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Consonant deletion, obligatory synharmony, typical suffixing

An explanation of spelling practices in Mayan writing*

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The Pre-Columbian Mayan hieroglyphic script utilized logograms, representing CVC roots or CVCVC stems, and CV syllabograms. Starting with Knorozov's (1952 etc.) initial breakthroughs in applying a Mayan linguistic model to account for the script's spelling practices, most scholars have assumed that 'synharmonic' spellings of roots or stems, those in which the final consonant is 'complemented' by means of a CV syllabogram whose vowel is identical in quality to that of the root (e.g. $C_1V_1C_2 - C_2(V_1)$), exhibited a linguistically 'fictitious' (or silent) vowel; such synharmonic spellings were commonly assumed to be default. Efforts were then aimed at determining the motivation of spellings in which the final syllabogram is instead 'disharmonic' (e.g. $C_1V_1C_2 - C_2(V_2)$). Recently, it has been proposed that the vowels of disharmonic spellings were utilized as diacritics applied to the vowels of the preceding syllables in order to convey that such vowels were complex, while maintaining, generally, that synharmonic spellings were default. The present paper offers a thorough review of these proposals and gives arguments against their persuasiveness, abiding instead by four phonological contexts that call for the insertion of fictitious synharmonic vowels, supplemented by morphological conditioning and consonant deletion that account for additional cases of synharmonic spellings, and the vast majority of disharmonic spellings. These principles allow for a major refinement of the definition of 'conventionalized' and 'default' spellings, a new avenue for determining the nature of 'pseudologographic' or 'morphosyllabic' signs based on common syllabograms, and a new cognitive framework for addressing the question of the nature of logograms and syllabograms, as well as the origin and development of Mayan spelling practices.

Keywords: Mayan, epigraphy, hieroglyph, disharmony, synharmony, morphosyllable, phonological conditioning, morphological conditioning, typical suffixing, conventional spellings

1. Introduction

Knorozov's (1952, 1955, 1958, 1965) Principle of Synharmony¹ states that the phonetic spelling of the second consonant of a $C_1V_1C_2$ root would involve a phonetic sign of the shape C_2V_1 , whose vowel echoed the vowel of the root, but was not meant to be read, i.e. it was 'fictitious'. This principle is illustrated by the spellings in Figures 1a and b, K'IN-ni for Pre-Ch'olan *k'iin 'sun, day' and k'a-k'a for Pre-Ch'olan *k'ahk' 'fire', respectively.² However, Kelley (1962) emphasized that a Principle of Disharmony, whereby the word-closing consonant of a $C_1V_1C_2$ root are spelled with a C_2V_2 sign whose vowel differed from the vowel of the root, was much more common than Knorozov had originally thought, and thus posed a great challenge to decipherment.³ This principle is illustrated by the spellings in Figures 1c and d, TUN-ni for Pre-Ch'olan *tuun 'stone', from Proto-Mayan *toonj, and cha-ki for Late Proto-Ch'olan *chahk (~ *chahak) 'lightning', from Proto-Mayan *kahoq. The question is, then, what determines whether a spelling is synharmonic or disharmonic?

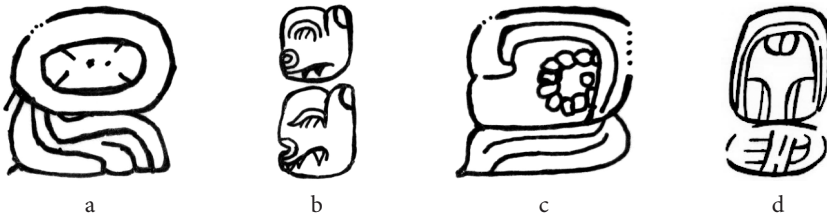


Figure 1. Synharmonic and disharmonic spellings of CVC roots.

- a. K'IN-ni. Excerpt from Chichen Itza Four Lintels, Lintel 2. After Beyer (1936:235).
- b. k'a-k'a. Excerpt from Chichen Itza Monjas Lintel 4. After Beyer (1936:236).
- c. TUN-ni. Excerpt from Tonina Monument 95. After drawing by Ian Graham.
- d. cha-ki. Excerpt from Caracol Ballcourt Marker 3. After drawing by Nikolai Grube in Chase et al. (1991:5, Figure 3).

Three types of approaches have been utilized to address this question, and are given the following labels: (1) an Orthographic Approach, based on Orthographic Arbitrariness; (2) a Phonological Approach, based on Phonological Conditioning; and (3) a Morphological Approach, based on Morphological Conditioning, with Actual Suffixing and Typical Suffixing subtypes. These approaches, their subtypes, and their major proponents are listed in Table 1. The present paper reviews and tests some of these proposals in detail: Bricker (1989), Justeson (1989), Hopkins (1997), Houston et al. (1998, 2004), and Lacadena and Wichmann (2004). Part of the impetus for this study lies in the wide acceptance of two recent proposals by Houston et al. (1998, 2004) and Lacadena and Wichmann (2004), who have argued that

disharmonic spellings served as diacritics to indicate that the vowel of a preceding syllable was complex (Vh, V7, VV) rather than simplex (V). This wide acceptance is unfortunate for the following reasons: (1) many specialists and non-specialists alike have begun to utilize the predictions of such hypothesis as tools for historical linguistic reconstruction even when linguistic evidence for such reconstructions is otherwise lacking or contradictory; (2) these authors have not systematically and exhaustively tested previous approaches, but have simply dismissed them out of hand; (3) the two teams of scholars have followed a purely etymological approach,

Table 1. Approaches to synharmony and disharmony.

Scholars	Synharmony	Disharmony
Knorozov 1952, 1958, 1965	Default	Motivated morphologically
Kelley 1962, 1976	Default	Remnant of ancient phonological root structure
Bricker 1989	Default	Consonant Deletion or Vowel Insertion
Hofling 1989	Default	Actual Suffixing
Justeson 1989	Generally default, some are due to Phonological Conditioning	Consonant Deletion, Typical Suffixing, some are due to Phonological Conditioning
Hopkins 1997	Actual Suffixing should be the null hypothesis to be tested; Also, Phonological Conditioning, due to echo vowels, also a possible source for some of the 'fictitious' vowels	
Houston et al. 1998, 2004	Default (1998), Default and Phonological Conditioning (2004)	Phonological Conditioning
Lacadena and Wichmann 2004	Default initially, later due to Phonological Conditioning Possibly Orthographic Arbitrariness initially based on neutral use of Ca word-closing syllabograms	Phonological Conditioning
Justeson 2000	Typical Suffixing, except cases of CăC roots, which frequently exhibit synharmony with Ca signs	Typical Suffixing
Mora-Marín 2001, 2002, 2004, 2005a	Default, Consonant Deletion	Typical Suffixing, Consonant Deletion, Actual Suffixing
Kaufman 2003a, 2003b	Morphological Conditioning and Typical Suffixing	
Anderson 2004	Phonological Conditioning based on homorganicity	
Boot 2004	Neutral use of word-closing syllabograms: Ce, first, and Ca, later; Value of Ce was based on Typical Suffixing	

studying roots in isolation from their morphological properties, whether inflectional or derivational, and their syntactic contexts; and (4) one of the proposals, the one by Houston et al. (1998, 2004), is analytically interrelated with a second proposal by Houston et al. (2001), dubbed here the Morphosyllable Hypothesis, which is shown to exhibit important analytical and empirical flaws.

Furthermore, Houston et al. (2001) have put forth a model of the analysis and interpretation of the spellings of morphological suffixes in Mayan texts that is directly linked to the implications of their approach to disharmonic spellings, and therefore requires careful examination as well.

With this background in mind, the goals of this paper are the following:

- a. To test the proposal by Houston et al. (1998, 2004), referred to below as Disharmony Hypothesis I (DH I), and its more refined version by Lacadena and Wichmann (2004), referred to as Disharmony Hypothesis II (DH II), by assessing whether alternative approaches that have not been properly tested can account for the same data.
- b. To determine whether ‘morphosyllables’ in the Morphosyllable Hypothesis (MH) by Houston et al. (2001) are necessary constructs for analyzing spelling conventions.
- c. To assess whether synharmonic spellings are really unmarked or default, or whether they are themselves guided by more complex principles.
- d. To arrive at a definition of ‘conventionalization’ in terms of what it meant in the practical everyday use of the script.
- e. To consider the implications of the analysis for the history of the script.

The first section of the papers provides the basic framework for the epigraphic and linguistic study of Classic Mayan writing, as well as the rationale for the methodology employed.

2. Preliminaries

2.1 Linguistic assumptions

Classic Lowland Mayan (CLM) writing represented a standard Ch'olan language, one of the subgroups of the Mayan language family (Figure 2), as evinced by exclusive Ch'olan innovations present in the conventional spellings of the most conservative components of the script, such as the time period and month names (Campbell 1984; Campbell & Kaufman 1985; Josserand et al. 1985; Justeson et al. 1985; Justeson & Fox 1989; Justeson & Campbell 1997; Houston et al. 2000; Lacadena & Wichmann 2002). The script was adopted by Yucatecan speakers,

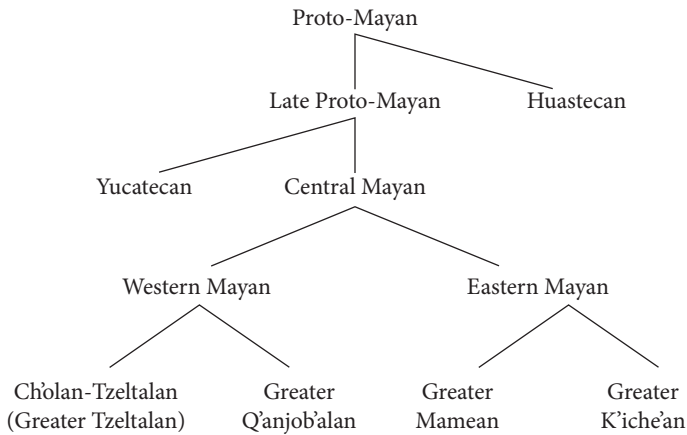


Figure 2. Major subgroups of the Mayan language family (after Kaufman 1976, 1990).

probably during the Early Classic period if not earlier, who began to incorporate Yucatecan innovations gradually at first, but at an accelerated pace by the middle of the Late Classic period (Bricker 1986; Justeson & Fox 1989; Lacadena & Wichmann 2002).⁴ Nevertheless, a significant number of standard traits present in the script represent linguistic materials no longer preserved in any of the Ch'olan or Yucatecan languages, but still present in other branches of the Mayan language family, especially the Tzeltalan branch, the languages most closely related to the Ch'olan languages (Mora-Marín 2003, 2009a; Mora-Marín et al. 2009).

The basic root shape in Mayan languages, including the languages of relevance to this paper, is CVC, or Consonant-Vowel-Consonant, where the vowel, V, may be simplex (V) or complex (VV, V7, Vh).⁵ Syllabification, for example of a CVCVC word follows the pattern CV.CVC, as with *ʔah.kòt* 'dance', and that of a CVCVC-VC word consisting of a root and a suffix follows the pattern CV.CV.CVC, as with *ʔah.kò.t-aj* 's/he danced', which is realized as CVC.CVC due to vowel syncope (deletion) of *o*, *ʔahk'.t-aj*. The most common suffixes exhibit the shapes -V (-i 'completive status of positionals'), -VC (-el 'inalienable possession') and -CVC (-laj 'intransitivizer of positionals').

Proto-Ch'olan has been reconstructed with a six-vowel system (/ *i, *e, *a, *ä, *o, *u/) by Kaufman and Norman (1984), with only Vh remaining as a complex vowel, as a result of a merger of *V7 and *VV into VV, possibly during Proto-Ch'olan-Tzeltalan times, but very likely by Pre-Proto-Ch'olan times, and the merger of *VV and *V into V, with a concomitant shift of *a to ä, by Proto-Ch'olan times. Houston et al. (1998, 2004) argue instead that Proto-Ch'olan, and in fact, the ancestor of Ch'orti' and Ch'olti', the two Eastern Ch'olan languages in Kaufman and Norman's (1984) classification, still retained contrastive vowel length, using evidence from disharmonic spelling patterns in support of this hypothesis.⁶ Similarly,

Lacadena and Wichmann (2004) have argued, also based on their own analysis of disharmonic spelling patterns, that Ch'olan still retained *V7 and *VV during the Classic period, but soon began to lose such distinctions, leading to a period of differentiation in disharmonic spelling patterns. Thus, a resolution to these questions may be crucial to the analysis of the linguistic history of Ch'olan. Part of this controversy is somewhat of a matter of relative chronology. Justeson et al. (1985) have observed that Pre-Ch'olan likely retained phonemic *VV:*V contrasts, based on the evidence of diffused Ch'olan vocabulary in Yucatecan.⁷ If the script was innovated and standardized, say, by Pre-Ch'olan speakers, then it is possible that some convention for conveying vowel length contrasts could have been incorporated at some point. The present paper addresses whether this was the case, not whether it was Pre-Ch'olan, Proto-Ch'olan, or some post-differentiation branch of Ch'olan that standardized the script.

2.2 Epigraphic assumptions

The Maya script is pictorial and logosyllabic: it uses CVC and CVCVC logograms (e.g. T544 K'IN for **k'in* 'sun, day', B'ALAM for **b'ahläm*), as well as CV syllabograms (e.g. T25 ka, T130 wa, as in T25.25: 130 ka-ka-w(a)). It also uses semantograms (determinatives, classifiers), discussed in Hopkins and Josserand (1999) and Mora-Marín (2008), but these are of no consequence in the present paper. Logosyllabic spellings, those combining logograms and syllabograms, were very common for roots and their suffixes (e.g. HUL-li for *hul-i-Ø* arrive.here-CMP-3SABS 's/he/it arrived', CHUM-wa-ni for *chum-wan-i* sit-IVZR-CMP 's/he sat down'), but they were also used in cases where a suffix was not obviously present or intended, leaving a word-closing syllabogram with a 'fictitious' vowel — a vowel that was not to be read. This is the vowel that is at the crux of the problem, for this vowel is the one proposed by some scholars to be a diacritic of the complexity of the vowel of the preceding syllable.

2.3 Methods

In contrast to Houston et al.'s (1998) approach, in which previous proposals, such as consonant deletion (Bricker 1989) and typical suffixing (Justeson 1989), are simply claimed to have been proven inadequate to account for the nature of disharmonic spellings, the present paper will test such ideas directly, in a much more systematic and thorough fashion than was attempted by their original authors. For the fact is that these early proposals have not received the detailed treatment they deserve. To test them, two kinds of evidence are needed: (1) multiple spellings of the same word in similar grammatical environments, and (2) multiple spellings of

the same word in different grammatical environments. Also, there are two kinds of evidence used by Houston et al. (1998) and Lacadena and Wichmann (2004) that are not useful in testing the consonant deletion and typical suffixing approaches: (1) unique spellings, and (2) spellings of words with unknown etymologies or phonological shapes. In other words, such approaches can only be tested by means of contextual analysis, not isolated analysis of the spelling of the roots alone, without regard for their suffixes and grammatical contexts.

3. Testing the disharmony hypotheses

3.1 Disharmony Hypothesis I

Houston et al.'s (1998, 2004) hypothesis, dubbed here Disharmony Hypothesis I (DH I), proposes that disharmonic word-closing syllabograms serve as diacritics indicative of complex syllable nuclei (i.e. CVVC, CV7C, CVhC, as opposed to plain CVC). Thus, in their approach, an isolated spelling such as **b'a-ki** would be read as **b'a-k(i)** for *b'aak* 'bone', from Proto-Mayan **b'aaq*, and another such as **cha-ki** would be read as **cha-k(i)** for *chahk* 'lightning, thunder', from Proto-Ch'olan **chahuk*, from Proto-Mayan **kahok*. The DH I also claims that: (1) synharmonic spellings are unmarked/default, in which case **wi-ts(i)** would give us Proto-Ch'olan **wits* 'mountain' from Proto-Mayan **wits*, and **ts'i-b'(i)** would give us Proto-Ch'olan **ts'ihb'* 'writing' from Proto-Mayan **ts'ihb'*; (2) there are no exceptions (cases where a disharmonic spelling yields a simple syllable nucleus); and (3) whenever a disharmonic syllabogram is used to represent vowel complexity, but the root it is found with requires a suffix of some sort, an additional sign or sequence of signs, called 'morphosyllables' (Houston et al. 2001), is necessary to spell that suffix. For example, a spelling such as **B'AH-hi-ja** would be interpreted as **B'AAH(-hi)-AJ** (Figure 3a), for *b'aah-aj* head-UNPOSS 'head/face (of someone)' rather than **B'AH-hi-j(a)** for *b'a(:)h-ij*, under the assumption that the **hi** syllabogram is used in this context to indicate, with its disharmonic *i* vowel (which differs from the *a* vowel of the preceding syllable), that the preceding syllable has a complex vowel, *aa*. At the same time, if the *i* of the syllabogram **hi** is being used solely for its diacritic function, then it cannot serve in the spelling of the required suffix. Instead, such suffix is spelled exclusively by the syllabogram **ja**, which is no longer merely a syllabogram, but a morphological logogram, or *morphosyllable* — hence, this is the basic formulation of the Morphosyllable Hypothesis (MH) as presented by Houston et al. (2001). In fact, this idea has many precedents, starting with Knorozov (1952, 1955, 1958, 1962), who analyzed T181 **ja** also as **-aj** when used to spell a suffix on a verb, and Thompson (1950), who analyzed T24 **li** also

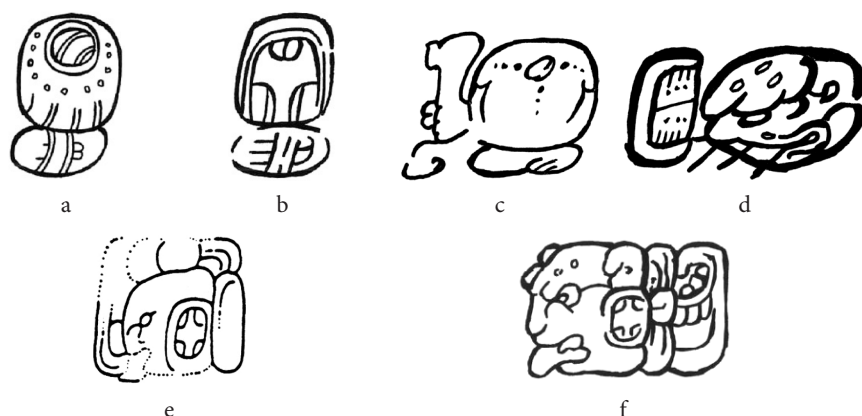


Figure 3. Synharmonic and disharmonic spellings of CVC roots.

- a. **b'a-ki**. Excerpt from Yaxchilan Lintel 46. After drawing by Ian Graham.
- b. **cha-ki**. Excerpt from Caracol Ballcourt Marker 3. After drawing by Nikolai Grube in Chase et al. (1991: 5, Figure 3).
- c. **wi-tsi**. Excerpt from Dos Hombres pottery plate. After Drawing by Kerri Mulvania in Robichaux and Houk (2005: Figure 4).
- d. **ts'i-b'i** for *ts'ihb'* 'writ(e/ing)'. Passage from unprovenienced ceramic vessel. After Stuart (1987: 52).
- e. **7u-B'AH-hi-li** for *7u b'ah-il* 'his/her head (portrait)'. After drawing by Ian Graham.
- f. **B'AH-hi-ja** for *b'ah-ij* 'portrait (of someone)'. After drawing by Marc Zender in Zender (2004).

as **-il** when used to spell a suffix on a noun, not to mention the assumed correctness of this principle by Fox and Justeson (1984a), MacLeod (1984), Mathews and Justeson (1984), Justeson (1985, 1989), Bricker (1985), Justeson and Fox (1989), among others, such as Closs (1986), who dubbed it the Commutativity Principle. Houston et al. (2001) have added an important element to this tradition, that of tying the formulation of the DH I and MH, which in their partly explicit view are interdependent, even if they do not say so explicitly.

