxford University Press.

Stemberger J. (1992). "Vocalic underspecification in English language production", *Language*, Vol. 68, No. 3, pp. 492-524.

Tobin Y. (1993). *Aspect I the English Verb: Process and Result in Language*, London and New York: Longman.

Tobin Y. (1995 [1994]). *Invariance, Markedness and Distinctive Feature Analysis: A Contrastive Study of Sign Systems in English and Hebrew*, Amsterdam/Philadelphia: John Benjamins [hardcover] [1994], Be'er-Sheva: Ben-Gurion University Press (paperback) (1995).

Tobin Y. (1997). *Phonology As Human Behavior: Theoretical Implications and Clinical Applications*, Durham, NC/London: Duke University Press.

Tobin Y. (2005). "Between phonology and lexicon: A question of semiological economy", Department of Foreign Literatures and Linguistics, Ben-Gurion University of the Negev, Typescript, pp. 1-23.

Tobin Y. (2006). "Phonology as human behavior: Inflectional systems in English", in: J. Davis, R. J. Gorup & N. Stern (Eds.), *Advances in Functional Linguistics: Columbia School beyond Its Origin*, Amsterdam/Philadelphia: John Benjamins, pp. 169-196.

Tobin Y. (2011). "Phonology as human behavior from an evolutionary point of view", in: B. de Jonge & Y. Tobin (Eds.), *Linguistic Theory and Empirical Evidence*, Amsterdam/Philadelphia: John Benjamins, pp. 63-86.

Zeitchik A. (1992). "The perception of auditory, visual and audio-visual sensitivity in the hearing impaired (in Hebrew)", M.A. theis, Department of Communication Disorders, Speech, Language and Hearing, Sackler Faculty of Medicine, Tel-Aviv University.

Zlatic L., MacNielage P. F., Matyear C. L. and Davis B. L. (1987). "Babbling of twins in a bilingual environment", *Applied Psycholinguistics*, Vol. 18, pp. 453-469.