The origin of Mayan syllabograms and orthographic conventions

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This paper surveys several processes by which CV and CVC phonetic sign readings were derived in Mayan writing. Four of these are acrophonic derivation processes: $C_1V_1$ and $C_1V_1G$ signs from $C_1V_1G$ roots ($G = /h?y\ w\ x/$; $C_1V_1$ and $C_2V_1C_1$ signs from $(CV(G))C_2V_1(G)C_1$ roots/words; $C_1V_1$ signs from $C_1V_1C_2$ roots/words ($C_2 / G$); and $C_1V_1$ from $C_1V_1(G)C_2V_2C_3$ or $C_1V_1C_2V_2(G)C_3$ roots/words. Four more are non-acrophonic processes which have been discussed previously by other authors: script transfer, linguistic change or variation, formal or phonetic divergence, and formal or phonetic convergence. The implications of some of these processes for the origin and history of the Mayan script are discussed here, as well as for some of the underlying linguistic bases for such practices.

1. Introduction

Using the iconic motivation of a sign as a clue to its decipherment is not the most cautious methodological approach, though it has been used, often successfully, in the decipherment of scripts around the world. In some cases, even when the iconic motivation of a sign is known, there may be several possible sourcewords to choose from. In other cases, this approach can be misleading, especially when a phonetic sign is used in pictorial art as a spelling for the name of an object or person rather than as a true icon. This distinction is clear in the following example based on Lounsbury (1989:229–30).
Figure 1. Examples illustrating pictorially embedded glyph with non-iconic function:

c. Lord seated on a throne with mat laid on top and with graphically infixed T622 po as a phonetic complement to the POP for *pohp ‘mat’. Drawing of Early Classic carved panel from Bonampak in Lounsbury (1989:230, Fig. 9a).
d. Lord seated on glyphic spelling T622.622 po-p(o) for *pohp ‘mat’. Drawing of painted ceramic plate by Nicolas Helmuth in Lounsbury (1989:230, Fig. 9b).

Figure 1a shows the Mayan syllabogram T622 po. Figure 1b shows a lord seated on a mat with a jaguar pelt laid on top; Figure 1c shows a lord seated on a throne with a mat laid on top, and with an example of T622 po placed inside (i.e. graphically infixed) and functioning as a phonetic complement to the MAT icon (i.e. MAT(-po) for a descendant of proto-Mayan *pohp ‘mat’, such as proto-Ch’olan *pohp). Figure 1d shows a lord seated on the glyphic spelling T622.622 po-p(o) for *pohp ‘mat’ instead of on a mat icon. While it is not
obvious what the T622 po sign represents iconically, it is clearly not a mat; therefore its use in pictorial art, as in Figure 1d, is not an aid in determining its source word.

Despite these potential pitfalls, establishing the iconic motivation and sourceword of a deciphered sign can lead to rewarding insights into the orthographic practices of the script tradition, and indeed, into the script's structure and origin (e.g. Campbell 1984, Justeson 1989, Justeson & Fox 1989, Zender 1999, Houston et al. 2000). Consequently, the major aims of this paper are to contribute to the systematization of the knowledge about Mayan orthographic practices, and to discuss what such practices reveal about the script's origin. I study some of the methods by which ancient Lowland Mayan scribes innovated new phonetic sign readings. I describe four processes for the acrophonic derivation of phonetic sign readings (i.e. the derivation of purely phonetic readings based on the linguistic sourceword of the iconic referent of the signs). I also describe four more processes for the derivation of new sign readings that are not acrophonic in nature (e.g. script transfer, interlinguistic or interdialectal variation and change, formal divergence, and formal convergence), some of which have been proposed by Fox & Justeson 1984a.

![Diagram of Mayan diversification model by Kaufmann 1976, 1989.](image)

![Diagram of Ch'olan diversification model by Kaufmann & Norman 1984.](image)
2. Preliminaries

2.1 The languages of the script

In this section I provide the linguistic and epigraphic assumptions used throughout the rest of the paper. First, I assume the historical linguistic scenarios for the Mayan language family, and for the Ch’olan and Yukatekan
languages, by Kaufman 1976, 1989, Kaufman & Norman 1984, and Justeson et al. 1985, which are favored by most linguists; see Figs. 2–4. Competing diversification models for the Mayan family and for the Ch’olan subgroup have been proposed by Robertson 1992, 1999; see Figures 5–6.

I assume that the languages of the texts were languages of the Lowland Mayan contact area, namely Ch’olan and Yukatekan (Justeson et al. 1985:9–10, Justeson & Fox 1989, Justeson & Campbell 1997). I agree with Houston et al. 2000 that a Ch’olan language served as the basis for the script; in fact, Fox & Justeson 1982, 1989, MacLeod 1984, Justeson 1985, Justeson et al. 1985, and Justeson & Campbell 1997 had previously provided support for that idea. However, Houston et al. 2000 argue that a descendant of proto-Ch’olan which they call Classic Ch’orti’an — which Robertson 1992, 1999 argues was a direct ancestor of Ch’orti’ — was the language that served as the standard of Mayan texts. In contrast, Justeson et al. 1985 and Justeson & Fox 1989 favor a form of Ch’olan prior to its breakup into Western Ch’olan (Ch’ol, Chontal) and Eastern Ch’olan (Ch’olti’, Ch’orti’) — such as proto-Ch’olan, pre-Ch’olan, or even proto-Greater-Tzeltalan — as the language that forms the basis of the script. Whether the script was used to represent a single standard dialect or language throughout its geographic distribution, or more than one vernacular Lowland Mayan dialect or language depending on the time period and region (cf. Justeson & Fox 1989, Lacadena & Wichmann 1999, 2000, Bricker 2000), is still a matter of debate. In this paper I evaluate the possibility that both Ch’olan and Yukatekan scribes innovated components of the script, including new sign readings.

2.2 Formal traits of the script

The Mayan script reads from left to right and top to bottom. Some texts contain examples of both single- and double-column formats, and a few texts exhibit a triple-column format. The script uses both logograms (signs with both phonetic and semantic values) of CV(G), CV(G)C, CV(G)CVC, and CVCV(G)C shapes, and syllabograms (signs with phonetic values only) of CVC and CV shapes. Two additional types of signs with no specific phonetic value of their own exist (Mathews & Justeson 1984, Fox & Justeson 1984b, D. Stuart 1988, D. Stuart & Houston 1994, Hopkins & Josserand 1999, Zender 1999): diacritics (e.g. sign doubler) and semantic determiners (e.g. DAY.NAME cartouche). The script used a compositional form of regularized shape and size, the glyph block, as the basic structural unit of texts (e.g. Justeson 1978, 1986, 1989).
In monumental inscriptions, the tendency is for glyph blocks to demarcate syntactic units: noun phrases, verb phrases, prepositional phrases, and adverbial phrases. Recently, I have pointed out that this was not necessarily the case of all types of texts (Mora-Marín 1999).