Another example will be useful at this point: the case of the spellings of **7u-TUN-ni-li** for *7u tuun-il* 'his/her/its stone' (3SERG-stone-POSS). Under the DH I and MH approaches, this would be read **7u-TUUN(-ni)-IL**, for *7u tuun-il* 'his/her stone', rather than **7u-TUN-(n)i-l(i)** for *7u tu(u)n-il*, the reading obtained from a strict assumption of phoneticism of syllabograms such as advocated by Stuart (1987). In a case like **7u-TUN-ni-li**, a suffix **-il** would be obtained, whether analyzed as **7u-TUUN(-ni)-IL** or **7u-TUN-(n)i-l(i)**, and that is in fact the shape of the suffix that is known to be used in the Lowland Mayan languages with this noun. However, with a case like **B'AH-hi-ja**, if analyzed as **B'AAH(-hi)-AJ**, one encounters a special challenge: none of the modern Lowland Mayan languages preserves a suffix **-aj** used with unpossessed nouns, but other Mayan languages do, and in those

languages the suffix is usually composed of two or three allomorphs, *-aaj*, *-ijj*, *-eej*. Thus, the DH I and MH approaches are negating the possibility that B'AH-*hi-ja* could be spelling *b'ah-ij* on purely theoretical grounds, not on empirical grounds.

The data set used by Houston et al. (1998; 2004:93, Figure 5.1), reproduced here as Table 2, is problematic: (1) almost none of the spellings in the Houston et al.'s Appendix contains source information that would be necessary to examine the orthographic and grammatical contexts of the spellings; (2) two of the examples represent the same morpheme, the suffix *-om* or *-oom*, once as *-Co-ma* and also as *7u-to-ma* for *uht-o(o)m*, which contains the same suffix, bringing their useful sample size from 75 to 74; and (3) the authors do not mention which spellings were used for the *Cu-Ci* cell (i.e. *uu... i*), leaving 72 useful examples. These are the examples reproduced in this paper's Addendum. The case of the *-o:m* suffix is important, for it illustrates the interdependence between the DH and MH: if the spelling *7u-to-ma* calls for the use of the *o* of *to* as a diacritic for a preceding complex syllable nucleus, *uh* of *7uht-oom*, then it is not used to spell the vowel of the suffix *-oom*, which it could very easily represent under normal, syllabographic spelling conventions; instead, such *o* vowel is provided by the syllable *ma*, which is now assumed to be a morphosyllable *-OOM*.

Table 2. Houston et al.'s (1998) data set.

	i	a	u
i	i...i (3)	i...a (-)	i...u (-)
	ii...i (1)	ii...a (2)	ii...u (-)
	ih...i (2)	ih...a (-)	ih...u (1)
	i7...i (-)	i7...a (-)	i7...u (-)
e	e...i (-)	e...a (-)	e...u (-)
	ee...i (-)	ee...a (2)	ee...u (1)
	eh...i (-)	eh...a (-)	eh...u (1)
	e7...i (-)	e7...a (-)	e7...u (-)
a	a...i (1)	a...a (18)	a...u (-)
	aa...i (8)	aa...a (2)	aa...u (1)
	ah...i (4)	ah...a (2)	ah...u (1)
	a7...i (1)	a7...a (-)	a7...u (-)
o	o...i (-)	o...a (-)	o...u (-)
	oo...i (2)	oo...a (5)	oo...u (-)
	oh...i (-)	oh...a (-)	oh...u (-)
	o7...i (-)	o7...a (-)	o7...u (-)
u	u...i (-)	u...a (-)	u...u (5)
	uu...i (2)	uu...a (3)	uu...u (4)
	uh...i (-)	uh...a (-)	uh...u (2)
	u7...i (-)	u7...a (1)	u7...u (-)

3.1.1 *Exceptions*

Contra Houston et al.'s (1998, 2004) claim of no exceptions, the following counter-examples do exist (Table 3; Figure 4):

Table 3. Exceptions to DH I (Houston et al. 1998, 2004).

Spelling ⁸	Reconstruction	Source
1. 7o-ki-b'i (7ok-ib' 'step')	PC *7och, PYu *7ok	PM *7ok 'enter'
2. 7i-chi-la (7ich-il 'within')	PYu *7ich-il	
3. 7u-tsi (7uts 'good')	PC *7uts 'good'	PM *7uts
4. ch'a-ji (ch'aj 'dripping')	Yucatec <i>ch'ah</i> 'to drip' TV, <i>ch'aa'h</i> 'drop' N (Some cases of PM *ty' are preserved in PYu and PC as *ch')	PM *ty'aj 'dripping, splattering'
5. ha-7i (ha7+i 'this one') ⁹	PC *hain+e	PM *ha7 (+i/+e/+a/+o) 'demonstrative pronoun base' plus deictic enclitic
6. la-ji (-laj-i 'intransitivizer of positional roots')	PreC *-laj 'intransitivizer of positionals', PYu *-laj 'intransitivizer of completive positionals'	
7. ta-ki (-tak 'pluralizer of some nouns')	PC *-tak (Ch'ol -tyak, Ch'orti' -tak), PYu *-tak	PM *tiq ~ *taq 'plural'
8. ta-li (-tal 'incompletive intransitivizer of positionals') ¹⁰	PC *-tal 'incompletive intransitivizer of positionals'	
9. wa-ni (-wan/-wan 'intransitivizer of positionals')	PC *-wan/-wan	
10. WINAK/WINIK (winak/winik 'man, person')	PC *winik 'man, person'	PM *winaq 'person'
11. yi-ch'a-ki (y-ihch'ak(-il) 'his/her/its fingernail/claw')	PC *7ihch'ak	PM *7iSk'aq
12. yu-k'i-b'a and 7u-k'i-b'a (y-uk'-ib 'his/her/its drinking cup', 7uk'-ib'-äl/al '(some-one's) drinking cup')	PC *7uch', PYu *7uk'; PC -Vb', PYu *-Vb'	PM *7uk' 'drink', PM *-a-b' (TV roots), *-b' (Derived TV), *-i-b' (IV roots)
13. ka-yo-ma (kay-o(o)m 'fisherman')	PC *ch'ay, PYu *kay	PM *kar 'fish', *-oom 'agentive nominalizer of nouns'
14. tsi-ma-hi (tsimah 'gourd')	PCH *tsimah	PM *tsima7

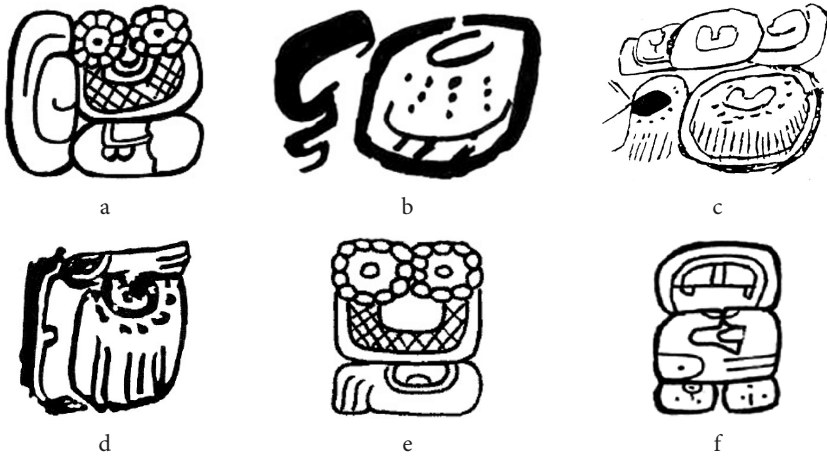


Figure 4. Some examples of counterevidence to the DH I.

- a. *yi-ch'a-ki* on Piedras Negras Lintel 2. After Stuart (1987: Figure 38e).
- b. *7u-tsi* on Vase K1453. After photograph of Vase K1453 in Kerr (1999).
- c. *yu-k'i-b'a* on Early Classic bowl. After photograph in Coe (1973: 110).
- d. *7u-k'i-b'a* for *uk'-(i)b'-äl* 'cup (of someone)', on Late Classic pottery vessel. After photograph in Coe (1973).
- e. *ch'a-ji* on Quirigua Stela E. After drawing in Stuart (1987: Figure 54d).
- f. *7i-chi-la* on Lintel 4A at Chichen Itza, Las Monjas. Drawing by the author based on drawing by Graham (1977a) in Bricker (1986: 98).

Houston et al. (1998, 2004) do acknowledge the case of *yi-ch'a-ki* as a possible exception, but claim that its reconstruction is uncertain; in other words, they suggest that it could just as easily have been *y-ihch'aak* instead of *y-ihch'äk*. However, the evidence for this reconstruction is relatively straightforward, even if one considers vowel-lengthening morphophonemic processes that result from possession of certain nouns: in some Mayan languages the vowel of a noun root is lengthened when the root is possessed, e.g. Mam *n-xaaq+a* 'my rock', based on *xaaq* 'rock'. A survey of possessed forms of this particular root in languages that exhibit vowel lengthening with possession, seen in Table 4, suggests this root does not experience such process (Kaufman 2003a). I have also added the likely Proto-Yucatecan form **7ihch'äk*, given the Yucatec and Mopan data from Bricker et al. (1998) and Cohuoju et al. (2001: 33), as well as the Chontal form *ich'äc* /7ich'äk/, discussed below.

In the Chontal term *7ich'äc* /7ich'äk/ (Keller & Luciano 1997: 116), the *ä* almost certainly descends from Pre-Proto-Ch'olan **a* (Kaufman & Norman 1984), for this language, unlike the other extant Ch'olan languages (Ch'ol, Ch'orti'), retains vowel length contrasts in morphophonemic contexts, particularly in the derivation of nouns from verbs: *män* 'to buy (something)' contrasts with *man* 'purchase' (Knowles 1984).

Table 4. Comparative data for ‘claw, fingernail’ (primarily from Kaufman 2003a: 364–365).

Language	Attested form of ‘his/her/its claw, fingernail’
Popti’ (Jakaltek)	y-isk’aq
Q’anjob’al	y-isq’aq chej
Chontal	ʔich’äk
Mam	t-xky’aq
Poqom	ERG-ixk’aq
Kaqchikel	r-ixk’aq
Yucatec	ʔu y-ich’ak
Mopan	ʔu y-ich’ak

Another case is the spelling **ka-yo-ma** for *kay-o(o)m* ‘fisherman’. If we abide by the MH we would get **ka-y(o)-OM**, in which case a form *kaay-o(o)m* would be represented. However, the term for ‘fish’ comes from Proto-Mayan **kar*, with reflexes **chäy* in Proto-Chölan (from Pre-Chölan **chay*) and **kay* in Proto-Yucatecan. The suffix is reconstructible as **-oom* in Proto-Mayan or Central Mayan, as indicated by other cases of nouns derived from other nouns provided by Kaufman (2003a: 69, 361): **b’eh.oom* ‘rich; wealthy’ seemingly from **b’eh* ‘road’, and **baaq-eel jol-oom* ‘skull (bone of the head)’ from *jol* ‘head’.¹¹ If we abide by simple spelling rules, we obtain **ka-yo-m(a)**, where only one fictitious vowel — the *a* of **ma** — is required, instead of two — the *o* of **yo** and the *a* of **ma**, as in the **ka-y(o)-OM** analysis under DH and MH. Earlier it was noted that the inclusion of both **-Co-ma** and **ʔu-to-ma** in the data set poses a *major* problem: if intended to suggest that the *a* of **ma** in **-Co-ma** serves as a disharmonic diacritic of vowel complexity for the preceding syllable nucleus, i.e. **-Co-m(a)** for *-o:m*, and at the same time, that the *o* of **to** in **ʔu-to-ma** serves as a disharmonic diacritic of vowel complexity for the preceding syllable nucleus, i.e. **ʔu-t(o)-ma** for *ʔuht-om*, then **ʔu-to-ma** cannot represent both complex vowels at the same time. This is a major inconsistency that could complicate a large number of readings, essentially any spelling of a word exhibiting these general traits: two complex vowels, one in the root, and one in the suffix.

These approaches problematize spellings that are completely unproblematic under simple spelling rules (syllabographic conventions), leading, in some cases, to constructions that go against the grain of linguistic evidence, but generally and unnecessarily multiplying the number of entities that require explanation. For instance, in Figures 5a and b, two spellings of **CHUM[mu]-li** for *chum-ul-Ø* ‘it is seated’ appear. Following the DH I and MH approaches we would analyze this spelling as **CHUM([mu])-IL**, which would suggest an *-il* suffix, rather than an *-ul* suffix, for the ‘stative’ marker of positionals, which is without a doubt a *-V₁l* suffix



Figure 5.

- a. CHUM[mu]-li for *chum-ul* sit-STA ‘seated’ from Copan Hieroglyphic Stair Step 8. After drawing by Barbara Fash in Schele (1989:81).
- b. ti-CHUM-mu-li for *ti chum-ul* ‘seated’. After drawing in Stuart (2005:73).

whose vowel echoes the vowel of the positional root. Of course, under the MH approach, Houston et al. (2001) call for the existence of two kinds of morphosyllables: (1) regular morphosyllables, involving cases where a syllabogram was used as a morphosyllable with a $-VC$ shape whose vowel varied according to vowel harmony rules, as with T130 *wa*, used in the spelling of the $-V_1w$ suffix of active transitive verbs; and (2) irregular morphosyllables, those with a $-VC$ shape whose vowels were invariable, as in the case of T24 *li* as $-IL$ for the possessive suffix $-il$. Given such conceptualization, one could simply say that T24 *li*, which they define as an irregular, invariable, morphosyllable $-IL$, is actually regular in this instance, and thus it can stand for any $-V_1l$ with any vocalic value. But this is not necessary: if we simply abide by simple spelling rules, the *u* of *mu* would spell the vowel of the $-V_1l$ suffix, and the *l* of *li* spells its consonant: CHUM[mu]-li for *chum-ul*.

3.2 Disharmony Hypothesis II

Turning now to the DH by Lacadena and Wichmann (2004), henceforth DH II, it consists of the following formulation of rules: (1) Harmony Rule 1, under which synharmonic spellings are not default, but serve instead as diacritics of simplex syllabic nuclei ($CV_1C-CV_1/CV_1-CV_1 \rightarrow CV_1C$); (2) Harmony Rule 2, under which two kinds of disharmonic spelling contexts are diacritics of long vowels in the preceding syllable ($CVC-Ci/CV-Ci \rightarrow CVVC$, where $V = \{e, a, u, o\}$, and $CVC-Ca/CV-Ca \rightarrow CVVC$, where $V = \{i\}$); and (3) Harmony Rule 3, under which two kinds of disharmonic spelling contexts are diacritics of glottalized vowels in the preceding syllable ($CV(C)-Cu \rightarrow CV'(V)C$, where $V = \{i, a\}$, and $CV(C)-Ca \rightarrow CV'(V)C$, where $V = \{e, u, o\}$). Lacadena and Wichmann qualify their first rule by saying that several synharmonic examples are actually used to spell words with a Vh nucleus, and so they do not argue for the use of disharmonic spellings to represent Vh nuclei. In fact, they also note that some synharmonic spellings are known to occur for roots with VV or $V7$ vowel nuclei: CHAN-na for *chan* < Proto-Mayan

**kaan* ‘snake’, K’IN-ni for *k’in* < Proto-Mayan **q’iiŋ* ‘sun, day’, and 7AJAW-wa for *7ajaw* < Proto-Mayan **7aajaaw* ‘ruler’. The authors argue that spellings like these are conservative, “harking all the way back to an ‘Age of Synharmony,” when the spelling rules for representing VV and V7 had not yet developed (Lacadena & Wichmann 2004:132). The authors also note that “[w]hen looking through the earliest texts we notice that Ca complements dominate the picture,” and suggest that prior to the ‘Age of Synharmony’ the scribes used “the a-vowel as a default in complements,” concluding that “[t]he competing principles of synharmony and

Table 5. Counterexamples to DH II (Lacadena & Wichmann 2004).

Rule	Counterexamples
Harmony Rule 1: CV ₁ C-CV ₁ /CV ₁ -CV ₁ → CV ₁ C	<p>b’u-ku for *<i>b’uhk</i> ‘clothes’ ts’i-b’i for *<i>ts’ihb</i> ‘writing’ k’a-k’a for *<i>k’ahk</i> ‘fire’ ta-na for *<i>tahn</i> ‘chest’ cha-pa-ta for <i>chapaht</i> ‘centipede’ K’AB’A7-7a for *<i>k’aba7</i> < Lowland Mayan *<i>k’aab’aa7</i> ‘name’ 7AJAW-wa for *<i>7ajaw</i> < Proto-Mayan *<i>7aajaaw</i> ‘lord, ruler’ CHAN-na for *<i>chan</i> ‘sky’ (PYu. *<i>káan</i>) < Proto-Mayan *<i>ka7ŋ</i> SNAKE-na for *<i>chan</i> ‘snake’ (PYu. *<i>káan</i>) < Proto-Mayan <i>kaan</i> K’IN-ni for *<i>k’in</i> ‘sun, day’ (PYu. *<i>kiin</i>) < Proto-Mayan <i>q’iiŋ</i> t’u-lu for *<i>t’uhl</i> ‘rabbit’ k’u-k’u for *<i>k’uk</i> < Proto-Mayan *<i>q’u7q</i> ‘quetzal’</p>
Harmony Rule 2: CVC-Ci/CV-Ci → CVVC, where V = {e, a, u, o}	<p>yi-ch’a-ki for *<i>y-ihch’iak</i> (see above) su-ts’i for *<i>suts</i> < Proto-Mayan <i>so7ts</i> ‘bat’ ma-xi for *<i>max</i> < Western Mayan + Yucatecan *<i>ma7x</i> ‘spider monkey’ xo-ki for Col. Yucatec (xooc), likely /xo7k/ ‘shark’ HAB’-b’i for *<i>hab</i> < Proto-Mayan *<i>ha7b</i></p>
CVC-Ca/CV-Ca → CVVC, where V = {i}	
Harmony Rule 3: CV(C)-Cu → CV’(V)C, where V = {i, a}	<p>chi-ku (no semantic control to confirm meaning/etymology) 7a-ku for *<i>ahk</i> ‘turtle’ 7a-nu (no confirmed meaning or etymology) b’a-ku (evidence suggests it is really b’a-TUN(-ni))</p>
CV(C)-Ca → CV’(V)C, where V = {e, u, o}	<p>tu-pa for Yucatecan *<i>tùup</i> ‘earring’ JUN-na for *<i>jun</i>= ‘one’ < Proto-Mayan *<i>ju:ŋ</i> LAJUN-na for *<i>läjun</i>= ‘ten’ < Proto-Mayan *<i>la:ju:ŋ</i> CHAPAT-tu for <i>chapaht</i></p>

Ca-complementation were each assigned their own function and coordinated into a larger system” (Lacadena & Wichmann 2004: 132). As is shown below, this notion of an ‘Age of Synharmony’ is not supported by the data; this fact, and several additional counterexamples to DH II, shown in Table 5, argue against its validity.¹²

It is also worth observing that while Lacadena and Wichmann (2004) call for the existence of an early period of time during which scribes applied synharmony quite regularly and generally, Houston et al. (1998, 2004) argue for a similar period of time, only a late one, during the Late Classic period at the sites of Caracol and Copan, during which scribes applied synharmony in a very general fashion. The former scholars suggest that the disharmony rules had not yet devised during that early period, while the latter scholars propose that the late period of synharmony reveals language in progress, particularly in the mergers of VV and V7 to V. While these proposals are not necessarily contradictory, the fact is that neither is necessary, as is argued below.