Logograms spell the following elements:

a. CV(G)C roots, e.g., T744 K’UK’ for descendants of proto-Mayan *q’u’q’ ‘quetzal (feather)’.
b. CV(G)CVC, CVGCV(G)C, or CVCV(G)C words, e.g., T751 B’ALAM for proto-Ch’olan *b’ahläm ‘jaguar’.
c. CV(G) particles, e.g. T51 TA and T59 TI for proto-Ch’olan *tà ~ *ti ‘generic preposition’.

While -CVC suffixes were generally spelled phonetically (e.g. T130:116 -wa-ni for proto-Ch’olan *-wan(-i) ‘intransitivizer of positionals’, T178.181 -la-ja for pre-Ch’olan *-laj ‘completive status of positionals’), sometimes they were spelled by means of CVC syllabograms or logograms (e.g. T86 NAL/nal to spell -nal ‘native of X place’, T528 TUN/tun in the spelling of -t-un ‘transitivizer’) and -V(C) affixes were often spelled phonetically too (e.g. …Ca-jV… for -aj). Syllabograms (syllabic signs) spell CV sequences, e.g. T1 (’u, T25 ka, T501 b’a; or CVC sequences, e.g. T86 NAL/nal, depicting an ear of maize, probably derived from a presumed logographic use as NAL for *nál ‘ear of maize’.

Roots and words can be spelled in a purely logographic manner (e.g. B’ALAM for *b’ahläm), in a partly logographic and partly syllabographic manner (e.g. (b’a)-B’ALAM or B’ALAM(-ma)), or in a purely syllabographic manner (e.g. b’a-la-m(a)). In logossyllabic and syllabic spellings, the V of the last CV sign was generally not read (i.e. with a phonetic value, though perhaps as a type of diacritic for a phonetic quality of the preceding syllable under some proposals; see below). Purely syllabographic spellings of roots and words were accomplished with CV signs (e.g. wi-ni-ki for Lowland Mayan *winik ‘person, man’), but also with CVC signs (e.g. via rebus phoneticism, as in the use of T757 B’AH ‘gopher’ as a CVC sign b’ah to spell descendants of proto-Mayan *b’aah ‘top, head, self’), or with a combination of CV and CVC phonetic signs (e.g. the use of T114 xa and T566 MAN/man to spell xa-MAN for xaman ‘north’).

There is currently substantial debate about how spellings of nominal and verbal affixes are to be analyzed orthographically. While affixes are spelled with
signs that otherwise have purely phonetic values, some authors have argued that such signs may be used logographically when spelling affixes (Fox & Justeson 1984a, Mathews & Justeson 1984, Justeson 1985, 1989, Bricker 1986, D. Stuart et al. 1999, Houston et al. 2001). For example, is the spelling T710.181 (i.e. T710 CHOK for proto-Ch’olan *chok ‘to throw (down)’) followed by T181 (phonetic ja), which was most likely intended to represent cho[h]k-aj ‘throw.down[pass]-pass/prtc’, to be read as CHOK-ja (logosyllabographic), CHOK-AJ (logographic), or CHOKAJ(-ja) (logosyllabographic, with logographic CHOKAJ followed by syllabographic ja as a phonetic complement)? I discuss this problem below with regard to the implications derived from the acrophonic processes.

2.3 Graphic segmentation and superimposition

There is a principle of representation called the pars pro toto ‘part-for-the-whole’ or segmentation principle (Coe 1976) that is shared by the art and writing traditions of Mesoamerica (Justeson 1986). It consists of the representation of an entity (e.g. RULER) by means of a segment of that entity (e.g. the head of a ruler). Mayan writing uses this convention too, so that the head of a person with a royal headband signifying rulership, T1000d, is sufficient to represent AJAW ‘lord, ruler’.

Figure 7. Examples of superimposition principle discussed by Zender (1999, Fig. 29):

b. T1.586:25:21.528 for u-pa-ka-b’u-TUN(IL) in Po Panel. After drawing by Kornelia Kurbjuhn. Note how T203 FISH in (a) is superimposed by T586 pa in example (b), with only T25 FISH.FIN visible. The same for T21.741 in (a) versus T21 in (b)

Mayan writing, in turn, also exhibits a principle of representation of superimposition, in which part of one sign may be superimposed by another sign
without affecting its reading (cf. Houston 1988, D. Stuart 1995, Zender 1999). For example, T25 FISH.FIN (see Figure 7a) and T203 FISH (see Figure 7b) are probably derived from a descendant of proto-Mayan *kar ‘fish’. Other examples known to epigraphers include the following: T21 and T21.741 b’u (see Figs. 7a–b), T19 and T19.741 mu, T4 and T4.1008 na/NAH, T149 and T604 k’u, T278 and T278:553b sa, T74 and T74:616/617:255 ma, T60 and T60:528 hi, T116 and T116.741 ni, T115 and T115.673 yo, and T44 and T44:563b to/TOK. Below I discuss two more examples in detail. One is T236 BIRD k’i and T77 BIRD.WING k’i (Mora-Marín 2000, D. Stuart 2002). The other is T124 tzi and T124:507 tzi.

2.4 Rebus phoneticism

The process of rebus phoneticism, discussed at length by Justeson 1989 for the Mayan script, was used to derive purely phonetic sign readings as well as logographic sign readings. Since the focus of this paper is the first case, i.e. the derivation of phonetic sign readings, let me offer a novel example of how logographic sign readings could be derived via rebus.

![Figure 8](en-space)

**Figure 8. Examples of rebus:**

a. T187 **K’AB’A** for Lowland Mayan *k’a(a)b’(a)* ‘name’. Drawing from Naranjo Hieroglyphic Stair 1, Step XII:Z2 after Grube (1994a, Figure 2).


T187, a logogram known to have the reading K'AB'A’ for Lowland Mayan *k’aab’aa’ ‘name’ (proto-Ch’olan *k’ab’a’) has a very peculiar shape (Figure 8a): it resembles the position of an arm with the elbow flexed and projecting at a right angle. The sign is often shown with a crossed-bands sign on the corner and two sets of parallel lines on each end. It is possible that the conventional nickname for this glyph as “elbow” or ELBOW may not be too far off the mark after all. Some examples of the glyph make it clear that the sign depicts a hand with an upward pointing thumb (Figs. 8b–d). The term for ‘hand’ and ‘arm’ is *k’ab’, which suggests that the logogram K’AB’ ‘hand, arm’ was used as a rebus for K’AB’A’ ‘name’. This process may have been motivated by the echo-vowel of Mayan languages. As explained by one of the referees of this paper, in Mayan languages “the phrase-final allophones of consonants include ‘echo syllables’; the consonant is repeated in a voiceless syllable with a copy of the preceding vowel” (i.e. C₁V₁C₂V₂). Such a process could lead to a pronunciation of *k’ab’ as *k’ab.b’a, which in turn makes the resemblance with proto-Ch’olan *k’aab’a’ even stronger.

![Figure 9](image)

Figure 9. Innovation of a new sign for AJ ‘male proclitic’ based on near homophony between said proclitic and yah’h ‘painful’.


Another example of the productivity and elasticity of rebus sign usage in Mayan writing was proposed by Stephen Houston. His argument concerns a sign used as a variant of T12 AJ for aj’+ ‘male proclitic’ (see Figure 9a) on an inscribed Chocola-style vase (Justeson 1989:32). The variant depicts a man with an expression of pain in his face, holding his head with both hands (see Figure 9b), and was likely intended as a rebus for proto-Ch’olan *aj+ based on proto-Ch’olan *yah ‘painful’ from proto-Mayan *ra’h. It is possible too that the reading AJ for the SCREAMING.MAN sign may have been based on a form closer to proto-Ch’olan *aj+’, such as modern Yukatek ‘àah’ excl. ah!’ (Bricker...
et al. 1998:2). In any case, although the SCREAMING.MAN sign is a Late Classic innovation — and an idiosyncratic one at that, with no other known attestations — it does illustrate the process of rebus phoneticism and the apparent freedom that the highly pictorial nature of Mayan graphemes afforded the scribes when developing new signs or reinterpreting the motivation behind existing signs.

3. Acrophonetic derivation of phonetic sign readings

There are four main processes by which a sign can acquire a phonetic reading based on the linguistic referent of its iconic referent. These involve the derivation of $C_i V_1$ signs from (1) $C_i V_1(G)G$ roots, (2) $C_i V_1(G)C$ roots, (3) $C_i V_1(G)CV(G)C$ roots or words, and (4) $CV(G)CV_1(G)C_i$ roots or words, where G stands for a “weak” consonant, such as /h l y w/, as well as vowel length and /j/. While the first two could be collapsed into one, and described formally as $C_i V_1 < C_i V_1(G)C$, the fact is that epigraphers have treated them differently; some have thought it unlikely that $C_i V_1$ signs were derived from $C_i V_1(G)C$ roots. For that reason I treat them separately here. Processes 1–4 are attested in other writing systems around the world; Process 4 may be unique to the Mayan script.

3.1 Process 1: $C_i V_1$ signs from $C_i V_1(G)G$

In Process 1, phonetic signs of the shape $C_i V_1$ were derived from $C_i V_1(G)G$ roots as suggested by examples listed in Table 1. Additional examples of this process of derivation, not listed in Table 1, include the following:

a. T757 b’a (iconically the head of a gopher) from descendants of proto-Mayan *b’aaah ‘gopher’ (Campbell 1984, Bricker 1986).

b. T301 b’i/b’e (iconically a footprint inside a cartouche) from a descendant of proto-Mayan *b’eeh ‘road’, such as proto-Greater Tzeltalan *b’eeh and proto-Ch’olan *b’ih (Campbell 1984, Justeson 1984).

c. T120 ne (iconically, the tail of an animal) derived from a descendant of proto-Mayan *Neeh, such as Lowland Mayan *neh (Campbell 1984).

d. T117/277 wi (iconically, a root) from Lowland Mayan *wip ‘root, bulb’ (Fox & Justeson 1984a).
The following abbreviations for language subgroups and language areas are used: C = Ch’olan, GLM = Greater Lowland Mayan, GT = Greater Tzeltalan, LM = Lowland Mayan, pM = proto-Mayan, T = Tzeltalan, Yu = Yukatekan, WM = Western Mayan. The following abbreviations for authors’ names are used: BM = Barbara MacLeod, BS = Brian Stross, DM = David Mora-Marin, DS = David Stuart, JF = James Fox, JR = John Robertson, LC = Lyle Campbell, MC = Michael Closs, MM = Martha Macri, MZ = Marc Zender, PM = Peter Mathews, SH = Stephen Houston, TK = Terrence Kaufman, VB = Victoria Bricker, WN = William Norman.