3.3 Section summary

The above examples illustrate the urgency of evaluating the DH I, DH II, and MH approaches, which have been widely accepted as valid by many specialists. Martin and Grube (2000:22), for instance, analyze the names of several kings — two at Tikal, one at Calakmul, one at Tonina — that contained the CLAW logogram as *Ich'aaak*, an analysis that exhibits two errors: it omits the preconsonantal *h* of the first syllable of Proto-Ch'olan *7ihchiak*, which has never been in question, and it shows a long vowel, *aa*, in the second syllable, which the comparative and historical evidence demonstrates not to be accurate. Many epigraphers who have adopted DH II have routinely incurred in the practice of reconstructing the phonological shapes of glyphic roots and affixes based on this hypothesis, even when outside evidence for their meaning or etymology is unavailable (e.g. **7a-nu**) or contradictory: the spelling **ch'a-ho-ma** is now often transliterated as *ch'aj-o'm*, or *ch'ah-o7m* ‘dripper’, following the present orthographic conventions, even though no outside evidence for *o7*, only for *oo*, which would yield *ch'ah-oom* ‘dripper’, is known. Also, some scholars arbitrarily reconstruct VV for any disharmonic term: thus, **7a-na-b'i** is reconstructed as *7a[j]-naab* ‘he of lakes’, even though the root in question is *nahb* ‘lake’, and Vh did not merge with VV in Proto-Ch'olan-Tzeltalan or Proto-Ch'olan. Thus, transcriptions and reconstructions, in an attempt to show more linguistic details called for by the DH I or DH II, have become highly unreliable and inconsistent.¹³ Some of the remaining violations to the DH (I/II) likely involve Actual Suffixing, such as the case of the independent demonstrative pronouns (e.g. **ha-7i**, likely for **ha7-Ø+i* ‘that one’ and **ha-7o-b'a**, likely for **ha7-o7b'+a* ‘these ones’), and are further discussed below.

4. Testing alternative approaches

4.1 Consonant deletion

Neither of the DH approaches takes into account the convention of Consonant Deletion (C-deletion), which leads to underrepresentation, most commonly of root- and word-final consonants, especially /l/ (Mathews & Justeson 1984; Bricker 1989, 2000; Justeson 1989; Zender 1999). Examples of such practices are very common in two contexts: (1) the second consonant of the first root in a compound word, such as *ta-ja-MO7(-7o)*, attested in more complete spellings as *ta-ja-l(a)-*

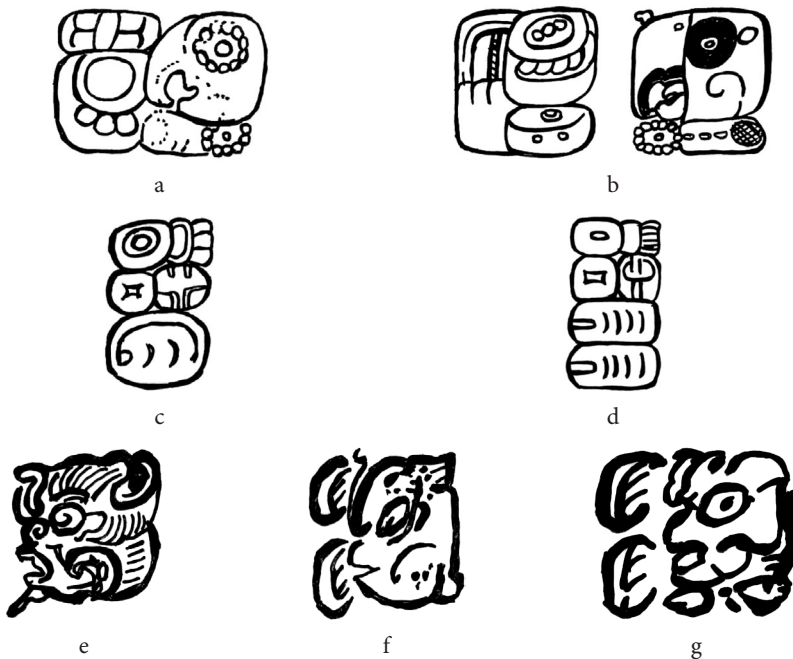


Figure 6. Principle of Consonant Deletion.

- a. *ta-ja-MO7-7o* for *taj-a(l)=mo7* 'Torch Macaw'. Yaxchilan Hieroglyphic Stairway 5, Glyph 84. After drawing by Graham (1982: 179).
- b. *ta-ja-la-MO7-'o* for *taj-al=mo7* 'Torch Macaw'. Machaquila, Structure 4, Glyphs V2-V3. After drawing by Graham (1967: Figure 39).
- c. *ti-7AJAW-le* for *ti 7ajaw-lel* 'in lordship'. Piedras Negras Stela 3, Glyph F5a. After drawing by Sylvanus G. Morley in Bricker (1989: 48).
- d. *ti-7AJAW-le-le* for *ti 7ajaw-lel* 'in lordship'. Piedras Negras Throne 1, Glyph H'3. After drawing by Sylvanus G. Morley in Bricker (1989: 48).
- e. *ka*. Excerpt from vessel K532. After photograph in Kerr (1999).
- f. *ka-ka*. Excerpt from pottery vessel. After photograph in Robicsek and Hales (1981: 200).
- g. *ka-ka-wa*. Excerpt from pottery vessel K1837. After photograph in Kerr (1999).

MO7, for *taj-a(l)=mo7* ‘torchy macaw (a species of macaw?)’ (Figures 6a and b), and also *k’u-MO7(-7o) ~ k’u-k’u-MO7(-7o)* for *k’uk’=mo7* ‘quetzal macaw’; and (2) the final consonant of a root or word, such as *ka-se*, also *ka-se-wa*, for ‘fifth month’, 7AJAW-*le*, also 7AJAW-*le-le* and 7AJAW-²*le* for 7*ajaw-(a)l-el* ‘kingship’, and *ch’a-jo*, also *ch’a-jo-m(a)*, for *ch’aj-o(7)m* ‘dripper’. Given such practice, one could ask whether *yi-ch’a-ki* is an underspelling of *y-ihch’ak-il* (cf. Ch’ol *iy-ejč’ach-il*). Of interest here, Bricker (personal communication 2002) has suggested that the C-deletion and synharmony (see below for more discussion) evinced in cases like the spelling of the suffix *-lel* could be more phonetically generalized, and perhaps used in other contexts, i.e. examples where C_1VC_1 sequences. Evidence for this phenomenon is presented below.

In any case, this tells us that it is not difficult to test for C-deletion. It is simply necessary to find spellings of the same word in identical morphosyntactic environments. The following spellings, among many others, are found in free variation in identical morphosyntactic environments that require a *-Vl* suffix (Table 6; Figure 7).

A few of these examples are illustrated in Figures 7 and 8, where the title 7a(j)-*b’i-k’i-la* appears in free variation with 7a-*b’i-k’i*, which is missing the *la* sign from the first example (see arrow), in the spelling of the the same scribes’ names. In Figure 7, two different examples attest to C-deletion: first, free variation in the spellings *ma-su-la* and *ma-su* in the context of the same title, and second, free variation in the spellings ... TUN-*ni* and ... TUN-*ni-li*, in both cases for ‘stone’, which appears in identical morphosyntactic contexts, as the head of a possessed noun phrase that functions as the subject of an intransitivized verb.

Using the database of Primary Standard Sequence texts prepared by Mora-Marín (2004), which currently includes 805 entries, it is possible to show that out of 348 entries with the ‘drinking cup’ expression, *yu-k’i-b’i* for *y-uk’-ib’* (Mora-Marín 2000), only 16 contain a final IV syllabogram, 14 of them with *la* and 2 with *li*; these point to the generally implicit presence of a possessive *-Vl* suffix that is partly spelled by the *i* of T585 *b’i*. In the same database, out of 47 entries of the possessed nominalization 7*u-ts’ihb’-naj-al* ‘his/her painted thing’, which exhibits the suffix *-naj* ‘passivizer of derived transitives’ followed by the suffix *-al* ‘nominalizer’, 23 examples show an explicit syllabogram *la*, while 24 show no such syllabogram, even though the possessed nominalization context requires a possessive *-Vl* suffix. Similarly, of the 99 examples of the possessed verbal noun 7*u-ts’ihb’-al* ‘his/her writing’ as 7*u-ts’i-b’a-li*, 80 occur with an explicit *li* syllabogram, while 19 occur without it, also suggesting that these 19 were intended to be read as 7*u-ts’ihb’-al*. C-deletion, in conclusion, can account for a large number of so-called disharmonic and synharmonic spellings.

Table 6. Variable spellings occurring in equivalent morphosyntactic contexts.¹⁴

Morphosyntactic Context	Spelling Variation for -VC suffixes	Sources
[Possessed Noun]- <i>il</i> + Possessor	7u-B'AH ~	Yaxchilan Lt 24: B1b, G1a
	7u-B'AH-hi ~	Yaxchilan Lt 1: E1
	7u-B'AH-hi-li	Yaxchilan St 1
	7u-TUN-ni ~	Nim Li Punit St 15: E1
[Possessed.Noun]- <i>al</i> + Possessor	7u-TUN-ni-li	Copan HStairway
	7u-LAKAM-TUN-ni ~	Quirigua St 1: C3-D3
	7u-LAKAM-TUN-ni-li	Tikal St 12
	yu-k'i-b'i ~	[Hundreds of cases; e.g. Colas et al. (2002)]
[Possessed.Noun]- <i>ul</i> + Possessor	ya-ja-wa ~	Tonina Mn 31: B3
	ya-ja-wa-la	Rio Azul Plaque
Titles	7aj-b'i-k'i ~	Piedras Negras Throne 1
	7aj-b'i-k'i-la	Piedras Negras St 12
Proper Names	ma-su ~	Rio Azul jade earring
	ma-su-la	Early Classic incised bowl
	7IX-sa-ja ~	Yaxchilan Lt 14: C3
	7IX-sa-ja-la	Yaxchilan Lt 54: C2
	7a(j)-?-ni ~	El Chorro Altar 2: D5, St: A9 ¹⁵
	7a(j)-?-ni-la	El Chorro St: B3, Itzan St 17: I11
	ma-ta-wi ~	Looted Panel: D3
	ma-ta-wi-la	Palenque TFC Alfarda: B2
	7a-7u-ku ~	Yaxchilan Lt 42: G3, Lt 3: G1, Lt4: D5b
	7a-7u-ku-m(a)	Yaxchilan 54: C2
Proper Names	7a-ku ~	Palenque TI, West Tablet: O1
	7a-ku-la	Bonampak Stela 1: I, Stela 2: D7
	TAPIR-la ~	Palenque Eves of House C and Yaxchilan Lt 35: A7
	ti-la ~	Vase K1253
	ti-la-la	Vase K1442
	sa-ku ~	Quirigua St E: D13
	sa-ku-ma/la	Quirigua St C, Tonina Mn 69

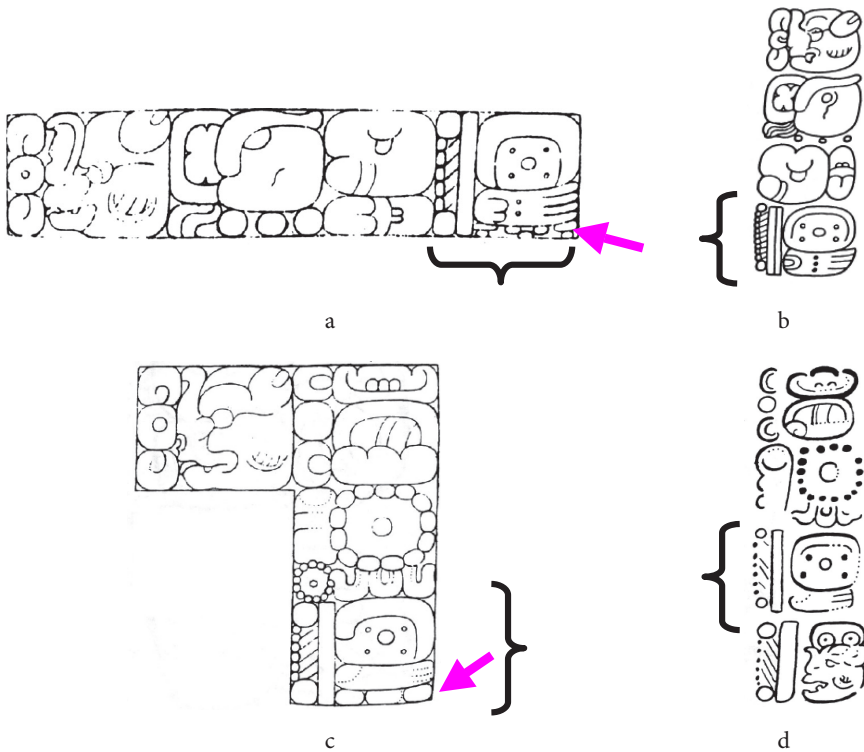


Figure 7. Presence or absence of explicit *-Vl* suffix in names of same scribes. Name of same scribe illustrating C-deletion.

- a. Scribal signature on Piedras Negras Stela 12. Drawing by John Montgomery at <http://research.famsi.org/montgomery.html>.
- b. Scribal signature on Piedras Negras Throne 1. Drawing by John Montgomery at <http://research.famsi.org/montgomery.html>.
- c. 7a(j)-b'i-k'i-l(a) title demonstrating presence of an *-il* suffix after root *b'ik'*. Detail of drawing by John Montgomery at <http://research.famsi.org/montgomery.html>.
- d. 7a(j)-b'i-k'i title demonstrating underspelling of *-il* suffix as simply *-i(l)*. Detail redrawn by this author after drawing by John Montgomery at <http://research.famsi.org/montgomery.html>.

4.2 The fallacy of default synharmony

The DH, particularly DH I, also assumes that synharmonic spellings are unmarked or default. This is not the case. Justeson (1989) demonstrated that two types of phonological contexts, C_1VC_1 and $CV7$ roots, call for obligatory synharmony (Table 7; Figures 9a–d):

Cases that appear to be exceptions to this rule can be explained as an anticipated spelling of the initial vowel of a following word, C-deletion, or morphological

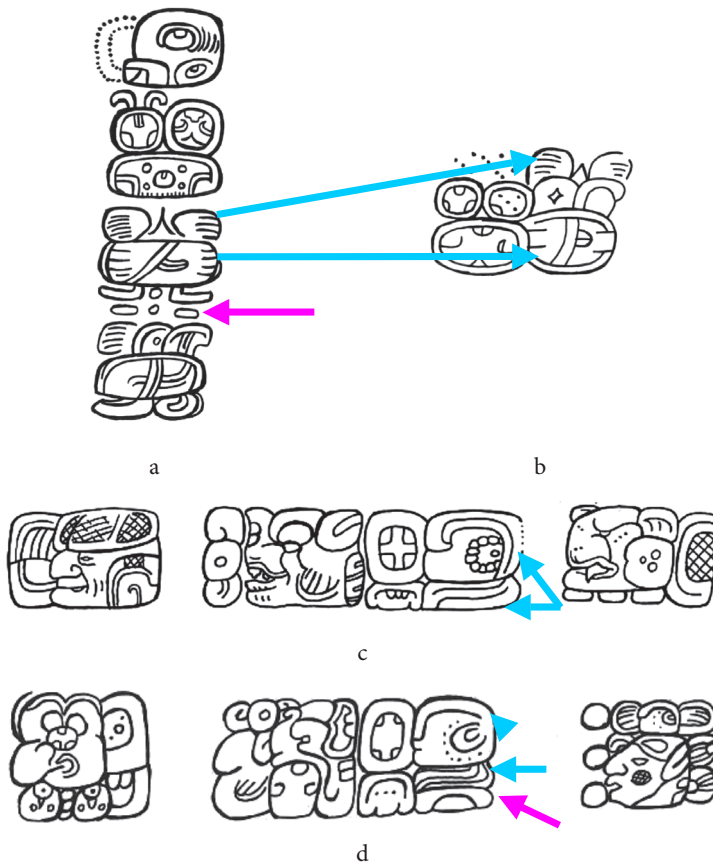


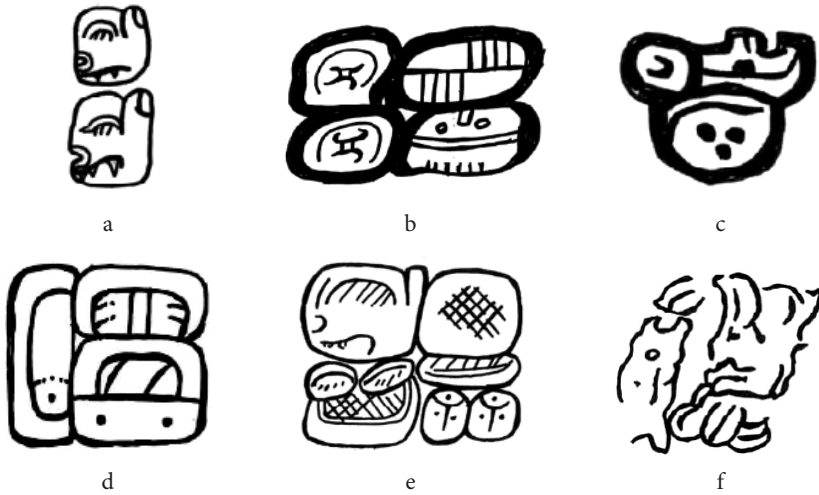
Figure 8. Spellings of *ma-su-l(a)*.

- a. *ma-su-l(a)* on unprovenienced Early Classic incised bowl. After drawing in Martin and Grube (2000: 42).
- b. *ma-su* on Early Classic incised earflares reportedly from Rio Azul. After drawing in Martin and Grube (2000: 42).
- c. VS sentence with possessed noun as subject. Note possessed noun spelled K'AN-na-TUN-ni. Excerpt from Tonina Monument 148. After drawing by Ian Graham (1996).
- d. VS sentence with possessed noun, spelled K'AN-na-TUN-ni-li, as subject. Excerpt from Tonina Monument 95. After drawing by Ian Graham (1996).

conditioning. In other words, it is necessary to carefully analyze the morphosyntactic contexts of these expressions, rather than simply isolate them (Figures 9e–f). An example such as *k'a-k'u-pa-ka-la* (Figure 9e) for *k'ahk' u-pakal* 'his shield is fire' (fire 3SERG/POSS-shield), exhibits disharmony because the *u* of the *k'u* sign is utilized to spell a following *u*- 'third person singular pronominal', as explained by Kelley (1976), while an example such as *ts'u-ts'i-hi* (Figure 9f) is spelling the term

Table 7. Contexts for phonologically-conditioned synharmony (according to Justeson 1989).

C ₁ VC ₁ roots	CV7 roots
k'a-k'a for *k'ahk' 'fire'	mo-7o for *mo' 'macaw'
po-po for *pohp 'mat'	te-7e for *te' 'tree'
k'u-k'u for *k'uk' (< *q'u7q')	ti-7i for *ti' 'mouth; edge'
ta-ta for *tāt 'thick (of liquids)'	ts'i-7i for *ts'i7 'dog'

Figure 9. Examples of C₁VC₁ roots.