### Table 1. Signs derived through Process 1

<table>
<thead>
<tr>
<th>Sign</th>
<th>Iconicity</th>
<th>Sourceword</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (’u)</td>
<td>bead</td>
<td>pM *ʼu’h ‘bead’</td>
<td>VB 1986:52, JJ 1989:32</td>
</tr>
<tr>
<td>T585 b’i</td>
<td>crossroads, axis mundi</td>
<td>C *b’ih ‘road’</td>
<td>JJ 1984</td>
</tr>
<tr>
<td>T19 (.741)</td>
<td>b’u toad</td>
<td>LM *b’u(h)b’ ‘tadpole’</td>
<td>this paper</td>
</tr>
<tr>
<td>T758 ch’o</td>
<td>mouse head</td>
<td>pM *ch’o’h ‘mouse’ (?)</td>
<td>this paper</td>
</tr>
<tr>
<td>T287 ch’o</td>
<td>half-closed eyes</td>
<td>Yu ch’op ‘to blind temporarily’</td>
<td>MM 2000</td>
</tr>
<tr>
<td>T136 hi</td>
<td>sand?</td>
<td>GT *hi’ ‘sand’</td>
<td>LC 1984</td>
</tr>
<tr>
<td>T178 la</td>
<td>inverted LORD sign</td>
<td>Col. Yukatek &lt;la-il&gt; ‘principal, el ser (de cada uno)’</td>
<td>LC 1984</td>
</tr>
<tr>
<td>T220 ke</td>
<td>hand</td>
<td>keh ‘measure between thumb and knuckle of forefinger’</td>
<td>MZ 1999</td>
</tr>
<tr>
<td>T582 mo</td>
<td>macaw eye</td>
<td>GLM *mo’ ‘macaw’</td>
<td>LC 1984</td>
</tr>
<tr>
<td>T1000 a na</td>
<td>head of woman</td>
<td>LM *na’ ‘mother’</td>
<td>LC 1984</td>
</tr>
<tr>
<td>T116/1019 ni</td>
<td>mustache (?)</td>
<td>pM *ni’ ‘nose’ (?)</td>
<td>this paper</td>
</tr>
<tr>
<td>T586 pa</td>
<td>net bag</td>
<td>pM *paah ‘net’</td>
<td>LC 1984, JJ 1984</td>
</tr>
<tr>
<td>T854 pu</td>
<td>cattail</td>
<td>Tzo. pu ‘cattail’</td>
<td>DS 2000</td>
</tr>
<tr>
<td>T87 te</td>
<td>tree</td>
<td>pM *tyee’ ‘tree’</td>
<td>LC 1984</td>
</tr>
<tr>
<td>T370 tzu</td>
<td>gourd</td>
<td>pM *tzuh ‘gourd’</td>
<td>LC 1984, JF/JJ 1984a</td>
</tr>
<tr>
<td>T203c tz’u</td>
<td>fish swallowing something</td>
<td>pM *tz’ub’ ‘suck’</td>
<td>MZ 1999</td>
</tr>
<tr>
<td>T130 wa</td>
<td>tamale</td>
<td>WM+Yu *waj ‘tortilla’</td>
<td>KT 1989</td>
</tr>
<tr>
<td>T126 ya</td>
<td>penis bloodletting?</td>
<td>C *yah ‘painful’</td>
<td>this paper</td>
</tr>
</tbody>
</table>
e. T25 ka (iconically, the fin of a fish) and T203 ka (a whole fish) from a descendant of proto-Mayan *kar ‘fish’ such as Yukatekan *kay (Justeson 1989) or proto-Western Mayan *kay (Houston et al. 2000), but not proto-Greater Tzeltalan *chay or proto-Ch’olan *çıy.


T740 hu (iconically an iguana) from Lowland Mayan *huj ‘iguana’ (Campbell 1984).


i. T82 le (iconically a leaf) from Yukatekan *lec’ (Campbell 1984).

Figure 10. Examples of acrophonic derivation of CV signs from CVG roots:

a. T710 HAND read phonetically as ye and probably derived from proto-Ch’olan *ye’ ‘to show’. After drawing in Stuart et al. (1999:37).

b. T590 JAWBONE read phonetically as cho probably derived from proto-Ch’olan *choh ‘cheek’. Drawing from Copan Stela 13:D8 after Grube (1994a, Fig. 2).

c. T708 CLENCHED.TEETH sign read phonetically as ko and probably derived from proto-Yukatekan *kóoh ‘teeth’. Drawing from Palenque Palace House C Platform at D3, after Grube & Stuart (1987, Fig. 8).

Other examples are worth a few words. T710, a sign depicting a hand and deciphered as phonetic ye by David Stuart, was likely derived from proto-Ch’olan *ye’ ‘to show’, given the posture of the hand (see Figure 10a). T669 ka, a sign depicting a closed fist, may have been derived from Lowland Mayan *k’ab’ ‘hand, arm’ (Fox & Justeson 1984a:69) through this process. Although at first sight b’ does not seem to be a weak consonant, in some dialects of Yukatekan and Ch’olan it alternates in final position with glottal stop; cf. Yukatek k’ab’ ~ k’a’ (Bricker et al. 1998:140), Ch’ol k’ab’ ~ k’ä’ (Schumann 1973:21). Thus k’ab’ ~ k’a’ or k’äb’ ~ k’ä may have served as the basis for T669 ka as *k’ab’ ~ *k’a’.

I mention here only two more examples from Table 1. T590, likely phonetic cho (cf. D. Stuart 1995), depicts a jawbone with molar teeth (see Figure 10b). It may be derived from a descendant of proto-Mayan *kooh ‘cheek; tooth (molar)’ (Fox 1978:119–20). This item underwent the shift of k to ch in Greater...
The origin of Mayan syllabograms and orthographic conventions

Tzeltalan, where it is attested as *choh with the meaning 'cheek'; it is reconstructed for proto-Ch’olan as *choh ‘cheek’ (Kaufman & Norman 1984:118). Fox points out (1978:119–20) that Yukatekan has *koh ‘tooth’, and that *koh or *kooh can be reconstructed for proto-Mayan with the meaning ‘cheek, tooth (molar)’ based on the cognates in other subgroups. Based on this, it is possible that Ch’olans may have retained the ‘tooth (molar)’ meaning for some time, and that the molar tooth depicted in the T590 sign makes reference to this.

T708, a sign depicting an open mouth with clenched teeth, each tooth showing a jade inlay, is of interest here (see Figure 10c). The sign has been deciphered as phonetic ko (Grube & Stuart 1987). Based on the iconic motivation and the phonetic value, the most likely sourceword for the syllabogram is Yukatekan koh ‘tooth’, as argued recently by Macri 2000. In other words, T590 cho and T708 ko may have had essentially the same sourceword in different languages, suggesting that both Ch’olan and Yukatekan scribes influenced the development of the script’s signary.

Table 2. Signs derived through Process 2.

<table>
<thead>
<tr>
<th>Sign</th>
<th>Iconicity</th>
<th>Sourceword</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>T280</td>
<td>(‘)o</td>
<td>bird feather</td>
<td>Yu ‘bop ‘parrot’</td>
</tr>
<tr>
<td>T585</td>
<td>b‘i</td>
<td>perforated earflare</td>
<td>Yu b‘is ‘pierce, bore, prick’; Itza b‘is ‘perforated with fine holes’</td>
</tr>
<tr>
<td>T19(.741) b‘u</td>
<td>toad</td>
<td>LM *b‘u(h)b‘ ‘tadpole’</td>
<td>this paper</td>
</tr>
<tr>
<td>T110</td>
<td>ko</td>
<td>turtle carapace?</td>
<td>C ‘kok ‘turtle’</td>
</tr>
<tr>
<td>T669</td>
<td>k’a</td>
<td>closed fist</td>
<td>pM *q‘ab‘ ‘hand/arm’</td>
</tr>
<tr>
<td>T24</td>
<td>li</td>
<td>hook-shaped object?</td>
<td>WM *lich ‘hanging’</td>
</tr>
<tr>
<td>T24</td>
<td>li</td>
<td>reflective object?</td>
<td>WM *litz ‘shine’</td>
</tr>
<tr>
<td>T950</td>
<td>li</td>
<td>hawk</td>
<td>C *lik-lik ‘hawk (species)’ (highland loan)</td>
</tr>
<tr>
<td>T21(.741) mu</td>
<td>frog or toad</td>
<td>GLM *much ‘toad’</td>
<td>this paper</td>
</tr>
<tr>
<td>T126</td>
<td>ya</td>
<td>flowing liquid?</td>
<td>GLM ‘yal ‘throw down’</td>
</tr>
</tbody>
</table>
3.2 Process 2: $C_1V_1$ signs from $C_1V_1(G)C_2$

A second process consists of the derivation of $C_1V_1$ syllabograms from $C_1V_1(G)C_2$ roots or stems in which $C_2$ is not a weak consonant; see Table 2. A few examples have recently been presented by Houston et al. (2000:328): T110 ko, T134[595] no, and T44(:563b) to/TOK. They suggest that T110 depicts a turtle carapace, and that its sourceword may be proto-Ch’olan *kok ‘turtle’. They also suggest that T134[595] no may have been derived from proto-Mayan *nooq’ ‘clothes, cloth’, although the iconic motivation of T134 is not very clear. Another example they point to is T44(:563b) to/TOK, which iconically depicts clouds, and may therefore be derived from a descendant of proto-Mayan *tyooq(-al) ‘cloud’, such as proto-Ch’olan *tokal (Kaufman & Norman 1984:132).7

![Figure 11. Examples of acrophonic derivation of CV signs from CVC roots.](image)

b. Late Classic example of T24 li. After drawing in Stuart et al. (1999:61).
e. Late Classic example of T126 ya with central element resembling a penis, from Palenque. After drawing in Lacadena (1996:238).
f. Early Classic example of T126 ya from an inscribed jade plaque. Drawing by D. Mora-Marín.

Another case may be T669 k’a, mentioned above as possibly derived through Process 1. If it originated in a Ch’olan or Yukatekan dialect in which final $b’$ was not in alternation with glottal stop in the word *k’a*b ‘arm’, it would be an
example of Process 2. A better example may be T24 li. The earliest forms of T24 li suggest the depicted entity was a hooked object, as in Figure 11a; the later forms, as in Figure 11b, show no hook element. It is possible that its reading may have been derived accordingly from the Western Mayan positional root *lich’ ‘hanging’ (Kaufman & Norman 1984:125).8

T126 ya depicts three flowing or curling elements, with the central element pointing down; see Figure 11c. Later examples show three dots instead for a central element; see Figure 11d. Based on this, it is possible that the reading ya derived from Greater Lowland Mayan (Tzeltalan, Ch’olan, Yukatekan) *yal ‘throw down’. However, an example of the spelling T60:528:358:126 on a jade celt from Rio Azul suggests a different origin for T126 ya. The example shows the central element of T126 as the profile view of the legs of a man performing a penis bloodletting rite, with the side curling elements possibly indicating the direction of the blood flowing down from the perforations; see Figure 11e. If this is the case, then T126 could be a part of a larger sign consisting of T358:126 and acrophonically based on proto-Ch’olan *yah ‘painful’, which would make T126 ya an example of Process 1. The possibility that T126 ya may have been derived from *yah ‘painful’ finds support in a late form of T126 ya attested at Palenque, in which the central element of the sign is apparently a penis; see Figure 11f. Such form reinforces the association with penis bloodletting apparent in the Rio Azul example. For now I consider this only an interesting possibility that requires further testing.

Two more examples include T21(.741) mu, which appears to depict a frog or toad and could therefore be based on Greater Lowland Mayan *much ‘toad’, and T19(.741) b’u, formally identical to T21(.741) except for a series of cross-hatched elements on the T19 component. The latter therefore depicts a toad as well and could be based on Lowland Mayan (Ch’olan, Yukatekan) *b’u(h)b’ ‘tadpole’. I discuss these two examples below with regard to the process of formal divergence.

A referee of this paper has suggested a few examples that I regard as good candidates for Process 2. One is T280 (’)?o, which depicts a feather and may have been derived from a cognate of modern Yukatek ñoop ‘parrot’ (Bricker et al. 1998:18). The referee also suggests that T585 b’i, which depicts a perforated earflare, may correspond to modern Yukatek b’is ‘pierce, bore, prick’ and modern Itzaj b’is ‘perforated with fine holes’ (Hofling & Tesucún 1997:178, Bricker et al. 1998:32).9 Macri 2000 has also suggested that T585 b’i was derived b’is; and she also argues that T287 ch’o, which depicts a pair of half-closed eyes, may be derived from a form such as modern Yukatek ch’op ‘to blind temporarily’ (Bricker et al. 1998:86).
One last example of this process may be the use of a JAWLESS.SKULL sign as a syllabogram b’a (cf. Zender 1999:38–41). This is illustrated on vessel K4357, where a JAWLESS.SKULL sign is used in the spelling u-ts’i-JAWLESS.SKULL-li to spell the syllable b’a, given its occurrence in the position normally occupied by the high frequency u-tz’i-b’a-li glyph. The b’a reading for this JAWLESS.SKULL sign may have been derived from its logographic reading B’AK ‘bone’ (cf. proto-Ch’olan *b’ak ‘bone’ < proto-Mayan *b’aaq), which Zender (1999:65–68) has shown was one of the logographic readings for this sign besides JOL ‘head’ and CHAM ‘to die’. The term in modern Ch’ol for ‘skull’ is baquel joläl, where bac is ‘bone’ and jol is ‘head’ (Aulie & Aulie 1978:30, 35, 67); the term is therefore ‘the bone of the head’. Consequently, it is quite probable that a descendant of proto-Mayan *b’aaq could be the source of the b’a usage for JAWLESS.SKULL.

Table 3. Signs derived through Process 3.