- Spelling k'a-k'a for *k'ahk' 'fire'. Excerpt from Chichen Itza Monjas Lintel 4. After drawing by Graham (1977a).
- po-po-t's'a-ma for *pohp-ol, t's'am-a(l)* 'mat and throne'. From Dresden Codex page 46. After drawing by Markus Eberl in Knowlton (2002: 10).
- c. te-7e for *te7* 'tree'. From Madrid Codex page 42c. After drawing in Bricker (1995: Figure 3a).
- d. 7u-ts'i-i for *7u ts'i7* 'his dog'. After drawing by Stuart (1987: Figure 13).
- e. k'a-k'u-pa-ka-l(a) for *k'ahk' 7u pakal* 'his shield is fire'. Chichen Itza Monjas Lintel 2 (at B1). After drawing in Graham (1977a: 269).
- f. ts'u-ts'i-hi for *t's'uts'i(h)* 'coati'. Excerpt from Kerr Vase 8076. After drawing in Houston et al. (2001: Figure 2b).

t's'uts' 'coati' with some sort of *-ih* suffix, possibly a weakened version of *-il*, as in cases where final *l* is weakened word-finally in the Lowland Mayan languages.¹⁶

This rule, I would argue, can be extended to phonological sequences, not just roots, as first suggested to me by Bricker (personal communication 2002).¹⁷ I have found supporting evidence for this hypothesis (Table 8). The evidence also

shows that scribes were free to spell C_1VC_1 sequences with a single C_1V sign quite frequently. This was the case with **yu-ne**, the more common spelling of *y-unen* 'his child', which was occasionally rendered as **yu-²ne**, with a reduplication diacritic (D. Stuart 1985, 1988), as well as **ts'u-nu** ~ **ts'u-²nu** for Pre-Ch'olan **ts'unu7n* 'hummingbird', and even **ka** ~ **ka-wa** ~ **²ka-wa** ~ **ka-ka** ~ **ka-ka-wa** for Pre-Ch'olan **kakaw* 'cocoa'.

Table 8. More general phonological contexts for obligatory synharmony.

C_1VC_1 Sequences	CV7 Sequences
-le-l(e) for * <i>lel</i> 'abstractive'	K'AB'A7-7a for * <i>k'aab'aa7</i> 'name'
yu-ne ~ yu-²ne for <i>y-unen</i> 'his child'	
ts'u-nu-n(u) for * <i>ts'unun</i> (< PM * <i>ts'uunu7n</i>) 'hummingbird'	
si-na-n(a) for Yu. <i>síná7an</i> 'scorpion'	
(ka-)ka-wa ~ ²ka-wa for Pre-Ch'olan * <i>kakaw</i> 'cocoa'	

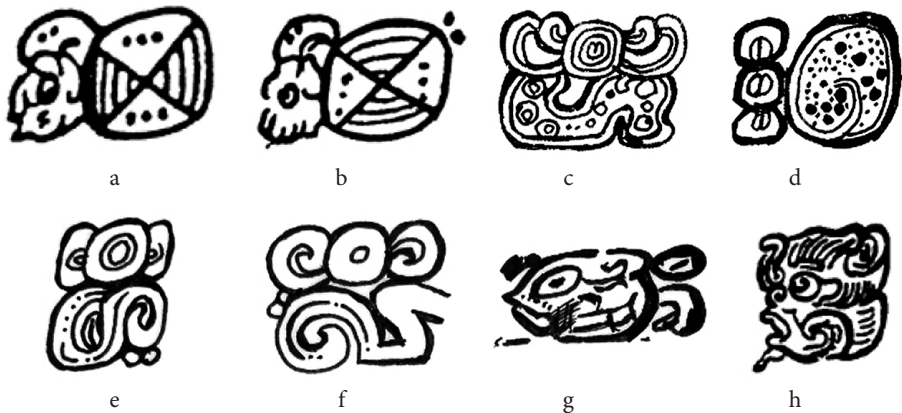


Figure 10. Examples of C_1VC_1 non-morphemic sequences.

- Spelling **ts'u-nu**.
- Spelling **ts'u-²nu**.
- yu-ne** on Copan Stela 63. After drawing by Marc Zender (1999: Figure 48a) after Fash (1991).
- yu-ne** on pottery vessel. After drawing by Marc Zender (1999: Figure 48d) after Coe (1973: 103).
- yu-ne²** on unprovenienced panel. After drawing by Marc Zender (1999: Figure 48e) after Mayer (1987: Plate 104).
- yu-ne²** on unprovenienced panel. Drawing by Marc Zender (1999: Figure 48f) after Mayer (1987: Plate 54).
- Spelling **ka-wa** for **käkäw* 'cocoa'.
- Spelling **ka** for **käkäw* 'cocoa'.

I have further identified two additional contexts, not previously discussed by any author in relation to the possibility of obligatory synharmony, that demand obligatory synharmonic vowel insertion (Table 9; Figure 11). Kaufman (personal communication, 2004) has discussed the spelling of *+ich* ‘already, yet; indeed’ as a separate word in Classic texts, as in the case of K’AL-la-j(a)–(j)i-ch(i), for *k’al-aj-Ø+ich* ‘it was wrapped already/indeed’, and has suggested that this redundant use of jV syllabograms allows for the syllabographic spelling of a V-initial enclitic as a separate word. As it turns out, this context coincides with one of the two additional contexts for obligatory synharmony discussed next.

The first examples, those of ...VCCV... sequences, appear to be cases of vowel syncope (deletion) between consonants whenever a following syllable (e.g. in the form of an added suffix) is present, a process well known for Proto-Ch’olan (Kaufman & Norman 1984). This rule accounts for all positional verb roots, which typically take either a synharmonic $-V_1l$ ‘stative’ suffix, or $-CVC$ suffixes such as $-laj(-i)$ and $-wan(-i)$. The use of one of these rules with foreign words (e.g. *cactonal*) supports its status as a phonologically conditioned process. In fact, 12 of the 39 synharmonic spellings in the Houston et al. (1998) data set can be accounted for in this way. Some synharmonic spellings, in particular those of nouns that do not correspond to roots of C_1VC_1 or CV7 shapes, cannot be readily accounted for in this way, and I address those below. The examples in Table 9q–r constitute cases of Consonant Insertion akin to the cases identified by Bricker (1985: 352) in the post-conquest *Books of Chilam Balam of Chumayel*. She notes a series of spellings with

Table 9. Obligatory synharmony with vowel insertion in the spelling at morpheme boundaries.

VCCV... Sequences ¹⁸	VC-V... Sequences ¹⁹
a. 7a-k’(a)-ta for *ahk’(o)t-a(j) ‘to dance’	p. yi-l(i)–(7)a-ji for <i>y-il-a-ji</i>
b. yo-k(o)-b’i-l(i) for <i>y-ok-b’-il</i>	q. 7u-PAT(-ta)–(t)i-ji for <i>u-pat-ij(+i)</i>
c. jo-ch’(o)-b’i-ya for <i>joch’-b’-i(y)(+a)</i>	r. K’AL-la-j(a)–(j)i-chi for <i>k’al-aj+ich</i>
d. jo-l(o)-b’i-ya for <i>jol-b’-i(y)(+a)</i>	
e. chu[k(u)]-ji-ya for <i>chuk-(a)j-i(y)(+a)</i>	
f. ti-l(i)-wa/wi for <i>til-w-a/i</i>	
g. cho-k(o)-wa/wi for <i>chok-w-a/i</i>	
h. 7u-pa-k(a)-b’u for <i>u-pak-b’u</i>	
i. 7e-k(e)-li-b’(i) for <i>ek-l-ib’</i>	
j. 7e-k(e)-wa-ni for <i>ek-wan-i</i>	
k. CHUM(-mu)-wa-ni for <i>chum-wan-i</i>	
l. pa-t(a)-wa-ni for <i>pat-wan-i</i>	
m. xi-w(i)-te-i for <i>xiutecuhkli</i> (Nahuatl)	
n. ta-wi-s(i)-ka-l(a) for <i>huiz cal</i> (Nahuatl)	
o. ka-k(a)-tu-na-l(a) for <i>cactonal</i> (Nahuatl)	



Figure 11. Newly defined contexts for obligatory synharmony.

- a. 7a-k'(a)-ta for *ahk't-aj* 's/he danced'. Edzna Stela 18 (at A2-B2). After drawing in Stuart et al. (1999: II-38).
- b. Spelling **ts'i-b'(i)-na-j(a)** for *ts'ihb'-n-aj* 'it is/was painted'. Passage from unprovenienced ceramic vessel. After drawing by Stuart (1987: 52).
- c. yo-k(o)-b'i-l(i) for *y-ok-b'-il*. Palenque Temple XIX Platform, West Side (at A3). After drawing in Houston et al. (2001: Figure 6).
- d. Spelling **chu[k(u)]-ji-ya** for *chuk-(a)j-iy(+a)* 's/he is/was seized'. From Yaxchilan Hieroglyphic Stairway 3, step I, tread, glyph A2. After drawing by Graham (1982: 166).
- e. Spelling **7u-pa-ka-b'u** for 's/he placed it face down' or 'placed face down (e.g. stone lintel)', on Early Classic lintel at the Nelson-Atkins Gallery in Kansas City. After drawing in Stuart et al. (1999: 32).

- f. Spelling **7e-k(e)-wa-ni** for *7ek-wan-i* ‘it insert vertically (onto a wall)’. Tortuguero Monument 6. After drawing in Wichmann (2002: 10).
- g. Spelling **7e-k(e)-li-b’i** for *7ek’-l-ib’* ‘vertically inserted panel’. La Corona Panel 2B. After drawing in Wichmann (2002: 9).
- h. Spelling **CHAK-xi-wi-te-7i**, for Nahuatl *xiutecuhтли*. Dresden 49. After drawing in Bricker (2000: 98, Figure 15b).
- i. Spelling **ta-wi-si-ca-la**, for the first half of Nahuatl *tlahuizcalpantecuhтли*. Dresden 49. After drawing in Bricker (2000: 98, Figure 15a).
- j. Spelling **ka-ka-tu-na-la**, for Nahuatl *cactonal*. Dresden 49. After drawing in Bricker (2000: 98, Figure 15c).
- k. Spelling **yi-l(i)-7a-ji-ya** for *y-il-ä-j-iy(+a)* ‘s/he it has said it’. From Palenque Temple of Inscriptions, middle panel, glyph H2. After drawing by Stuart (1987: Figure 36d).
- l. Spelling **(7/Y)IL(-li)-7a-ja** for *y-il-ä-(a)j(+a)* ‘s/he has seen it’ or *il-ä-(a)j(+a)* ‘it/s/he has been seen’. Excerpt from Naj Tunich. Drawing by Barbara MacLeod in Stone (1995).
- m. **7u-we-7i-b’i** for *7u we7-ib’* ‘his/her thing for eating’. After drawing by Zender (2000).

‘doubled consonants’ to spell -VC suffixes, as in ⟨ahau uob⟩ instead of ⟨ahauob⟩ for *7ajaw-o’ob’* ‘rulers’, and ⟨u mul lil⟩ instead of ⟨u mulil⟩ for ‘its mound’. She also compared these to the glyphic examples **7u-K’IN-ni-le** and **ti-CHAN-na-li**, which would amount to ⟨u kin nil⟩ and ⟨ti caan nal⟩ if they were written in Colonial Yucatec orthography. In these cases, as Bricker explains, the -VC suffixes are spelled as CVC syllables, in the case of the *Chumayel*, or CV-C(V) sequences, in the case of the Pre-Columbian texts. More recently, Kaufman (2004) noted his discussion with Barbara MacLeod and Nikolai Grube of March 11, 2002, and subsequently, in which the **yi-chi ~ ji-chi** collocation of the Primary Standard Sequence of dedicatory texts was discussed and defined as a spelling of *+ich* ‘already, indeed’: **ts’i-b’(i) na-ja ji-chi** for *ts’ihb’-naj-Ø+ich* (writing-DTV.PSSVZR-3SCMP+indeed) ‘it was written indeed’ and **GOD.N-yi yi-chi** for *GOD.N-Vy-Ø+ich* (VERB-DERV.SFFX-3SCMP+indeed) ‘it was GOD.Ned indeed’. In each case, the vowel-initial enclitic is spelled as a separate word with an initial consonant copying the immediately preceding consonant. Yet another example is present in Figure 11m): **7u WE7 7i-b’i**, for *7u we7-ib’* (3SERG eat-INSTR) ‘thing for eating’. Here the suffix *-ib’* ‘instrumentalizer’ was spelled as its own word with an initial 7, which is also the final C of the root *we7* which it inflects. These are also examples of Consonant Insertion for the spelling of a -VC suffix or enclitic. Bricker notes that the same practice was used in the *Chumayel* for the spelling of -V suffixes and enclitics, as with ⟨chac ce⟩ instead of the alphabetic version ⟨chace⟩, involving *chak* ‘rain’ and *+e* ‘topicalizer’, and ⟨muyal le⟩ instead of ⟨muyale⟩, for *muyal* ‘cloud’ and *+e* ‘topicalizer’.

Lastly, an important number of synharmonic spellings are likely the result of C-deletion, or of morphological conditioning, particularly when the typical suffixes of such roots were synharmonic. Thus, for some spellings of $C_1V_1C_1$ roots, it



Figure 12. Name of prisoner on Yaxchilan Hieroglyphic Stairway 3, Step I (at E1-E2).
po-po-l(o) cha-ya. After drawing from Graham (1979: 166).

is possible that their $-V_1C$ suffixes, whose vowel harmonized with the vowel of the root, were sufficient to condition synharmonic spellings. For example, in the spelling **po-po-lo cha-ya** (Figure 12), where the first term likely spells *pohp-ol*, possibly ‘of the mat’, the suffix was synharmonic, and thus, cases where the spelling appears as **po-po** could be the result of C-deletion or perhaps morphological conditioning, as explained next.²⁰

4.3 Morphological conditioning

There are two types of evidence for morphological conditioning: epigraphic (Mora-Marín 2001, 2002, 2004) and linguistic (Kaufman 2003a, 2003b). The two almost always reinforce each other, as shown in this paper, and in some cases one approach can fill in the gaps of the other. This process involves the typical or most common suffix of a root or stem as the strongest influence in the spelling of this root or stem even when no suffix was required in a different morphosyntactic context. For example, Justeson (1989) argued that the typical spelling of intransitive roots with a Ci word-closing syllabogram (e.g. 7OCH-**chi**, hu-**li**) was based on the frequent suffix $-i(h/y)$ ‘completive status of intransitives’ (i.e. 7och-*i* ‘s/he entered’, hul-*i* ‘s/he arrived (here)’), and likewise, that the **b’a** sign of **ts’i-b’a** in 7AJ/7aj-**ts’i-b’(a)** was due to the fact that *ts’ihb’* ‘writing’ is a noun that requires an applicative suffix $-ä$ to be transitivized; thus, its typical spelling as **ts’i-b’a** even in contexts where it was not a transitive verb (e.g. 7aj-*ts’ihb’* ‘writer’) could be due to its typical suffixing.²¹ In other words, a root or CVC sequence could be spelled with a conventionalized CV-CV sequence in which the vowel of the second syllabogram reflects the vowel of the most common $-VC$ suffix a root might take (Table 10; Figures 13 and 14).

The vowel of the typical $-VC$ suffixes of these terms is maintained in spellings where no explicit suffix is apparent or needed by the morphosyntactic context. Some of these spellings supplement Kaufman’s (2003a, 2003b) approach. For instance, Kaufman did not find evidence for the use of suffixes with Proto-Mayan

Table 10. Spelling alternations in differing morphosyntactic contexts, one requiring a -VC suffix, the other not.

No explicit suffix ²²	Suffix needed
a. 7u-mu-t(i) *mut 'bird'	CHAK-mu-ti-l(a) for <i>chächäk mut-il</i> 'red bird' ²³
b. 7a-na-b'(i) 7a[j]+nabh' 'he of the pool'	ya-na-b'i-l(i) for <i>y-a[j]+nabh'-il</i> 'his 7aj-nabh'
c. 7u-to-k'a 7u-tok'(-al) 'his flint'	7a(j)-to-k'a-l(a) for <i>7aj+tok'-al</i> 'he of the flint'
d. cha-k(i) <i>chahk</i> 'lightning, thunder'	7u-cha-ki-l(i) for <i>7u-chahk-il</i> ²⁴
e. yu-ha <i>y-uh(-al)</i> 'his bead'	7u-ha-j(a) for <i>7uh-aj</i> 'bead (of someone)'
f. 7u-tu-pa 7u-tuup 'his earring'	tu-pa-j(a) for <i>tuup-aj</i> 'earring (of someone)'
g. yo-7OL-la <i>y-ohl</i> 'his heart'	7o-la-s(i) for <i>7ohl-as</i> 'heart'
h. 7e-b'u *7ehb' 'step'	ye-b'u-l(i) for <i>y-ehb'-ul</i> 'his step' ²⁵
i. K'IN-n(i) *k'in 'sun, day'	(7u-)K'IN-ni-l(i)/l(e) for <i>k'in-il</i> 'by day; special day' or <i>7u-k'i(:)n-il</i> 'his/her day; special day', K'IN-ni-ch(i) for <i>k'inich</i> 'Sun God'
j. 7u-WAY(-ya) 7u-way 'his alter ego'	WAY-ya-l(a) for <i>way-al</i> 'alter ego' WAY-ya-s(i) for <i>way-as</i> 'alter ego/sorcerer'
k. chu[k(u)]-ka-j(a) <i>chuk-aj</i>	7u-chu-ku-w(a) for <i>7u-chuk-uw</i> 's/he seized it'

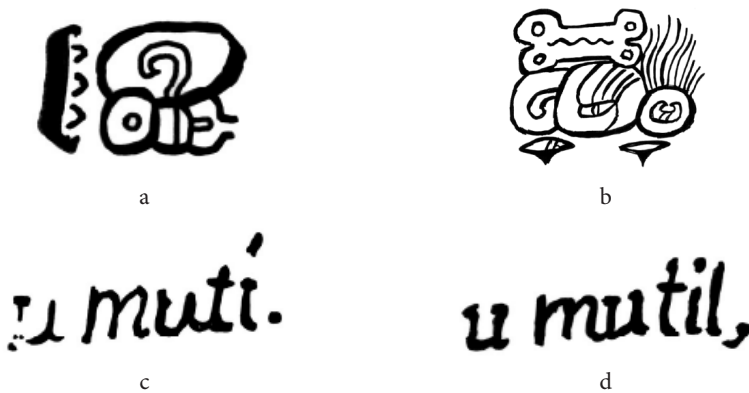


Figure 13. Spellings of the term *mut* 'bird; omen'.

- 7u-mu-ti. Dresden Codex, D18b. Drawing by this author after Bricker (1989: 48, Figure 4.12).
- ?CHAK-mu-ti-l(a). Passage from unprovenienced Early Classic ceramic vessel in the shape of a bird. Drawing by this author.
- Spelling of *u mu(:)t-il* as <u muti> on page 2 of The Book of Chilam Balam of Chan Kan. After photograph in Bricker (1989: 46).
- Spelling of *u mu(:)t-il* as <u mutil> on page 2 of The Book of Chilam Balam of Chan Kan. After photograph in Bricker (1989: 46).



a



b



c



d



e



f



g



h



i



j



k



l



m



n



o



p



q



r

Figure 14.