<table>
<thead>
<tr>
<th>Sign</th>
<th>Iconicity</th>
<th>Sourceword</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>T513</td>
<td>June bug</td>
<td>Tzeltal umoh/umuh/omoh ‘June bug’</td>
<td>VB 1986</td>
</tr>
<tr>
<td>T1040 b’a</td>
<td>human skull</td>
<td>pM *b’aaq</td>
<td>MZ 1999</td>
</tr>
<tr>
<td>T758a ch’o</td>
<td>mouse head</td>
<td>C *ch’olak ‘mouse’ (?)</td>
<td>this paper</td>
</tr>
<tr>
<td>T918 PET/pet</td>
<td>spindle whorl</td>
<td>pM *peteh ‘spindle’</td>
<td>this paper</td>
</tr>
<tr>
<td>T44 to</td>
<td>clouds</td>
<td>C *tokal ‘cloud’</td>
<td>SH/JR/DS 2000</td>
</tr>
<tr>
<td>T507 tzi</td>
<td>gourd</td>
<td>pan-Mayan *tzima(h) ‘gourd’</td>
<td>this paper</td>
</tr>
<tr>
<td>T124 tzi</td>
<td>handle of incense burner</td>
<td>Tojolob’al *tzik ‘to burn incense’</td>
<td>this paper</td>
</tr>
<tr>
<td>T115 yo</td>
<td>leaf?</td>
<td>pC *yop-ol ‘leaf’</td>
<td>this paper</td>
</tr>
</tbody>
</table>

Figure 12. Iconographic evidence for derivation of T507 tzi:

3.3 Process 3: $C_1V_1$ signs from $C_1V_1(G)C_2V_2(G)C_3$

To the processes already mentioned, another can be added: the derivation of $C_1V_1$ syllabograms from $C_1V_1(G)C_2V_2(G)C_3$ roots or words; see Table 3. One clear example, shown in Figure 12a, is T507 tzi from pan-Mayan *tzima(h) ‘gourd’, an early borrowing from Mixe-Zoquean *tzima (Campbell & Kaufman 1976:84). This is evident through an examination of vase K1453 (Kerr 1989:86), where a gourd is depicted in the middle of the pictorial scene; see Figure 12b. In the accompanying text, T507 is rendered a few times with a strong resemblance to the gourd in the middle of the scene (Figure 12a). I will return below to T507 tzi in order to discuss a special case of formal convergence between T507 and T124, both read as tzi.

There may be other examples of Process 3 besides T507 tzi. As discussed by Zender (1999:38–41), on vase K2206 the logogram T751 B'ALAM is apparently used as a syllabogram b'a in substitution for T501 b'a in the spelling of u-ts'i-b'a-l(i). A somewhat similar example appears on K772, where the head of the Hero Twin YAX-B'ALAM, also used as the head variant of the numeral ‘nine’ (cf. proto-Ch’olan *b’olon=), was used as a b’V syllable — perhaps b’a, if based on the reading B’ALAM, or b’o, if based on the reading B’OLON=. Although these examples are rather unusual and clearly of a playful nature, they illustrate the process postulated here for T507 tzi, and the fact that scribes could produce such new sign readings on a whim. They confirm that scribes did in fact employ the process $C_1V_1 < C_1V_1C_2V_2C_3$ for obtaining phonetic signs. The difference between such signs and T507 was simply one of acceptance by other scribes.

Another example may be T758a ch’o, which depicts a mouse, possibly derived from proto-Ch’olan *ch’ohok ‘mouse’. However, proto-Greater Tzeltalan may have had *ch’oh, since the term is a reflex of proto-Mayan *ch’oh (Kaufman & Norman 1984:119). If T758a originated among Greater Tzeltalan speakers, its reading would be an example of Process 1, and not of Process 4.

It is possible that some CVC logograms or syllabograms signs may have been derived in this fashion too. The T818 SPINDLE sign deciphered by Nikolai Grube as PET, for instance, may have been derived from proto-Ch’olan *petelh ‘spindle’. Lastly, Bricker (1986:78–79) has offered another clear example of this process: She has shown that T513 (‘)u depicts a June bug, i.e. umoh ~ umuh ~ omoh in modern Tzeltal.
### Table 4. Signs derived through Process 4.

<table>
<thead>
<tr>
<th>Sign</th>
<th>Iconicity</th>
<th>Sourceword</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>T280 ()</td>
<td>macaw feather</td>
<td>GLM *mo’ ‘macaw’ (t)</td>
<td>this paper</td>
</tr>
<tr>
<td>T34/266 hu</td>
<td>bead necklace</td>
<td>pM *u/h ‘necklace’</td>
<td>this paper</td>
</tr>
<tr>
<td>T528 ku</td>
<td>stone</td>
<td>C *chahuk ‘lightning’</td>
<td>MC 1986</td>
</tr>
<tr>
<td>T77/236 k’i</td>
<td>(bird) wing</td>
<td>Yu *xik’ ‘wing’</td>
<td>DM 2000</td>
</tr>
<tr>
<td>T568 lu</td>
<td>heart</td>
<td>Yu *ół ‘heart’</td>
<td>JF/JJ 1984a, MC 1986</td>
</tr>
<tr>
<td>T568 lu</td>
<td></td>
<td>GTz *juö ‘pierce’</td>
<td>this paper</td>
</tr>
<tr>
<td>T51 ta</td>
<td>centipede</td>
<td>LM *chapah ‘centipede’</td>
<td>this paper</td>
</tr>
<tr>
<td>T79 pat</td>
<td>centipede</td>
<td>LM *chapah ‘centipede’</td>
<td>this paper</td>
</tr>
<tr>
<td>T126 ya</td>
<td>liquid flowing</td>
<td>C *yal ‘to fall’</td>
<td>this paper</td>
</tr>
<tr>
<td></td>
<td>downward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T61/62 yu</td>
<td>bead</td>
<td>C *uhy ‘necklace’</td>
<td>this paper</td>
</tr>
<tr>
<td>T114 xa</td>
<td>component</td>
<td>GLM *yax</td>
<td>MC 1986</td>
</tr>
</tbody>
</table>

3.4 Process 4: $C_1V_1$ signs from $C_1V_1(G)C_2(V_2(G)C_3)$

There are also examples of the derivation of $C_1V_1$ signs from $C_1V_1(G)C_2$ sourcewords, or $C_2V_2$ signs from $C_1V_1(G)C_2V_2(G)C_3$ sourcewords; see Table 4. This process is analogous to the convention of phonetic complementation of logographic signs (Closs 1986), although it may not have been necessarily understood in the same terms by the scribes. The process itself was first discussed by Fox & Justeson 1984a and by Justeson 1984; but Closs (1986:240–41) attempted a more systematic survey of its productivity.