- a. **7a-na-b'i** for *a(j)+na(h)b'(-il)*. Naj Tunich Drawing 29. Drawing by Barbara MacLeod in Stone (1995).
- b. **ya-na-b'i-li** for *y-a(j)+na(h)b'-il*. Naj Tunich Drawing 29. Drawing by Barbara MacLeod in Stone (1995).
- c. **7u-to-k'a-pa-ka-la** for *u-tok', u-pakal* 'his/her flint, his/her shield'. Yaxchilan Lintel 46 (F8). After drawing in Bricker (1995: Figure 6j).
- d. **7a(j)-to-k'a-l(a)** for *aj+to(:)k'-al* 'he of the flint'. After Stuart et al. (1999: II-44).
- e. **to-k'a-l(a)** for *to(:)k'-al*. Yaxchilan bone bloodletter. After unpublished drawing by Ian Graham.
- f. **cha-ki** for *chahk* 'rain, thunder (Rain God)'. Excerpt from Caracol Ballcourt Marker 3. After drawing by Nikolai Grube in Chase et al. (1991: 5, Figure 3).
- g. **7u-cha-ki-l(i)** for *u-chahk-il* 'his/her/its *chahk* (rainy season?)'. Comalcalco brick. After drawing in Martin et al. (2002: II-61).
- h. **CHAK-ki** for *chahk* 'lightning'. From Dos Pilas Stela 8. After drawing by Houston (1993).
- i. **7u-CHAK-ki-l(i)** for *u-chahk-il* 'his/her/its *chahk* (rainy season?)'. Vase of the Eleven Gods, K7750. After photograph in Kerr (1999).
- j. **7u-K'IN-ni-le** for *u-k'iin-il(+e)* or *u-k'iin-il-e(l)*. Kabah Structure I, North Jamb (B). After drawing in Bricker (1989: 40).
- k. **7u-K'IN-ni**. Chichen Itza, Temple of the Four Lintels, Lintel II, glyph E5. Drawing by Ruth Krochock.
- l. **K'IN-li-ni** for *k'iin-il*. Chichen Itza 4 Lintel 2. After drawing by Ruth Krochock.
- m. **[K'IN]chi-ni** for *k'iin-ich* 'Sun God'. Simojovel shell. After drawing by Peter Mathews in Schele and Miller (1986).
- n. **7u-tsi** spelling on pottery vessel for *uts* 'good'. Pottery vessel K1453. After photograph in Kerr (1999).
- o. **yu-tsi-li** for *y-uts-il* 'good/goodness'. Dresden Codex, D14b. After Stuart (1987: Figure 25b).
- p. **7e-b'u** for *ehb'* 'step'.
- q. **ye-b'u** for *y-ehb'(-ul)* 'his/her/its step'. From Calakmul.
- r. **ye-b'u-l(i)** for *y-ehb'-ul* 'his/her/its step'. From Naranjo. Drawings p–r. after drawing in Schele (2000).

tyooq'* (Lowland Mayan **took'* 'flint'). However, in CLM texts the term is found possessed as **7u-to-k'a (no explicit suffix) and unpossessed as **7AJ/7aj-to-k'a-la**, a spelling which exhibits a suffix *-al*. Also, Kaufman reconstructs Proto-Mayan **muut* 'bird; omen' and notes it is attested as *mut-al* in Tzotzil. This differs from its spelling in CLM texts as **mu-ti**, as in **7u-mu-ti** (Figure 13a); however, the phrase **CHAK-mu-ti-la** (Figure 13b) is also attested and suggests that the spelling with **ti** may have been motivated by a suffix *-il*; the Colonial period texts in Yucatec Maya discussed by Bricker (1989) in fact exhibit variation of the spellings of this term as ⟨u mut⟩, ⟨u muti⟩, and ⟨u mutil⟩, which would correspond to logographic

(7u-MUT > 7u-MUTIL), C-deletion (7u-mu-ti), and full spelling (7u-mu-ti-li) strategies of hieroglyphic writing, respectively.

In some of these cases we could be dealing with C-deletion, but it is likely that quite a few of these spellings with no apparent suffix are in fact conventionalizations. This is suggested by cases where it is clear from linguistic evidence that no suffix is necessary: (1) **yi-ts'i-n(a)** for *y-ihts'i(i)n* 'his younger sibling', and (2) **yi-cha-n(i)** for *y-ihchan* 'his maternal uncle'. These kin terms probably did not take a suffix when possessed, as is the case in modern Cholan-Tzeltalan languages. However, Kaufman (2003a, 2003b) has shown that the vowel of the word-closing syllabogram of these terms agrees with the vowel of the suffix that these kin terms take in the modern languages in unpossessed contexts.

Table 11. Examples of kin terms and glyphs that take -Vl suffix in absolute form but not in possessed form.

Hieroglyphic spelling	Extant language data
yi-cha-ni	Proto-Tzeltalan * <i>ichan-il(-ab)</i> 'tío materno', Tzeltal <i>y-ichan</i> 'su primo', Chól <i>y-ichan</i> 'su tío'
yi-ts'i-na	Tzeltal <i>ihts'in-äl</i> 'younger sibling', <i>k-ihts'in-ab</i> 'my younger siblings', <i>y-ihts'in</i> 'his younger sibling'
7i-ka-tsi ~ yi-ka-tsi	Tzeltal <i>7ihkatz-il</i> 'carga', <i>7ihkatz-in-el</i> 'llevar carga', <i>y-ihkatz</i> 'su carga'
yi-ch'a-ki	Proto-Tzeltalan * <i>ihchak-il</i> 'uña', Chól <i>ejkach</i> 'uña' <i>iy-eykach-il</i> 'su uña'

Thus, morphological conditioning is supported by epigraphic and linguistic evidence, and it explains conventionalized spellings in the hieroglyphic texts. Furthermore, some examples, such as **yi-ch'a-ki** (Table 5), can be explained as cases of conventionalization (i.e. the **ki** of **yi-ch'a-ki** as based on the probable unpossessed form **ihchak-il* 'fingernail, claw (of someone)') or underrepresentation (i.e. the vowel of **ki** as a partial spelling of *-il* of *iy-eykach-il*).

Another set of examples is seen in Figure 15. These and other examples are discussed by Houston et al. (2001), and also, in much more detail, by Zender (2004). These various authors, assuming the DH I by Houston et al. (1998), suggest that a spelling like 7u-tu-pa shows disharmony in order to indicate a complex vowel nucleus of the root, hence 7u-tu-p(a) for *tuup* 'earring'. They also argue that **tu-pa-ja** is to be analyzed as **tu-p(a)-AJ**: the *a* of **pa** is there simply as a diacritic for the complex vowel nucleus of *tuup*. The same is argued for **yo-7OL-la** and **7o-la-si**: they analyze these spellings as **yo-7OL(-la)** for *y-ohl* 'his/her/its heart' and **7o-l(a)-IS** for *ohl-is* 'heart', respectively. And finally, they analyze 7u-B'AH-hi as 7u-B'AH(-hi) for *7u-b'aah* and **B'AH-hi-ja** as **B'AH(-hi)-AJ** for *b'aah-aj*, as well

as **7u-si-hi** as **7u-si-h(i)** and **si-hi-ja** as **si-h(i)-AJ** for *7u-sih* ‘his/her/its gift’ and *sih-aj* ‘gift’, respectively. Nevertheless, the more conventional spelling rules would lead us to the following analyses: *7u-tuup* versus *tuup-aaj*, *7u-b’aaah* versus *b’aaah-ij*, *7u-sih* versus *sih-ij*, and *y-ohl* versus *7ohl-as*. Interestingly, the comparative

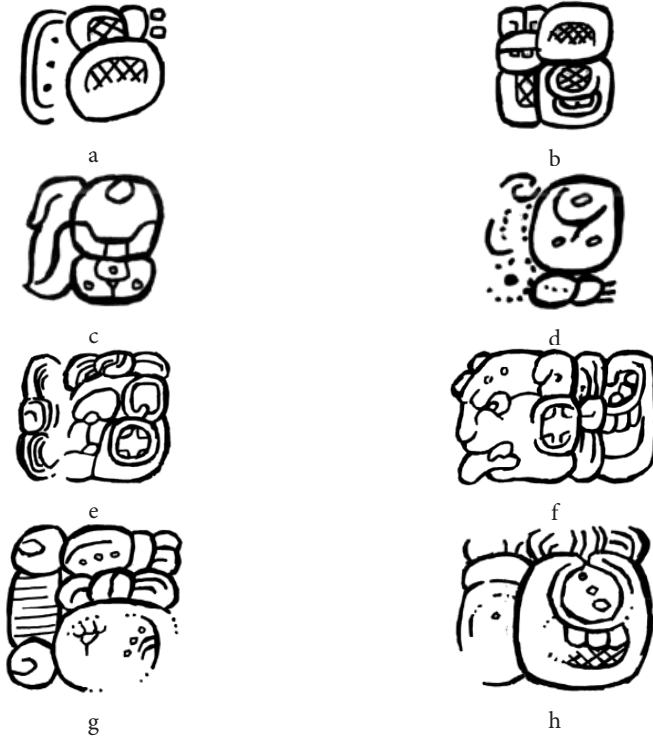


Figure 15. Spellings of absolute and possessed nouns.

- a. **7u-tu-pa** for *7u tu(G)p* ‘his earring’. Chichen Itza Cenote jade earring. After drawing by Tatiana Proskouriakoff.
- b. **tu-pa-ja** for *tu(G)p-a(:)j* ‘earring’. Palenque Temple of Inscriptions, Center Tablet (at A9). After drawing in Schele (2000).
- c. **yo-7OL-la** for *y-ohl(-al)* ‘his/her/its heart’. Palenque Temple of Inscriptions, West Tablet (at B7). After drawing in Schele (2000).
- d. **7o-la-si** for *7ohl-a(7)s* ‘heart’. Unprovenienced shell at Yale Art Gallery. After Stuart et al. (1999: II).
- e. **7u-B’AH-hi** for *7u ba(:)h-il* ‘his/her/its image/face/portrait’. Tikal Stela 5 (at D4). After drawing in Zender (2004).
- f. **B’AH-hi-ja** for *ba(:)h-i(:)j* ‘image’. Tamarindito Hieroglyphic Stairway 3, Step III (at E1). After drawing by Stephen Houston.
- g. **7u-si-hi** for *7u sih* ‘his/her/its gift’. Itzan Stela 17 (at C1). After drawing by Ian Graham.
- h. **si-hi-ja** for *sih-i(:)j* ‘gift’. Tamarindito Hieroglyphic Stairway 3, Step II (at E1). After drawing by Stephen Houston.

Mayan evidence supports the possibility of both *-a(a)j* and *-i(i)j*, for instance, as well as the existence of both *-as* and *-is*. Curiously, to my knowledge, no specialist has adduced explicit evidence for a form *-is* in the script: all explicit phonetic spellings point exclusively to *-as*. Therefore, the interpretation of the use of T57 *si* as a morphosyllable **-IS** is not clearly warranted. It seems simpler to assume that the spellings of the possessed forms were influenced or motivated by the spellings of the absolute forms: if **tu-pa-ja** shows an *-a(a)j* suffix, then the use of **pa** in the possessed form **7u-tu-p(a)** could be motivated by its use in the spelling of the absolute form.

Houston et al. (1998, 2001, 2004) and Zender (2004) have analyzed the above examples as invariant sets showing *-a(:)j* and *-i(:)s* suffixes. However, the spellings, if read conventionally, following Simple Spelling Rules, yield two variable sets *-a(:)j* ~ *-i(:)j*, on the one hand, and *-a(G)s* and possibly *-i(G)s*, on the other. These forms require some discussion. Fortunately, as the preceding authors have pointed out, these markers are attested outside of Ch'olan: Mam (*-b'aj* ~ *-j*), K'iche' (*-a:j* ~ *-i:j*), Kaqchikel (*-aj* ~ *-ij*, *-ätz*), Tz'utujil (*-a:j* ~ *-i:j* ~ *-e:j*), and Q'eqchi' (*-bej* ~ *-ej*) attest to it in Eastern Mayan, while Jakaltek (*-e*) and Q'anjob'al (*-e* ~ *-ej*) attest to it in Western Mayan. Together with the Classic Mayan forms, we can say that the cognate forms in this set of suffixes is reconstructible to Proto-Central Mayan, possibly as **-a:j* ~ **-i:j* ~ **-e:j*. Also, the fact that the K'iche', Kaqchikel, and Tz'utujil data attest two different vowels (Proto-Greater K'iche'an **-a:j* ~ **-i:j*) could suggest that the spellings from Classic Mayan texts (e.g. **tu-pa-j(a)** and **si-hi-j(a)**) could also point to two different vowels and therefore two morphophonemically or lexically-derived suffixes, *-a(:)j* ~ *-i(:)j*. So far no spellings support the retention of **-e:j* forms in the language of Classic Mayan texts, although the possibility that there might be such spellings is something that should be explored.

Also, the authors alluded to above read the T57 *si* sign as **-IS** in the context of unpossessed nouns, as with **7o-la-si**, following the MH approach, which would yield **7o-l(a)-IS**. Interestingly, not a single spelling of the form **7o-li-si** is known, to my knowledge, whereas several spellings of the form **7o-la-si** are known. Indeed, most of the spellings where Houston et al. (1998, 2001, 2004) and Zender (2004) propose a form **-IS** can be read simply as **-Ca-s(i)** spellings of an *-a(G)s* suffix, and none as an *-i(G)s* suffix: a Simple Spelling Rules approach yields **7o-la-s(i)**, with an *-a(G)s* suffix. This is a suffix of unpossessed nouns, and may be related to the frozen suffix of the Proto-Ch'olan term **alas* 'toy' from Proto-Mayan **a:la7s* 'toy'. The form can be analyzed as composed of **al* 'woman's offspring', from Proto-Mayan **aal*, and an apparently frozen suffix **-as*, seemingly from a Proto-Mayan form **-a7s*. Colonial Yucatec attests to a nominal term ⟨wayas⟩ 'lo que pasa de presto como sueño (that which happens quickly like a dream)', and ⟨wayasba⟩ 'sign(al), parable; divine by means of dreams and sign(al)s' (Barrera Vásquez 1980:916,

917), both probably based on a reflex of Proto-Mayan **wa(h)r*, itself likely derived from **war* ‘to sleep’ (Kaufman & Justeson 2004: 1260). This term may be attested in Classic texts, in the spellings discussed by Zender (2004): **WAY-ya-si**, analyzable here as **WAY-(y)a-s(i)** for *way-as*, but as **WAY(-ya)-IS** for *way-is* by Zender. The latter spelling alternates with the possessed form **7u-WAY-ya**.²⁶ The so-called ‘absolute’ suffixes of Mayan languages often convey clear meanings, such as uncertain possessor or generic/plural reference. In this case, one may take **al-as* as meaning ‘of a child’ (uncertain possessor), in other words, ‘toy (i.e. thing of a child)’. If so, we can posit a frozen Proto-Cholan suffix **-as*, which may have been productive in earlier times. This suffix may be a reflex of Proto-Mayan **-atz* ~ **-itz* ‘absolute noun forms’, as reconstructed by Kaufman (1989: 8, Part B). Poqom, in fact, shows *-is* ~ *-es* ~ *-b'es*, Kaqchikel shows *-ätz* < *-atz*, (Colonial) Yucatec shows *-tz(-il)*, and Mocho’ shows *-itz* ~ *atz* ~ *otz*. Colonial Yucatec attest to the term (*wayas*). In any case, these sets of uncertain possession or generic/plural markers typically show two or three distinct, morphophonemically-determined vowels; thus, the presence of *-a(G)s* ~ *-i(G)s*, which is in fact suggested by Simple Spelling Rules, should be no surprise.

Conventionalization could be promoted by multiple reinforcement based on different *-VC* suffixes with the same vowel:

(1) Multiple Reinforcement

7u-B'AH-hi-l(i) with *-il* and **B'AH-hi-j(a)** with *-ij* share vowel; both reinforce use of **hi**

K'IN-ni-l(i) with *-il* and **K'IN-ni-ch(i)** with *-ich* share vowel; both reinforce use of **ni**

Interestingly, it is possible that some conflicting spellings may have coexisted for some time, but one was ultimately picked as a result of frequency of associated suffix in the genre where it commonly occurred:

(2) Competing Motivations

yu-k'i-b'(a) ~ **yu-k'i-b'(i)** for *y-uk'-ib'* 3SERG-drink-INSTR ‘his/her cup’

7u-k'i-b'a for *7uk'-ib'-äl* drink-INSTR-UNPOSS ‘cup (of someone)’

yu-k'i-b'i for *y-uk'-ib'(-il)* 3SERG-drink-INSTR(-POSS) ‘his/her cup’

The term for ‘cup’ appears possessed in 91% of its occurrences; this fact probably influenced the preference for the spelling of this term with a word-closing syllabogram **b'i** (i.e. **yu-k'i-b'i**), given that in many of those possessed occurrences a possessive *-il* suffix was likely present after the instrumentalizing suffix *-ib'* (**yu-k'i-b'i-l(a)** and **yu-k'i-b'i-l(i)** for *y-uk'-ib'-il*), though not necessarily all (some cases of **yu-k'i-b'i** were probably for *y-uk'-ib'*). It is worth pointing out that in at least a handful of instances on Early Classic pottery vessels from Tikal and a Tikal-style

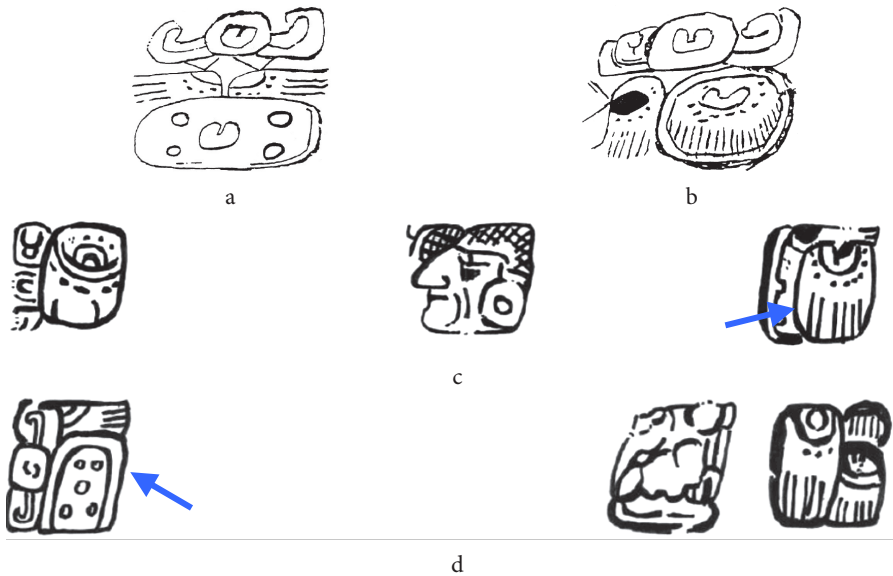


Figure 16. Competing motivations in spelling of 'cup'.

- yu-k'i-b'i** for *y-uk'-ib'* or *y-uk'-(i)b'-il* 'his/her cup' on Early Classic pottery vessel. After photograph in Coe (1973).
- yu-k'i-b'a** for *y-uk'-ib'*, not *y-uk'-(i)b'-il*, on same Early Classic pottery vessel as example a). After photograph in Coe (1973).
- Passage beginning with **7u-k'i-b'a** for *uk'-(i)b'-äl* 'cup (of someone)'; on Late Classic pottery vessel. After photograph in Coe (1973).
- yu-k'i-b'i**, on same Late Classic pottery vessel as example c). After photograph in Coe (1973).

vessel that is unprovenienced one finds **yu-k'i-b'i** as well as **yu-k'i-b'a**, in at least one case within the same text (Figure 16a–b). The use of T501 **b'a** is not motivated by the presence of a suffix *-il*; when possessed, it is plausible that only a suffix *-il* could be added, given the evidence from the modern languages. An explanation for this spelling type comes instead from the unpossessed form of the term for 'cup': *Ch'ol uch'-ib'-äl* 'cup'. In unpossessed form the noun for 'cup' requires an absolute (uncertain possessor) suffix *-äl*. Is it possible, then, that the use of **b'a** was motivated by the presence of a suffix *-äl* when the noun was not possessed? A fascinating dedicatory formula on an unprovenienced pottery vessel suggests this was in fact the case. On this vessel one finds several sentences and clauses. The first clause is made up of the Initial Sign (*lay* 'this'), the GOD.N glyph (a dedicatory verb) and the unpossessed term **7u-k'i-b'a** for *uk'-ib'-äl*. Thus, given the unpossessed form, it is likely that an absolute suffix *-äl* was intended, even if underspelled. This clause is followed immediately by a clause beginning with **yu-k'i-b'i**, the possessed form of the same term. This possessed term is then followed by its possessor, **ch'o-ko**

b'a-ka-b'a for *chòk b'a=kab* 'Sprout *Bakab*'. Thus, the whole sequence reads: 'The/a cup was dedicated. It is the cup of Sprout Bacab'.