Fox & Justeson (1984a:24, 71) suggest that T96/103 had a logographic reading EYE and a phonetic reading ta in the Postclassic codices. These authors contend that its phonetic reading ta may have developed from proto-Greater Tzeltalan or pre-Ch’olan *wat ‘eye’, which may be the iconic referent of T96. Justeson (1984b:367) also states that, in general, “a VC2 logogram may be used also with the corresponding CV1 phonetic value, and vice versa.” Thus he considers that T24 li may be read also as -IL ‘possessive/relational nominal suffix’, and T181 ja as -AJ ‘verbal suffix’ or as AJ+ ‘male proclitic’. The orthographic contexts of T181 support most of these readings. For example, the verb...
chok ‘to throw down’ may be spelled as a passive (i.e. cho[h]k-aj or chok-aj) either as cho-ka-ja or as CHOK-ja. Given the explicit phonetic spelling of the first example, which renders chok-aj, it is normally assumed that the second spelling would render also chok-aj, and thus justifying the interpretation of T181 as logographic -AJ rather than exclusively as phonetic ja. More recently, Stuart et al. 1999 and Houston et al. 2001 are taking up this issue again; they refer to phonetic signs that are used to spell grammatical affixes and particles by the term “morphosyllables.”

Closs (1986:231) has reformulated the orthographic rule proposed by Justeson (1984b:367) as a “rule of commutativity”, and has proposed that the emic basis for this practice may have lain in its equivalence to the practice of synharmonic phonetic complementation of logographic signs. Thus he has argued (1986:240–41) that the reading ku of T528 may have been derived from its logographic reading CHAHUK via a process analogous to synharmonic phonetic complementation: CHAHUK > ku.11 He has also suggested that T501 b’a may be derived from a logographic NAB ‘ocean’ reading, as well as a few additional examples: T114 xa (T16 YAX), T552 ta (T552 K’AT), T58 ka (T58 SAK), among others. Besides the T528 ku example, the cases T114 xa and T552 ta are especially appealing to me, and I describe them next.

Closs (1986:236–338) posits that T114 xa, a sign deciphered by D. Stuart (1987:28–31), was derived from the logographic reading of T16 YAX for yäx ‘green, first’, which often appears to have T114 inside (i.e. as a graphic infix). If so, T114 may have been innovated similarly to T25 ka from T203 ka, by means of the pars pro toto principle and the postposed phonetic complementation analogy: YAX(-xa). He also argues that T552, thought by some to have the logographic reading K’AT ‘to cross’ or ‘crosswise’ (Fox & Justeson 1984a), may have developed its reading ta, illustrated in the spelling of yi-ta-ji with T552 as ta (Schele 1990:106), through the same process: K’AT > ta. However, there is a possibility that T552 was read logographically as AT (Lounsbury 1989); if so, the reading ta could still be derived through the same process: AT > ta.
Figure 13. Examples of acrophonic derivation of $C_1V_1$ signs from $(CVC)C_2V_1(G)C_1$ roots, where $C_1$ can be any type of consonant.

a. Example of T62:62 spelling for $yu-y(u)$ or $y(u)$-UY for $y$-uhy ‘his/her bead’ on tubular jade bead from the Cenote of Chichen Itza. Drawing by author after photograph in Proskouriakoff (1974, Plate 45–1) and personal examination of piece at Peabody Museum at Harvard.

b. Example of T62 used pictorially as depiction of a perforated ear bead ornament on the Pomona jade ear flare. Drawing by author after photograph in Kidder & Ekholm 1951.

c. Example of T62 used pictorially as depiction of perforated pectoral bead ornament on Tikal Stela 31. Drawing by author after drawing in Jones & Satterthwaite (1982, Fig. 52).


Other examples of this process exist. I have argued (Mora-Marín 1997, 2000) that the reading $yu$ of T62, a sign depicting a jade bead assemblage, was derived from a probable logographic reading of T62 as UY ‘bead, necklace’ attested on a tubular bead from the Cenote of Chichen Itza (Proskouriakoff 1974, Plate 45-1).
In this tubular bead, an ownership statement T62:62 spells either yu-y(u) or y(u)-UY for y-uhY ‘his/her bead’ (see Figure 13a); either way, the iconic referent of T62 is a jade bead or bead assemblage (see Figs. 13b–c). Based on this, T62 was most likely derived from proto-Ch’olan *uhy ‘necklace’ (Kaufman & Norman 1984:135) (i.e. UY > yu), as previously suggested by Grube (1991:230), rather than from Greater Tzeltalan/Yukatekan *u(‘)h. Support for this hypothesis is found in rare uses of T62 as (‘)u (see Figs. 13d–f), suggesting that the sourceword for T62 was in fact *uhY (i.e. u < UY), and also that a given sourceword could potentially lead to more than one reading for that sign, as argued below also for T51 and T79. Indeed, the yu reading of T62 appears to have become the standard reading probably through conventionalization already during Early Classic times; but scribes in the Early Classic (note the unprovenanced cylindrical stone object in Houston & Stuart 1998:83) and the Late Classic (e.g. Yaxchilan Lintel 23:F2, Sacchana Stela 2:A3) still used it as (‘)u on occasion.

a. b.

Figure 14. Possible examples of development of syllabogram k’i from term for ‘wing’.

I have proposed (Mora-Marín 2000) the reading k’i for T77, a sign depicting the wing of a bird; see Figure 14. The proposal is based on several contexts, including its probable use as a phonetic complement to T544 K’IN in a few ceramic vases (e.g. T77-K’IN-ja most likely read as (k’i)-K’IN-ja) and at Xcalumkin (e.g. AJ-T77-K’IN-a most likely read as AJ-(k’i)-K’IN-a for ajk’in-a’ ‘Mr. Priest’). Again, I have proposed (in Mora-Marín 2000) an acrophonic origin, following MacLeod & Stross 1990, based on the Yukatekan descendant of proto-Mayan *xîik’ ‘wing’, which was *xîik in proto-Yukatekan, rather than the Ch’olan descendant *wich’ (Kaufman & Norman 1984:136), as follows: XIK’ > k’i. Since the sign could have been derived from a descendant of proto-Mayan prior to the k(‘) > ch(‘) shift of Greater Tzeltalan, the sign could have originated in a Greater Tzeltalan language that preceded that shift. It is possible, as D. Stuart 2002 has proposed, that the reading k’i for T77 may have been derived instead through Process 1 if based on k’iy ‘to spread out’ — a term attested in Tzeltal, Tzotzil, and Ch’ol (Aulie & Aulie 1978:102–3) — since the earliest forms of T77
show two spread-out wings. Thus, even though *xiik’ ‘wing’ is at first sight a more direct linguistic referent of the iconic motivation of T77 WING, the fact is, as D. Stuart points out, that some of the earliest versions of T77 show two spread-out wings rather than a single wing. For the moment, therefore, I prefer to include T77 in Table 1 (if derived from proto-Greater Tzeltalan *k’ij) and Table 4 (if derived from a descendant of proto-Mayan *xiik’).