Also worth discussing is the fact that Houston et al.'s data set contains examples of unique spellings that they have isolated from their morphosyntactic contexts. For example, to my knowledge, the spelling **te-mu** appears in only one text. Although they cite it as **te-mu** the spelling occurs possessed as **7u-te-mu-?li**, suggesting that it could simply be a case of **7u-te-mu-l(i)** for *u-tehm-ul*, not unlike the **ye-b'u-li** spelling for *y-ehb'-ul*. Other unique spellings are given without provided sources; thus, assuming they occur in isolation, or in other words as listed by Houston et al., it is impossible for one to test the typical suffixing approach from epigraphic evidence alone. However, the linguistic evidence, following Kaufman's (2003b) approach, does provide answers for some such unique spellings: ⟨wahil⟩ in Colonial Yucatec points to a common derivation based on *-il*, while ⟨u chachil⟩ points to a common possessive suffix *-il*.

Table 12. Possible linguistic motivations of selected unique spellings in the script.

Unique	Possible motivations
wa-WAJ-ji for <i>*wa(a)j</i> 'tortilla, food'	Col. Yucatec ⟨wahil⟩ 'banquete (banquette)'
cha-chi	Yu. <i>cháach-t</i> 'to sift, screen', Col. Yucatec ⟨u chachil⟩ 'the part that does not go through the screen or colander'

And last, in the most recent data set there is at least one spelling of unclear etymology, and therefore unclear phonological shape: **ja-yi**. Houston et al. (2004) themselves gloss it as *jaay* 'thin?', suggesting they consider it questionable.

4.4 Section results and discussion

When we take into account the revisions to Houston et al.'s (1998, 2004) data set already mentioned in Table 2, as well as the spellings that are accounted for by phonological conditioning (C_1VC_1 , CV7, ...VCCV..., VC-V) and morphological conditioning, 7 out of 39 disharmonic spellings (out of 72 tokens) remain unaccounted for (see Addendum).

Kaufman (2003b: 14), who argues specifically that it was the typical *-Vl* suffix of nouns that led to their conventionalization, has found 90.9% consistency with his hypothesis that "when nouns or adjectives end with a consonant, this consonant, if spelled, is spelled with a CV syllabogram that contains the same vowel as would appear in a *-V:l* suffix added to that lexical item." Kaufman's data set contains more examples than those used by Houston et al. (2004), but there are many that do not overlap. I suspect that testing the typical suffixing or morphological

Table 13. Revised data set: not accounted for (including unique and invariable spellings, as well as spellings of unknown etyma).

	i	a	u	Totals of disharmonic spellings unaccounted for
i	3 (syn)	1 (dis)	1 (dis, unique)	2
e	–	0	0	0
a	2 (dis, unique, uncertain)	5 (syn)	1 (dis, unique)	3
o	0	2 (dis)	–	2
u	–	1 (dis)	2 (syn)	1
	2	4	2	8/39 = 18%

conditioning approach on a larger data set will probably yield a higher rate of consistency for that approach as well.

Of the remaining 8 disharmonic spellings, 6 are unique (i.e. **b'a-ts'u**, **ta-ji**, **chi-ku**, **b'u-la**) or invariant (i.e. 7AYIN-**na**, **ja-yi**) spellings that cannot be used to test the typical suffixing and morphological conditioning approach, which requires spelling and contextual variation, and for which the linguistic approach cannot adequately account because those terms do not typically occur with suffixes in the modern languages. In fact, the term spelled by **ja-yi** is of uncertain etymology. This leaves only two frequent disharmonic spellings unaccounted for at this time: **-Co-ma**, and **-7o-b'a**.²⁷ Thus, if we do not take the unique spellings into account, we can say that morphological conditioning (typical suffixing, actual suffixing, consonant deletion) accounts for all but 5.1% of the disharmonic spellings in Houston et al.'s (1998, 2004) data set.

From another perspective, the disharmonic word-closing syllabograms in **-Ci** (18,52%) and **-Ca** (12,34%) significantly outnumber those in **-Cu** (5,14%); together, **-Ci** and **-Ca** spellings add up to 86% of all disharmonic word-closing syllabograms. This corresponds well with the much higher frequency in the descendant languages of vowel-initial suffixes that begin with *i* or *a*. In Yucatec, for example, of the 44 vowel-initial suffixes listed by Bricker et al. (1998:408), 13 (30%) begin with *i*, 14 (32%) begin with *a*, 8 (18%) begin with *e*, and 3 (7%) with *o*; the remaining 6 (13%) vowel-initial suffixes echo the root vowel, whatever that vowel may be. Together, *i*- and *a*-initial suffixes amount to at least 62% of all suffixes. In modern Ch'ol, based on data from Aulie and Aulie (1999:275–278), one can find 5 **-VC(VC)** suffixes with *a/ä*, 6 with *e*, 8 with *i*, 5 with *o*, and 3 with *u*. Though a lower proportion than in Yucatec, the *a*- and *i*-initial suffixes still account for 48.2% of the vowel-initial suffixes.

Table 14. Revised data set: not accounted for (*not* including unique, invariable, or etymologically problematic spellings).

	i	a	u	Totals of disharmonic spellings unaccounted for
i	3 (syn)	0	0	0
e	–	0	0	0
a	0	5 (syn)	0	0
o	0	2	–	2
u	–	1 (dis)	2 (syn)	0
Disharmonic		2		2/39 = 5.1%

5. Remaining matters

5.1 More on morphosyllables

The DH approach requires the existence of so-called ‘morphosyllables’, or otherwise certain necessary suffixes would be underrepresented or not represented at all. That is, given a spelling such as **B’AH-hi-ja**, if the **hi** of **B’AH-hi** is needed as a diacritic to mark vowel length of the root *bà(:)h* ‘head’, then it cannot be used to spell part of the *-VC* suffix that is needed here; instead, T181 **ja** must do this on its own, and must therefore be read as **-AJ** in this context. Likewise, in a spelling like **7u-TUN-ni-li**, if the **ni** of **TUN-ni** is needed as a diacritic to mark vowel length of the root *tu(:)n* ‘stone’, then it cannot be used to spell part of the *-VC* suffix needed here; instead T24 **li** must do this on its own, and must therefore be read as **-IL** in this context. Interestingly, in this last case, the suffix rendered would be the same regardless of the spelling principle involved: **7u-TUN-(n)i-l(i)** yields a suffix *-il* (simple spelling rules); and **7u-TUN(-ni)-IL** yields a suffix *-il* (morphosyllable and disharmony approach). However, in the first case, the suffix rendered will have different shapes depending on the approach: **B’AH-hi-j(a)** yields a suffix *-i(:)j* (simple spelling rules); and **B’AH(-hi)-AJ** yields a suffix *-a(:)j* (morphosyllable and disharmony approach). Thus, the approach invoked has substantive consequences for the reconstruction of the grammatical structure of the language represented in the texts.

Interestingly, in spellings like **B’AH-hi-ja** and **tu-pa-ja**, the simple spelling rules adhered to by epigraphers for the past half-century yield two suffix forms: *-i(:)j* and *-a(:)j*, respectively. This suffix, in either form, would represent a suffix marking ‘uncertain possession’. This marker is attested in Mayan languages with both *-i:j* and *-a:j* forms. However, it is not preserved in any modern Cholan language. Thus, the forms attested in CLM texts could simply reflect a retention of

Central Mayan **-i:j ~ *-a:j*, making it unnecessary to assume, as Houston et al. (2001) do, that only one form, *-a:j*, was represented.

A crucial example given the attention paid to it by Houston et al. (2001) is the case of the 7u-K'AWIL-wi-la-li spelling on Yaxchilan Lintel 26 (Figure 17a). Those authors argue the spelling is analyzable, assuming both DH I and MH, as U-K'AWI:L-wi-l(a)-IL, for *7u-k'awiil-il*. In other words, the vowel of the *la* sign would be silent and serve merely to indicate that the preceding vowel is complex (i.e. either *i:* or *i7* or *ih*), while the necessary suffix, which the authors assume to be of the form *-i(:)l*, is spelled exclusively by the *li* sign, which they argue is a morphosyllable -IL. The point worth reiterating here is that for there to be a spelling of the *-l* suffix that this possessed form of the K'AWIL glyph should take, the only recourse available to these authors is to analyze T24 *li* as -IL in this situation. The reason for this is, of course, that the vowel of the preceding T178 *la*, by the DH I hypothesis, is simply diacritical of the preceding vowel's complexity, and therefore fictitious. Consequently, the DH I requires the existence of morphosyllables.

There is, nonetheless, an alternative, one that assumes only simple spelling rules, and therefore, that the spelling in question be analyzed as 7u-K'AWIL-wi-la-l(i). This alternative also takes into account the morphosyntactic differences between the context of this spelling and of other, more common spellings of the form K'AWIL-la. First, it is worth noting that in contexts such as the one in Figure 17b),



Figure 17.

- Spelling 7u-K'AWIL-wi-la-li. Excerpt from Yaxchilan Lintel 15. After drawing in Schele (2000).
- Spelling TSAK-ji-ya K'AWIL-la. Excerpt from Yaxchilan Lintel 25. After drawing from the Corpus of Maya Hieroglyphic Inscriptions by Ian Graham (1977b).
- Spelling of full sentence: 7u-TSAK-wa 7u-K'AWIL-wi-la-li 7u-to-k'a-PAKAL 7a(j)-B'UTZ' 7o-CHAK-ki. Excerpt from Yaxchilan Lintel 15. After drawing in Schele (2000).

K'AWIL-*la* appears unpossessed as the subject of a passivized or mediopassivized verb, TSAK-*ji-ya*, for *tsa[-h-]k-[ij]-iy-Ø(+a)* conjure/cure[PASS]-IVZR-CMP-3SABS(+ENCL) 'it was/got conjured', while in the Yaxchilan Lintel 26 context, the term appears possessed as the subject of the active transitive verb 7u-TSAK-*wa* for *7u tsak-aw-Ø* 's/he grasped (conjured) it', seen more fully in Figure 17c). In Mayan languages in general, the most common forms of the possessive suffixes are *-i(:)l* and *-a(:)l*, and suffixes of different forms could be used depending on the type of possession (i.e. ownership, intimate, inalienable, part-of-the-whole, inanimate/associative, etc.), as well as abstractive suffixes of similar forms. Applying simple spelling rules would yield an *-a(:)l* suffix, a hypothesis worth entertaining: 7u-K'AWIL(-wi)-(l)a-I(i). This hypothesis, furthermore, would be consistent with the typical spelling of the unpossessed term, in accordance with the Typical Suffixing Principle: K'AWIL-*la*. In the present example, the possessor of *k'awil* in this context is not human, but an inanimate entity *7u tok' 7u pak-al* 'the flint and the shield of', which in turn is possessed by the spirit referred to as *7o Chahk*.²⁸ The name of the person who probably carried out the action of conjuring is not mentioned until the next clause, and there that person appears as the possessor of a nominalized verb (Mora-Marín 2004: 357–358). Even if taken concretely, the possessor of *k'awil* is a material object. Inanimate or impersonal possession in Ch'ol is carried out with four allomorphs (Aulie & Aulie 1999): *-al* (e.g. *7i yixm-al chol-el* 'el maíz de la milpa'), *-el* (e.g. *7i tye7-el 7otyot* 'the wood of the house'), *-il* (e.g. *7i yätz'm-il tyumut* 'la sal de los huevos'), and *-lel* (e.g. *7i yotyot-lel 7ixim* 'la casa del maíz' vs. *7i yotyot* 'his/her house'). The hieroglyphic example, if analyzed as *7u k'awil-al*, where *-al* follows a syllable with *i* as the vowel nucleus, would be consistent with the Ch'ol data, where *-al* follows a syllable with (underlying) *7i:7i yixm-al chol-el*, i.e. /iyixim-al chol-el/. Thus, taking *-li* in this context to be simply a morphosyllable -IL may be a bit premature, and it may lead epigraphers and linguists down a blind alley, one that would prevent them from refining the morphophonemic analysis of numerous grammatical affixes. Quite simply, simple spelling rules yield linguistic forms that accord well with expectations from the modern Mayan languages. It is therefore not necessary to revise them at this point.

5.2 Logosyllabic spellings, polymorphemic logography, phonetic complementation

If morphosyllables are unnecessary, what can we make of spellings like B'AH-*ja*, found in variation with B'AH-*hi-ja*, and spellings like 7u-TUN-*li*, found in variation with 7u-TUN-*ni-li*? In other words, B'AH-*hi-ja* and B'AH-*ja* are somehow spelling the same word; assuming so, and assuming too that B'AH-*hi-ja* was meant to be read B'AH-*hi-j(a)* for *b'a(:)h-i(:)j*, how are we to read B'AH-*ja*?

The answer lies in polymorphemic logography and the practice of phonetic complementation.²⁹ First, logograms in the script could represent CVC roots or CVC-VC stems (Justeson 1986, 1989). Day signs, for example, often represent polymorphemic words. The day sign for the first day name is not supposed to be read ^{DAY}7AJAW but ^{DAY}7AJWAL, as shown by Mathews and Justeson (1984), and as the occasional phonetic complement suggests (i.e. ^{DAY}7AJWAL(-li/la)). Also, T544 K'IN may be found as K'IN, K'IN-chi, and K'IN-ni-chi in identical contexts, such as in the name phrase of the same individual, suggesting that T544 by itself could be read as K'INICH.

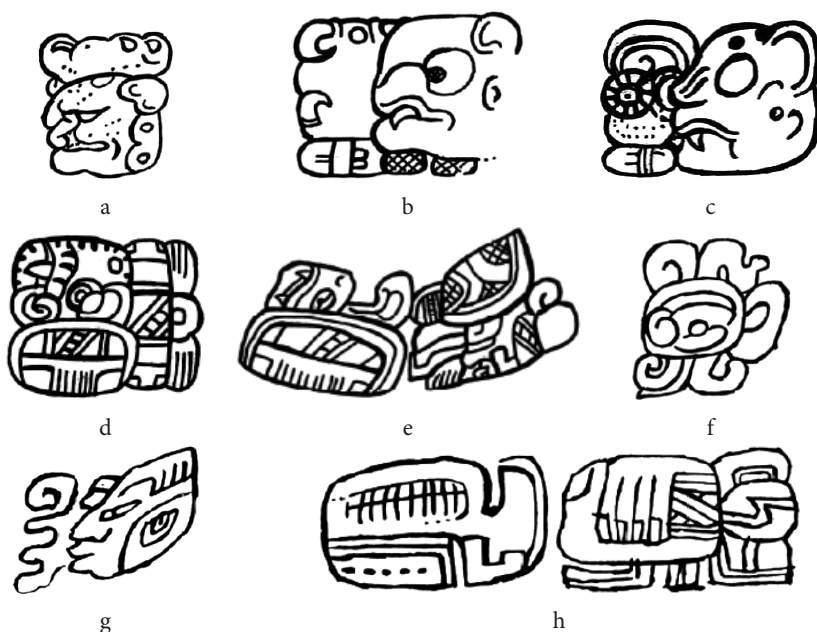


Figure 18.

- a. YICH'AK-B'ALAM. After Stuart (1987: Figure 38a).
- b. YICH'AK-ki-B'ALAM-ma. After Stuart (1987: Figure 38b).
- c. yi-ch'a-ki-B'ALAM. After Stuart (1987: Figure 38c).
- d. SIJYAJ-ya-ja-CHAN-K'INICH. Excerpt from Tikal Stela 31. After drawing in Schele (2000).
- e. SIJYAJ(-ja)-CHAN-K'AWIL. f. SIJYAJ-ya-ja-K'AK'. Excerpt from Piedras Negras. After drawing by Linda Schele at <http://research.famsi.org/schele.html>.
- f. SIJYAJ-ya-ja-K'AK'. Excerpt from Piedras Negras. After drawing in Schele (2000).
- g. ^{VOICE}K'AYOM for *kay-om* 'singer'. Glyph D6 on Pearlman Conch text. Drawing by the author after photograph in Coe (1982).
- h. K'a-yo-ma for *kay-om* 'singer'. Glyphs A5-B5 on Pearlman Conch text. Drawing by the author after photograph in Coe (1982).

Examples of syntactically complex proper names and titles show that polymorphemic logograms were interpretable in terms of syntax alone.

Table 15. Spellings of ‘Jaguar’s claw’.

Spellings	Gloss
a. yi-ch’a-ki B’ALAM	y-ihch’ak(-il) b’ahläm
b. YICH’AK(-ki) B’ALAM(-ma)	3 _{SERG} -claw jaguar
c. YICH’AK B’ALAM	‘the claw of the jaguar; Jaguar’s Claw’

Despite the absence of phonetic signs to make the *y*- ‘3_{SERG}’ marker explicit, as in Figure 18a, the spellings in Figure 18b–c are not unclear because in Mayan syntax the possessee precedes the possessor, and therefore the Mayan scribe would have known that a sign CLAW preceding a sign JAGUAR was supposed to be read ‘Jaguar’s Claw’. Other names and titles included inflectional and derivational morphology and phrasal constructions that were interpretable in terms of syntax even when spelled out logographically. In other words, syntax (and the fact that the scribes knew who they were writing about) was sufficient in principle for scribes to disambiguate between possible inflectional and derivational stems of a word represented by a given logogram. Similar examples of unrepresented *y*- ‘3_{SERG}’, both in possessor and subject agreement functions, are attested as well. The term *y-otot* ‘his/her/its house’ could be represented phonetically, as *yo-to-ti*, or as a polymorphemic logogram alone, as YOTOT.³⁰

Adjectives could similarly be expressed by means of polymorphemic logograms. Once again, the syntax of adjectives, which typically occur before the noun, makes it possible for scribes to disambiguate the function of a logogram that comes before a noun even in the absence of any necessary derivational material needed to make the logogram’s function clear. For instance, the nouns *chaan* ‘sky’ and *kab’chab* ‘earth’ could be derived into adjectives by means of *-Vl* suffixes, resulting in *chan-al* ‘heavenly’ and *kab’chab’-al* ‘earthly’, but such suffixes did not need to be explicitly spelled out for their position before a noun, such as T1016 K’UH for *k’uh* ‘god’, the typical position of adjective and modified noun, would be sufficient for a reader to interpret the logogram T561 CHAN as *chan-al*, and T526 KAB’/CHAB’ as *kab’chab’-al*. Such suffixes were occasionally indicated, in part — through phonetic complementation — by means of syllabograms, as in CHAN-NAL-*la* and KAB’/CHAB’-*la*. In fact, the logogram T1016 K’UH ‘god’ had to be read as K’UHUL for *k’uh-ul* ‘godly, divine’ when it preceded a noun, as was very often the case in Emblem Glyphs. Only rarely was it spelled out explicitly, as K’UH-hu-lu or K’UHUL(-hu-lu).

The same principle of polymorphemic logography applies to verbs of any kind: transitives, intransitives, positionals. T710 CHOK ‘to throw down’, for instance,

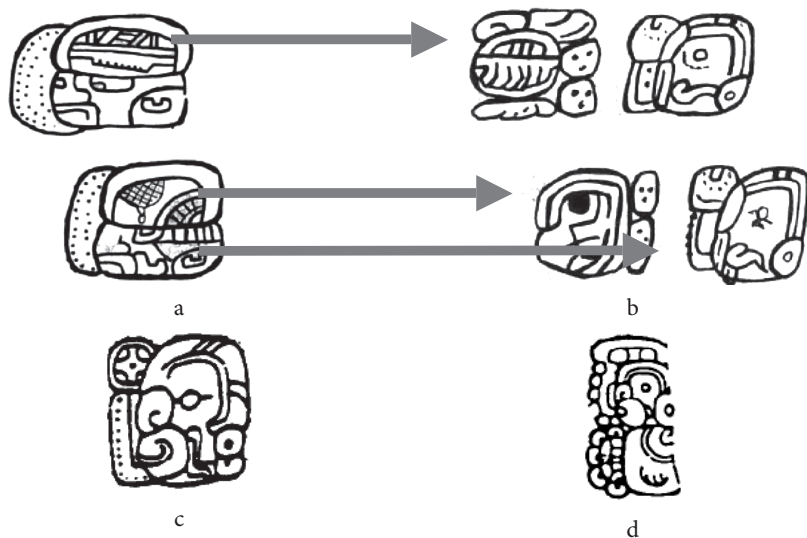


Figure 19. Spellings of polymorphemic modifiers.

- CHAN(AL)-K'UH, KAB'(AL)-K'UH. After excerpt of drawing of Tikal Stela 31 by William Coe in Hull (2003: 587, Figure 50).
- CHANAL-na-NAL-la K'UH, KAB'AL-la K'UH for *chan-al k'uh*, *kab'-al k'uh* 'heavenly gods, earthly gods'. After excerpt of text on Vase of the Seven Gods (K2796) in Hull (2003: 587, Figure 50).
- K'UHUL for *k'uh-ul* 'holy, divine'. Example from Palenque. After drawing in Schele andLooper (1996: 47).
- 7u-K'UHUL-hu-lu for *k'uh-ul* 'holy, divine'. From Yaxchilan Lintel 25. After drawing in Schele (2000).

may be found as an active transitive spelled as 7u-CHOK, 7u-CHOK-wa, or 7u-CHOK-ko-wa, for 7u *chok-ow-Ø* 3SERG-throw.down-PL-3SABS 's/he throws/threw it down'. Thus, T710 by itself could stand for *chokow*, i.e. 7u-CHOKOW.³¹ Given these patterns of alternation in identical contexts, one must reach the conclusion that syllabograms were being used as phonetic complements both on nouns and on verbs: K'INICH(-chi) and K'INICH(-ni-chi) were both cases of phonetic complementation, and so were 7u-CHOKOW(-wa) and 7u-CHOKOW(-ko-wa). The next example is an intransitive, more specifically, a passivized or mediopassivized verb: TSAK-ja for *tsa[h]k-aj* 's/he/it was/got seized (conjured)' provides evidence for a suffix of the form *-aj*, while TSAK-ji-ya for a sequence of suffixes *-(a)j-iy*, and last, TSAK requires a reading as either *cho[h]k-aj* and *tsa[h]k-aj* or *cho[h]k-(a)j-iy* and *tsa[h]k-(a)j-iy*, but a suffix or sequence of suffixes must be assigned.

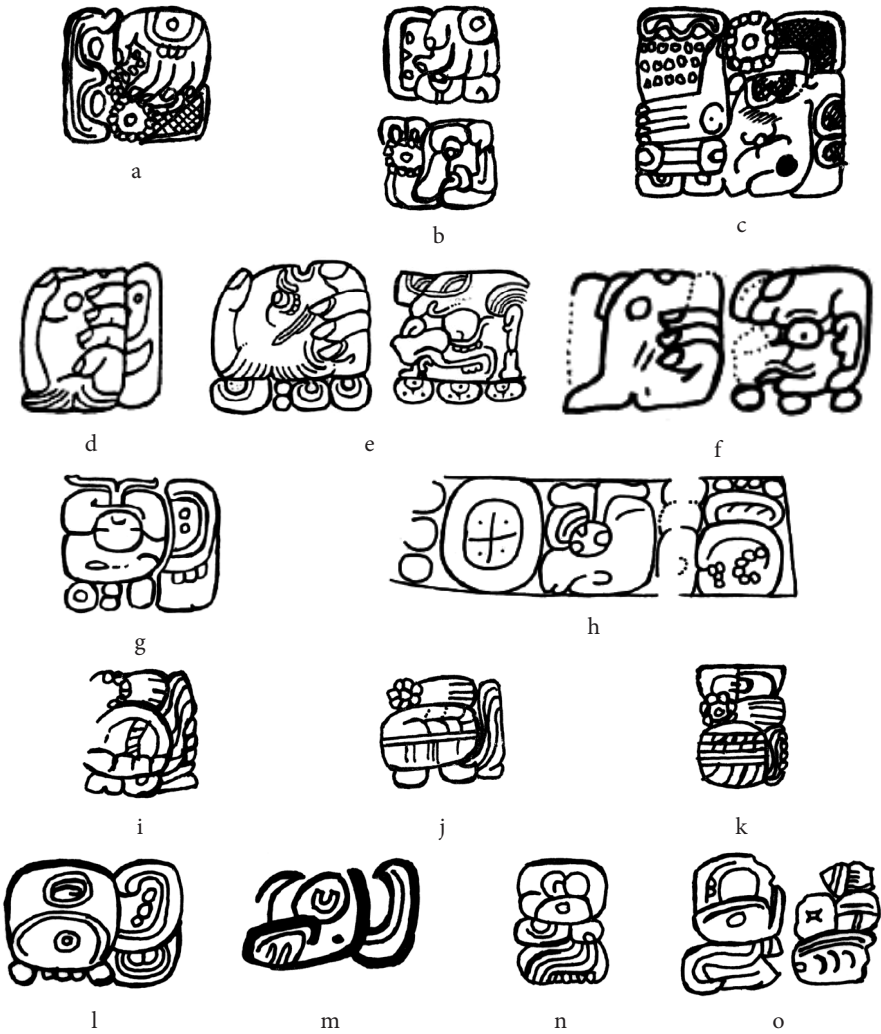


Figure 20.

- a. 7u-CHOK-ch'a-ji for 7u chok[-ow] chàj(-il) 's/he throws drippings [of incense]'. Quirigua Stela A. After drawing in Bricker (1986: 145).
- b. 7u-CHOK ch'a-ji. Quirigua Stela D. After drawing in Schele and Looper (1996: 135).
- c. 7u-CHOK-ko-wa-ch'a-ji. Ixtutz Stela 4. After drawing by Graham (1967).
- d. TSAK-ja. Excerpt from Yaxchilan Lintel 15. After drawing in Schele (2000).
- e. TSAK-ji-ya K'AWIL-la. Excerpt from Yaxchilan Lintel 25. After drawing from the Corpus of Maya Hieroglyphic Inscriptions by Ian Graham (1977b).
- f. TSAK K'AWIL-la. From Yaxchilan. After drawing from the Corpus of Maya Hieroglyphic Inscriptions by Ian Graham (1977b).
- g. WA7-la-ja. After Bricker (1986: Figure 193).
- h. WA7(LAJIY/WANIY). After Stuart and Houston (1994: Figure 17).

- i. PAT-ta-wa-ni. Excerpt from Copan Altar U. After drawing in Schele (2000).
- j. PAT-wa-ni. Excerpt from Copan Altar U. After drawing in Schele (2000).
- k. 7i/YUWAL-PAT-ni. Copan Altar S.
- l. CHUM[?mu]-la-ja. Tikal Stela 22.
- m. CHUM-ja. Excerpt from Hombre de Tikal statuette.
- n. CHUM[mu]-wa-ni.
- o. CHUM-ni ti-7AJAW-le. Caracol, Structure B16 Stucco. Drawing from Grube and Martin (2004: 103).

Polymorphemic logography and phonetic complementation also apply to -CVC suffixes. Examples of CHUM-la-ja (Figure 20l) and CHUM-ja (Figure 20m) at the same site, in equivalent morphosyntactic contexts, and thus likely representing *chum-laj-Ø* 's/he sat' in both cases, suggest that the latter example was supposed to be read as CHUMLAJ(-ja), with T181 ja functioning as a phonetic complement. Examples of the suffix -wan-i as -wa-ni and -ni in examples like CHUM-wa-ni (Figure 20n) and CHUM-ni (Figure 20o), or PAT-wa-ni (Figure 20j) and PAT-ni (Figure 20k), respectively, are in free variation with each other, suggesting that the second of each set should be read as CHUMWANI(-ni) and PATWANI(-ni). Examples of contrasts such as WA7-la-ja (Figure 20g) and WA7 (Figure 20h), the latter either for *wa7-laj* or *wa7-wan(-i)* for 's/he/it stands/stood', and therefore interpretable as WA7LAJ/WA7WAN, demonstrate that scribes occasionally prescinded from providing explicit spellings of -CVC suffixes altogether. Stuart (2002) has provided an example from Copan that he interprets as a possible case of underspelling of the phonetic sequence -wa-ni, namely, WA7-ni. Thus, polymorphemic logography explains spellings like B'AH-ja, 7u-CHOK-wa, TSAK-ja, and CHUM-ni, among many others, as cases of phonetic complementation, not as cases where otherwise syllabographic signs were used as pseudologograms or morphosyllables.

Given the fact that syntax is usually sufficient to determine the inflectional and derivational forms of polymorphemic logograms, it is quite possible that this practice was present in the scribal tradition from very early on. Evidence for this is found on the Dumbarton Oaks Quartzite Pectoral, a Late Preclassic text possibly dated to ca. 300–100 B.C. (Coe 1966; Mora-Marín 2001). The glyph is on Figure 21a), graphically, a precursor of the T644 SIT/SEATED glyph, read CHUM 'seated' in Classic texts. It is followed by 7AJAW(AL) 'lord, ruler'. Anyway that this phrase is analyzed, with the seated glyph as a finite verb (e.g. *chum-laj(-i)* 's/he sits/sat') and *7a:ja:w(al)* as its subject, or as an adjectival modifier with a stative suffix (e.g. *chum-ul sit-STA* '(s/he is) seated') to *7a:ja:w(al)*, the word represented by the presumed logogram CHUM is not fully explicitly spelled out, but must be understood from context as a polymorphemic logogram. It is also likely that spatial constraints made this practice attractive to scribes on many occasions: they could

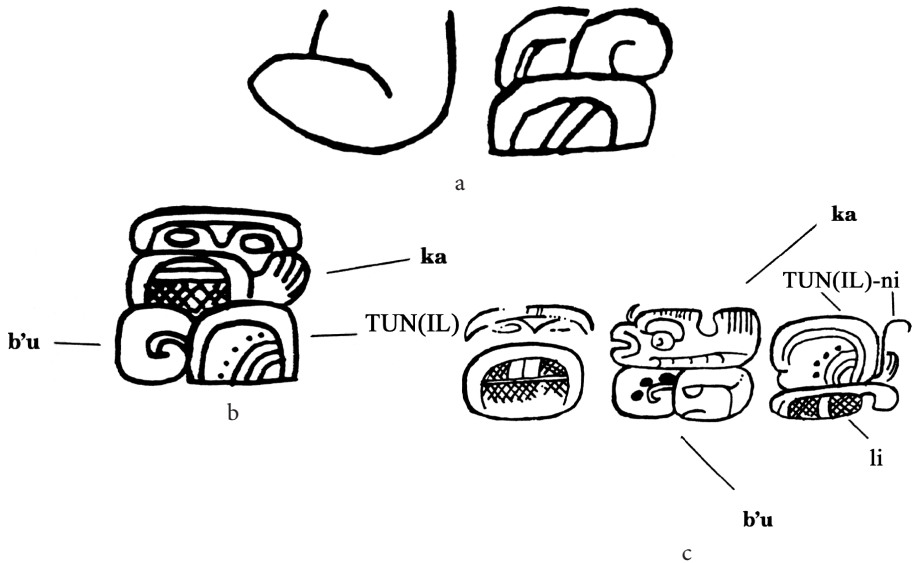


Figure 21.

- a. CHUM 7AJAW on positions A4-B4 on the Dumbarton Oaks quartzite pectoral. Drawing by the author.
- b. 7u-pa-ka-b'u-TUN(IL) in Po Panel. After drawing by Kornelia Kurbjuhn.
- c. 7u-pa-ka-b'u-TUN-ni-li in unprovenienced lintel at Nelson-Atkins Gallery in Kansas City. After Stuart et al. (1999: 32).

fit in more signs in a small space by leaving out the explicit spelling of inflectional and derivational suffixes. This is the case of Figure 21b), in contrast with that in Figure 21c). These cases show two identical possessee phrases from different texts that exhibit significant spelling variation: in the first case the glyph T528 TUN appears without any explicit indication of a required possessive suffix *-il*, while in the second case it appears as TUN-ni-li for *tuun-il*. Interestingly, the first example, the one lacking an explicitly spelled out suffix, also exhibits significant spatial constraints, crammed into a single glyph block, while the second example was spelled out across two glyph blocks. But in either case the possessive construction called for the *-il* suffix. Thus, the proper reading of these logograms was realized by means of syntactic disambiguation.

Thus, an obvious question arises:

- (3) If Mayan writing was in principle a logographic script with optional use of syllabograms primarily as phonetic complements, why were syllabograms innovated in the first place?

The question can be answered from the point of view of a writer: It would be useful to make explicit, even to a partial extent, some of the inflectional and derivational

endings of nouns and verbs during the composition of a text, following a ‘write by ear’ approach to writing, while at the same time preserve as many logographic or highly conventionalized phonetic spellings as possible for quick recognition during the reading of the text, which was likely part of a ritual performance, and thus following a ‘visual chunking’ or ‘read by eye’ approach to reading (Cattell 1886; Reicher 1969; Frith 1979, 1980; Bryant and Bradley 1980; Sampson 1985: 208–209; Coulmas 2003: 213). A balance between logograms and syllabograms was in fact the norm, and even late in the Classic period when phoneticism became more widespread a very high percentage of logogram use is still attested. This balance between the ease of reading and the ease of writing is what we find in spellings like **B’AH-ja** (instead of more explicit **B’AH-hi-ja**) for *b’ah-ij* ‘image (of someone)’, which shows that T757 **B’AH** could be read also as **B’AHIJ** (i.e. T757.181 as **B’AHIJ(-ja)**), or spellings like **7u-CHOK-wa** (instead of more explicit **7u-CHOK-ko-wa**) for *7u chok-ow-Ø* ‘s/he throws/threw it down’, which shows that T710 could be read also as **CHOKOW** (i.e. **7u-CHOKOW(-wa)**). The same logogram could have multiple polymorphemic readings: spellings like **7u-B’AH-li**, in alternation with **7u-B’AH-hi-l(i)**, both for *7u b’ah-il* ‘his/her image’, show that T757 could also be read as **B’AHIL** (i.e. **7u-B’AHIL(-li)**); while spellings like **CHOK-ja**, in alternation with **CHOK-(k)a-j(a)**, both for *chok-aj-Ø* or *chok[-h]-k-aj-Ø* ‘it is/was thrown down’, show that T710 could also be read as **CHOKAJ** (i.e. **CHOKAJ(-ja)**).

Thus, polymorphemic logography explains the spellings like **B’AH-ja** and **CHOK-ja** as cases of phonetic complementation, as minimal clues included by the scribe for the ease of reading and writing, not as cases where otherwise syllabographic signs were used as pseudologograms or morphosyllables.

5.3 True conventionalization

One question remains: What kinds of spellings, then, are truly conventionalized? We may talk about different types of conventionalization depending on their motivation. The motivation for examples like those in Figure 22 varies from case to case. For **ch’o[ko]-ko** (Figure 22a) and **7u-7u-ti** (Figure 22b) the motivation is entirely graphic (Zender 1999): the frequent use of T110 **ko** with the **ch’o** sign in the frequent spelling **ch’o-ko** for *ch’ok* ‘youth’ has resulted in their graphic amalgamation, leading the scribe to treat them as a non-decomposable unit, rather than a decomposable collocation. The same has happened in the second example, where the frequent use of T513 **7u** with the sign T59 **ti** in the frequent spelling **7u-ti** for *uht-i* ‘it happened’ has also resulted in their graphic amalgamation. In the case of deviations from the typical spelling of passivized root transitives, seen in Figure 22c) for **chu-ka-ja** for *chu[-h]-k-aj* or *chuk-aj* ‘s/he/it was seized’, the motivation for spellings such as **chu[ku]-ka-ja** (Figure 22d), **chu[ku]-ja** (Figure 22e), or **chu[ku]-ji-ya**



Figure 22. True conventionalization of spellings.

- a. HUN-ch'ò[ko]-ko.
- b. 7u-7u-ti.
- c. chu-ka-ja. After Bricker (1986: Figure 149e).
- d. chu[ku]-ka-ja. After Bricker (1986: Figure 149f).
- e. chu[ku]-ja. After Bricker (1986: Figure 149g).
- f. chu[ku]-ji-ya. After Bricker (1986: Figure 149c).
- g. 7u-chu[ku]-wa. After Bricker (1986: Figure 149a).
- h. yi-ts'i-na. After Stuart (1987: Figure 37a).
- i. yi-ts'i-ni. After Stuart (1987: Figure 37b).
- j. 7u-tu-pa for 7u tu(G)p 'his earring'. Chichen Itza Cenote jade earring. After drawing in Zender (2004: Figure 8.1g).
- k. yo-7OL-la for *y-ohl(-al)* 'his/her/its heart'. Palenque Temple of Inscriptions, West Tablet (at B7). After drawing in Zender (2004: Figure 8.2k).
- l. 7u-B'AH-hi for 7u-b'a(:)h-il 'his/her/its image/face/portrait'. Tikal Stela 5 (at D4). After drawing in Zender (2004: Figure 8.1e).

(Figure 22f) could be graphic (Bricker 1986), based on the use of T528 **ku** in the spelling of the active transitive form of the verb as **7u-chu-ku-wa** (Figure 22g) for *7u chuk-uw*, or phonological, given the obligatory synharmony rule for consonant insertion in ...VCCV... sequences, resulting in **chu[k(u)]-(k)a-ja**, for example. In other cases the motivation is clearly Typical Suffixation: **yi-ts'i-na** (Figure 22h), for *y-ihts'in* 'his/her sibling', can be explained by the use of an *-al* or *-äl* suffix in the unpossessed form, *ihts'in-äl* (Modern Ch'ol). In the possessed form the term does not take a suffix, and therefore the **na** sign of **yi-ts'i-na** is conventionalized based on the absolute form, and not the result of underspelling. And interestingly, the less frequent spelling **yi-ts'i-ni** (Figure 22i) could show a different motivation: the expansion of synharmony as a default spelling convention for root- or word-closing consonants. There is similarly no evidence to suggest that **7u-tu-pa** (Figure 22j) could represent an underspelled *-al* suffix, and thus we must take the **pa** sign to be conventionalized, most likely based on the *-a(:)j* suffix represented in the absolute form **tu-pa-ja**. Morphological conditioning, this time attested clearly in the affixation pattern in the texts, is probably responsible for the conventionalization of the **la** sign in spellings like **yo-7OL-la** (Figure 22k), given the attested absolute form **7o-7OL-la-si**, which points to an *-as* suffix. But again, this may not be the case with **7u-B'AH-hi** (Figure 22l) and **B'AH-hi-ja**, for the former may very well be an underspelled word, given that it is also attested in identical contexts as **7u-B'AH-hi-li**, suggesting an *-i(:)l* suffix was used. Consequently, the conventionalization of spellings must be considered one case at a time, while taking note of spelling variants, both in identical and variable morphosyntactic contexts, as fully as possible.

There are therefore two basic types of conventionalized spellings:

- (4) Truly Conventionalized Spellings and the rest
 - a. Frequent syllabographic or logosyllabic collocations treated as graphic units.
 - b. Frequent word-closing syllabograms motivated by frequent suffixes required in other contexts (Typical Suffixing).
 - c. All other spellings (the majority) are cases of C-deletion (synharmonic, disharmonic) or phonological conditioning (obligatory synharmony).

6. Conclusions

I conclude that:

- a. The DH does not adequately account for spelling conventions, and has as a major flaw in its decontextualization and isolation of glyphic spellings; contextualization is crucial to testing alternative approaches.

- b. Four phonological conditions require obligatory synharmonic silent vowel insertion; therefore, in these contexts, synharmony is clearly not default or unmarked, and this is something that DH does not account for.
- c. Remaining synharmonic spellings, and almost all of the disharmonic spellings can be accounted for in terms of underrepresentation and morphological conditioning; morphological conditioning itself accounts for underrepresentation.
- d. Morphological conditioning can explain conventionalized synharmonic and disharmonic spellings more effectively than DH, particularly when counterexamples to Houston et al.'s proposed DH principle are taken into account.
- e. DH requires existence of morphosyllables; no such sign type is needed if DH is not correct.

So what were the scribes doing, if they were not attending to the complexity of syllable nuclei? Much of the time, scribes were probably using the convention of consonant deletion or underrepresentation of word-final consonants. The rest of the time, when a spelling was maintained across morphosyntactic contexts that differed in whether or not a suffix was required, it seems that the spelling in the context not needing a suffix matched that of the context where a suffix was needed. In other words, conventionalized spellings were due to affixation patterns, or morphological conditioning.

This probably was a practical, efficiency-based convention. But the evidence suggests that there were sometimes competing motivations, based on the need for suffixes with different vowels, that led to contextually differentiated spellings (e.g. **ts'i-b'i** vs. **ts'i-b'a**; **(y)u-k'i-b'i(-li)** vs. **(y)u-k'i-b'a**). Perhaps differential frequency of the suffixes involved led to one spelling, the one reflecting the most frequent suffix in texts, becoming conventionalized in some cases (e.g. **(y)u-k'i-b'i**), whereas in other cases the two spellings remained side by side perhaps because the frequency of the contrasting contexts was comparable (e.g. **ts'i-b'i** vs. **ts'i-b'a**). At the same time, however, the choice for conventional spellings of some words may have been facilitated when those words frequently used suffixes with the same vowel (e.g. **7u-B'AH-hi-li**, **B'AH-hi-ja**; **K'IN-ni-li**, **K'IN-ni-chi**), creating a situation of multiple reinforcement of a particular CV syllabogram as the most common word-closing syllabogram for that word even when no suffix was called for.

The results and conclusions presented here are by no means the end of the story. An approach similar to those by Justeson (1989, 2000) and Anderson (2004), for example, in which the authors suggest a role for phonological conditioning in at least some disharmonic spellings, could yet provide a useful window into the broader picture of spelling conventions: for while the approach presented here accounts for spelling practices, it is likely that an approach that takes into account the interaction between root and suffixal vowels, on the one hand, and root-final

consonants and suffixal vowels, on the other, could account for many of the morphonemic conditions that explain why roots take the vowel-initial allomorphs of inflectional or derivational suffixes that they do. This would amount to a deeper explanation of spelling patterns, but one that is not strictly necessary to account for the spelling practices themselves.³²

Notes

* This paper is based on a lecture presented at the 2004–2005 SSILA Conference, in Oakland, California, January of 2005 (Mora-Marín 2005a), which in turn was based on several comments on the matter in Mora-Marín (2001) that led to a previous manuscript (Mora-Marín 2002) that was circulated among a few epigraphers, several of whom (Victoria Bricker, Barbara MacLeod) offered comments that were incorporated in a revised version (Mora-Marín 2004) presented at the informal Crabs and Glyphs meeting in Maryland in September of 2004, where additional epigraphers offered comments (Barbara MacLeod, John Harris, John Justeson) that have since been incorporated in the present paper. Subsequently it was presented at one of the sessions of the Society for the Study of the Indigenous Languages of the Americas (SSILA) meetings in January of 2005. These earlier papers used the term Affixation Conventionalization Hypothesis (ACH), which has been changed since to ‘typical suffixing’, because it is not just any type of affixation that matters in the process of spelling conventionalization, but suffixing in particular.

1. Knorozov (1958: 290) defines it thus: “As there are several alphabeto-syllabic signs [CV signs used at the end of words for their consonantal value only] for one and the same consonant sound, but with different vowels, for instance *k(a)*, *k(u)*, *k(e)*, it would seem to make no difference which of these signs was used to transmit one consonant sound at the end of the word. However, Maya scribes held rather strictly to the following orthographic rules: to transmit a consonant sound at the end of a word, one must use such an alphabeto-syllabic sign that the presumed vowel at the end of this sign corresponds to the preceding vowel sound. Such a mode of writing might be called synharmonic.”

2. Knorozov (1955) assumed Yucatec as a basis for philological analysis, based in large part on the identification of exclusively Yucatecan lexical items, such as *tsiùul* ‘dog’, attested in the script, but also the general sociocultural and historical context of the codices. Nevertheless, the evidence for Ch’olan as the language that served as the standard of the Classic inscriptions is overwhelming, and is thus assumed here.

3. Knorozov (1952, 1955) pioneered all of the basic methods for the systematic decipherment of phonetic values of Mayan writing: (1) The Principle of Synharmony; (2) Substitutional Analysis; (3) Structural Analysis; (4) Cross-Readings; and (5) Semantic Controls through text-image contextualization.

4. There exist several possible reconstructions of the internal affinities among the major subgroups of the Mayan language family. The one that is assumed in the present paper is that by Kaufman (1989). Other models, such as Robertson’s (1992, 1998), are also used by a few epigraphers. To my knowledge, this is not the case of linguists who are not directly affiliated with that author.

5. The following are the deviations from the IPA: ⟨b'⟩/⟨b⟩ for [b], ⟨ʔ⟩/⟨'⟩ for [ʔ], ⟨tz⟩ for [ts], ⟨ch⟩ for [tʃ], ⟨x⟩ for [ʃ], ⟨j⟩ for [x], and ⟨ä⟩ for [i, ʌ, ə]. However, many Mayanists have used ⟨j⟩ for [h], particularly for languages such as Ch'ol, in which the Proto-Mayan /h/: /x/ distinction (i.e. /h/: /j/) has been neutralized. In citing colonial alphabetic manuscripts, angled brackets, ⟨ ⟩, are used to enclose alphabetic spellings. The following abbreviations for morpheme glosses are used: 1 = first person, 2 = second person, 3 = third person; s = singular, p = plural; ABS = absolutive, ERG = ergative, UNCP = uncertain possession, POSS = possession; CMP = completive, INC = incomplete, PL = plain/indicative, DEP/SUBJ = dependent/subjunctive, IMP = imperative, NEG = negative, ASP = aspect, ST = status, STV = stative; APSS = antipassive, IVZR = intransitivizer, MPSS = mediopassive; POSS = possessive, PSS = passive, TVZR = transitivizer; ENCL = enclitic, PREP = preposition, PRO = pronoun, PROCL = proclitic, PROX = proximal, DIST = distal. For glyphic transcriptions into sign catalog codes the following sources are used: Thompson (1962) and Macri and Looper (2003). For glyphic transliteration into linguistic forms the following sources are used: Fox and Justeson (1984b) and G. Stuart (1988).

6. Ch'olti' is attested exclusively in the Moran (1695) grammar, lexicon, and catechism.

7. Justeson et al. (1985) have shown that Yucatecan has borrowed words from Ch'olan that exhibit the exclusive Ch'olan shift of *oo > uu, a shift that includes items that were previously *o7, such as Yucatecan *tùun*, instead of the expected *tòon, from Proto-Mayan *tooy 'stone'. This example, and a few others like it, suggest that Pre-Ch'olan retained *VV after the *oo > uu shift, or else Yucatecan would not retain such items with *ùu*, but with *òo* instead. Furthermore, while Kaufman and Norman (1984) assume that Proto-Ch'olan-Tzeltalan had already merged *V7 with *VV into VV, given that neither Proto-Ch'olan nor Proto-Tzeltalan can be reconstructed with *V7, those authors presented no positive evidence in support of such inference. I have found the term *tsùum* 'tuft of hair on chest of mature turkey' in Yucatec, which is likely related to Proto-Ch'olan *tsun 'moss' from earlier Greater Lowland Mayan (Ch'olan, Tzeltalan, Yucatecan) #tso7n, a diffused item meaning roughly 'body hair' (Kaufman 2003a). Yucatec in fact preserves the expected reflex as *cho7on* 'vellos (body hair)', and so the term *tsùum* appears to be a loan from Ch'olan that tells us that Yucatecan borrowed it from a Pre-Ch'olan stage with *VV, following the *oo > uu shift, which itself followed the merger of *V7 and *VV into VV.

8. Examples in (7f–h) are probably cases where the disharmonic vowel is not silent but represents an actual vowel representing an enclitic or suffix.

9. See Mora-Marín (2009b) for discussion of the deictic enclitics that are used with the demonstrative pronouns in the contemporary languages as well as in the ancient texts.

10. See Mora-Marín (2005b) for identification of this marker in the text of a Late Classic vessel.

11. Kaufman's (2003b) data show no cases of Western Mayan languages with *-oom* for this nominalizer, only *-om*, even among Greater Q'anjob'alan languages that have preserved vowel length.

12. Other potential counterexamples are discussed by Lacadena and Wichmann (2004) themselves, and treated in different ways, although the generalized approach is to question the correctness of the conventionally assumed reconstructions (e.g. Kaufman & Norman 1984) given more recent research by Brown and Wichmann (2003), for example. Unlike Houston et al. (1998,

2004), Lacadena and Wichmann (2004: 118–119) do discuss the potential of underrepresentation, although they do so only with regard to spellings like **te-mu**, and **7e-b'u**, and **che-7e-b'u**, spellings that violate their proposed spelling rules. Lastly, like Houston et al. (1998), Lacadena and Wichmann include spellings of verbs in their data. As already mentioned, such spellings should not be included, for their word-closing syllabograms are invariably used to represent -VC suffixes (Justeson 1989, 2000; Justeson & Campbell 1997). Furthermore, various authors have continued to add examples to the list of spellings proposed to exhibit disharmonic diacritics that also violate all existing linguistic evidence. Grube and Martin (2003a, 2003b), for instance, explain the spelling **k'o-b'a** for 'three stones of Creation', and thus based on the root present in the term *k'òb'èn* 'kitchen, hearthstone (refers to three hearthstones)' (Bricker et al. 1998: 154), as indicative of a form *k'ò'b'*; the spelling **le-ku** presumably for *le'k* 'tortilla gourd', but this term is actually *lèek* (Bricker et al. 1998: 167); and the spelling **tsi-ma-hi** for *tsimaah* 'gourd', but this term is actually reconstructible as **tsima(?)* to Proto-Mayan (Kaufman 2003a: 993). These examples add to the lists of exceptions to Houston et al.'s (1998, 2004) and Lacadena and Wichmann's (2004) proposed rules.

13. In fact, even Lacadena and Wichmann (2004) have suggested not following such a transcription convention, but to simply represent inferences based on disharmony in the linguistic reconstructions and transliterations, rather than the epigraphic transcription.

14. Some examples are not illustrated in this paper.

15. The hieroglyphic spelling is the proper name of a location that makes up the 'main sign' of the site's Emblem Glyph.

16. Another instance of **hi** possibly used to represent a weakened *l* is found on K8622, where the spelling **pi-tsi-hi** occurs as part of a person's title, instead of the more common **pi-tsi-la**.

17. This regularly applied rule of obligatory synharmonic vowel insertion in the spelling of C_1VC_1 sequences suggests then that the few apparent counterexamples are the result of different processes, such as morphological conditioning, as argued in Table 10. For example, the spelling **7u-K'AWIL-la-li** shows a disharmonic spelling **-la-li**. Thus, we may justifiably speculate about the possibility that the sequence **-la-li** spells two suffixes in sequence: *-al-i(l)*.

18. This synharmonic vowel-insertion strategy is analogous to that found in Linear B writing in spellings like **wa-na-ka** for /wanaks/ 'king'.

19. This morphophonemic context could be realized orthographically in one of two ways: **yi-l(i)-a-ji** or **yi-la-ji**. The first, which is very rare, recognizes a morpheme boundary, while the second, by far the most common, ignores it. Thus, this spelling convention is of the *morphographic* type attested in other logosyllabic scripts; just as in other scripts this spelling type is rare in Mayan. These are not the same as 'morphosyllables' (Houston et al. 2001), since morphographic spellings are purely phonetic. Furthermore, spellings like **yi-l(i)-a-ji** strongly support the contention by some epigraphers (e.g. Bricker 2004) that Mayan had signs for V syllables (i.e. a), not just CV syllables (i.e. 'a).

20. It is possible that C_1VC_1 roots were more likely to take synharmonic suffixes, and therefore that the exceptionless rule of synharmonic spellings of their word-closing syllables was influenced by such suffixes.

21. Hopkins (1997), for his part, suggests that in spellings such as **7u-ts'i-b'a**, the vowel of the **b'a** sign represented an actual suffix, *-ä*, reconstructed by Kaufman and Norman (1984) as **-ä* 'applicative: usative', resulting in *7u-ts'ihb'-ä-Ø* 's/he makes/uses writing'. I agree with Hopkins in this regard, at least in cases where the morphosyntactic context calls for such a suffix; in cases such as **7AJ/7aj-ts'i-b'a** it is not clear that such vowel would be necessary.
22. Example (k) does have an explicit suffix with a vowel different from that used in the spelling of the noun root, a fact that supports the typical suffixing proposal.
23. It is possible that **7u-mu-ti** itself represented *7u-mu(u)t-il*, but to my knowledge all examples of possessed **mu-ti** show up as **7u-mu-ti**, never as **7u-mu-ti-la**, for example. Nevertheless, the colonial Yucatec documents do provide evidence (Bricker 1989): they show variation between ⟨u mut⟩ ~ ⟨u muti⟩ ~ ⟨u mutil⟩.
24. Yukatek has the term *chá:kil* 'rainy season' based on *chá:k* 'rain' (Bricker et al. 1998:61).
25. The spelling **ye-b'a-li** is also attested, suggesting a suffix *-al* in some instances.
26. There are two terms for which no explicit phonetic spelling in unpossessed contexts is known: **B'AH/B'AJ-si** and **TI7-si**. The first is found in variation with the possessed form **7u-B'AJ-ji**. If we assume, as for the spellings **7u-B'AH-hi** and **B'AH-hi-ja**, that the **-ji** sign of **7u-B'AJ-ji** is conventionalized based on the vowel of the suffix in the form **B'AJ-si**, then a form *b'aj-is* is plausible. However, further analysis of this term, whose meaning and inflected forms are unclear, is necessary. The **TI7-si** 'mouth, edge' term is found possessed as **7u-TI7**, without clear evidence for what the vowel of the suffix would be. It is possible that the term would take an *-is* suffix: modern Ch'ol has *ti'* 'orilla (edge)' which shows possessed forms as *i ti'* and *i ti'-il*, both for 'su orilla (its edge)' (Aulie & Aulie 1978:117). Thus, it is possible that this term would have also taken *-is* in an earlier form of Ch'olan that retained such suffix. But so far no explicit spellings corroborate this.
27. An approach that suggests a neutral vowel *a* at the end of the spelling of verbs might prove useful in accounting for the first one (Mora-Marín 2002, 2003; Boot 2004), while an approach that suggests that independent pronouns were immediately followed by enclitics such as *+a* 'relatively near to speaker', *+i* 'relatively far from speaker', and *+o* 'yonder' could likewise prove useful in accounting for the latter.
28. The figurative, abstract sense of *7u tok'*, *7u pak-al* is 'war' (Knowlton 2002).
29. See Mora-Marín (2008) for a recent survey and analysis of phonetic complementation practices.
30. The latter spelling supports the possibility raised above that the prevocalic glides (*y/w*) of the ergative/possessive prefixes were treated as part of the root (i.e. *yohl* 'his/her/its heart'), whereas the vocalic or consonantal segments that preceded such glides were treated as proclitics (i.e. *u yohl* 'his/her/its heart'), and thus as separate morphemes.
31. Similarly, the verb *y-al-(a)jiy(+a)* 3SERG-say-PERF(+PROX) 's/he has said' could be represented phonetically, as **ya-la-ji-ya**, or logossyllabically, as **YAL-ji-ya**.
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Addendum

Data Set by Houston et al. (2004). It has been revised only to reflect the following conventions followed in this paper: ⟨ts⟩ instead of ⟨tz⟩, ⟨ʔ⟩ instead of no symbol word-initially before a vowel. Very few dates or contextual data are provided; this reflects the general nature of the information provided for the entries in Houston et al. (2004), as discussed in this paper.

Spelling	Typical Suffixing	C-Deletion	Obligatory Synharmony	Linguistic Data
Ci-Ci				
1. pi-ki*				
2. pi-si*				
3. wi-tsi	Yes			Yes
4. chi-ji				
5. tz'i-b'i	Yes			Yes
6. ti-li			Yes	
Ci-Ca				
7. AYIN-na*				
8. yi-tz'i-na				Yes
Ci-Cu				
9. chi-ku*				
Ce-Ca				
10. ke-le-ma				Yes
11. CH'EN-na	Yes			Yes
Ce-Cu				
12. te-mu	Yes			
13. e-b'u	Yes			

Spelling	Typical Suffixing	C-Deletion	Obligatory Synharmony	Linguistic Data
Ca-Ci				
14. yi-ch'a-ki				Yes
15. AAT-ti				Yes
16. b'a-ki	Yes			Yes
17. ja-yi*				
18. na-hi	Yes			Yes
19. ta-ji*				
20. wa-WAAJ-ji				Yes
21. yi-cha-ni				Yes
22. pa-ti				Yes
23. cha-chi				Yes
24. CHAK/cha-ki	Yes			
25. na-b'i	Yes			
26. pa-chi				Yes
27. HAAB'-b'i				Yes
Ca-Ca				
28. CHAN-na	Yes			Yes
29. CH'AM-ma	Yes			Yes
30. KAB'-b'a	Yes			
31. K'AN-na	Yes			
32. NAL-la/na-la	Yes			
33. SAK-ka				
34. a-k'a-b'a				Yes
35. b'a-la-ma				
36. ka-cha				
37. ka-ka-wa	Yes			
38. k'a-b'a	Yes			Yes
39. la-ka				
40. na-b'a			Yes	Yes
41. pa-ka			Yes	
42. pa-ta			Yes	
43. ta-ja	Yes		Yes	
44. tz'a-ka			Yes	
45. wa-ya	Yes			Yes
46. a-ja-wa	Yes			Yes
47. ya-la				
48. TAN-na	Yes			
49. K'AK'-k'a	Yes			
Ca-Cu				
50. b'a-tz'u*				
51. a-ku	Yes			

Spelling	Typical Suffixing	C-Deletion	Obligatory Synharmony	Linguistic Data
Co-Ci				
52. OK-ki				Yes
53. OTOT-ti				Yes
Co-Ca				
54. -Co-ma				
55. ha-'o-b'a	Yes			Yes
56. to-k'a	Yes			
Cu-Ci (not known)				
57. u-tzi	Yes			
58. lu-mi	Yes			
Cu-Ca				
59. hu-na	Yes			
60. tu-pa	Yes			
61. yu-ha	Yes			
62. b'u-la*				Yes?
Cu-Cu				
63. CHUM-mu			Yes	
64. chu-ku			Yes	
65. ku-chu			Yes	
66. mu-ku			Yes	
67. k'u-k'u			Yes	
68. tz'u-nu-nu			Yes	
69. u-lu				Yes
70. yu-mu				
71. b'u-ku				Yes
72. t'u-lu				

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