Figure 15. Signs depicting tail of centipede and whole centipede:

a. T51/53 CENTIPEDE with readings ta/TI/TA, as attested on Río Azul mural. After drawing by Peter Mathews.

b. T79 PAT ‘to form’ or phonetic pat. After example in polychrome vase K1398 (Kerr 1989).

c. Full form of the mythological centipede glyph on a Late Preclassic text inscribed on a Late Preclassic text inscribed on the back of an Olmec-style pectoral mask pendant on display at the Brooklyn Museum of Art. Probably logographic CHAPAT ‘centipede’. After photograph in Soustelle (1972, Plate 61) and first-hand examination of the piece at the Brooklyn Museum of Art.

d. Partial centipede glyph from Palenque, showing the head. Probably logographic CHAPAT ‘centipede’. After drawing by Linda Schele.

T51/53 ta/TI/TA, as shown in Figure 15a, is thought by various epigraphers to depict a centipede; it could very well have been derived acrophonically from an ancestor of Ch’olti’ *<chapaht>* ‘cienopies’ (Morán 1695:22), Ch’orti’ *chapaht* ‘animal said to resemble the centipede’ (Wisdom 1940), Colonial Yukatek *(ah) chapat* ‘ciento pies, insecto; sabandija que entra en el oído y mata; nombre genérico de las escolopendras’ (Barrera Vásquez 1980:84), and Tzeltal *chapat* ‘centipede’ (Slocum & Gerdel 1971:132), but not the Ch’olti’ entry cited by Grube & Nahm (1994:702). As I mention below, T79 PAT (see Figure 15b) may also be acrophonically related to T51/53 ta/TI/TA. This acrophonic origin is suggested also by a Late Preclassic text inscribed on the back of an Olmec-style pectoral mask pendant (Figure 15c) which shows the full form of the CENTIPEDE glyph (a mythological centipede), which is also attested in the Late Classic at Palenque (Figure 15d); the tail of the full-form centipede creature resembles T51/53. In this way, the phonetic reading of T51/53 may have been derived through the process: CHAPAT > ta.

It is possible that CVC phonetic signs may also be derived this way. T79, as in Figure 15b, is thought to be logographic PAT ‘to form’ as deciphered by D. Stuart; it seems to depict the same part of the centipede as T51/53. Since T79 does not seem to depict anything that is related to the concept of ‘to form’ (i.e., its relationship to the verb *pät* ‘to form’ is entirely arbitrary, rather than iconic/indexical), it is possible that it was a CVC phonetic sign *pat* that was frequently used in the spelling of the verb *pät* ‘to construct, build’ from proto-Mayan *pat* (Kaufman & Norman 1984:128). The reading of T79 may have been derived as CHAPAT > pat.

Another sign may be T548. There are a few instances in which T548 appears to have a purely phonetic reading of the shape b’V, as other epigraphers have also recognized (e.g. Marc Zender, p.c. 2000). One example is found on the pottery vase K4549, where the following appears: yu-k’i-T548. In this context T548 is in free word-final substitution for either T585 b’i or T501 b’a, and is probably used to spell yu-k’i-b’ (V) for *y-uk’-ib’* ‘his/her drinking cup’. An explanation of the apparent b’V reading for T548 can be proposed on the basis of its logographic reading HAB’ for *ha’b’* ‘year’ plus the phonetic complementation or commutativity process: HAB’ > b’V. To my knowledge no word-initial or word-medial contexts of T548 with a b’V reading are known; thus the precise vocalic value of this b’V sign, if indeed a b’V sign, is uncertain.
Figure 16. Acrophonic derivation of T568 lu.

c. Example of T568 lu that shows it as a clear depiction of a presumably human heart. Drawing from Xcalumkin Lintel 4 after Grube (1994b:320, Fig. 6a).
d. Iconic use of T568 lu as part of the logogram T918 JUL for *jul 'to pierce', which shows a spear going through a heart. After example on vase K595 (Justin Kerr Archive, www.famsi.org).

Lastly, T568 lu, as in Figures 16a–b, may have its origin in this process too. As seen in Figure 16c, the sign depicts a human heart (cf. Justeson 1984:344). No lexical item with the meaning 'heart' seems to provide a clear acrophonic basis for the phonetic value of the sign — despite the suggestions by John Justeson and by James Fox (cited in Justeson 1984:344), as well as by Closs 1986, that its sourceword was *ohl 'heart'. I think the iconic use of T568 lu as part of the logogram T918 JUL for Greater Tzeltalan *jul 'to pierce', which shows a spear going through a heart as on vase K595 (see Figure 16d), suggests that the lu reading was derived from JUL through the commutativity process: JUL > lu.14

4. Non-acrophonic derivation of phonetic sign readings

The following processes were first discussed by Fox & Justeson 1984a. Here I will only mention a few possible examples of these, pending a more thorough investigation in the future.
The origin of Mayan syllabograms and orthographic conventions

4.1 Process 5: Script transfer

There are two types of script transfer of relevance here. The first is diffusion between the Mayan and Epi-Olmec scripts, and the second between two Mayan dialects or languages.

There is at least one clear case of diffusion of a CV syllabogram from the Epi-Olmec script to the Mayan script, discovered by Stross 1990 on iconographic grounds, and later confirmed by Justeson & Kaufman 1993 on grammatical grounds, namely Epi-Olmec MS44 na and Mayan T23 na; see Figures 17a–b. Indeed, as Stross (1990:48–52) points out, the iconic motivation of the na sign supports an explanation of the origin of its reading based on the Mixe-Zoquean sourceword *naas’ land’ (Wichmann 1995:582), and not the semantically equivalent Mayan form (cf. proto-Ch’olan *kab’ ‘earth, land; town’; proto-Mayan *kab’ ~ *kaab’). As I have pointed out (Mora-Marín 1996), some Early Classic forms of Mayan T23 na are identical to this down-turning ground motif...
(see Figs. 17c–d), although later forms often seem to be more stylized (Figure 17b). Also, its iconic use in Late Preclassic Izapan art (see Figure 17e), as what is referred to as the down-turning ground motif (Gay 1973), supports an identification with ‘earth’, ‘land’, or ‘ground’.

Figure 18. The outline of the down-turning ground motif in Mayan art and writing.


c. Late Classic T23 na in Dos Pilas Stela 8, dated to 726 CE, and showing down-turning ground motif outline. After drawing by Stephen Houston.

Interestingly, the outline of MS44 na and of the down-turning ground motif of Izapan art corresponds to the top part of the split mountain motif of the Early Classic ‘mountain, hill’ logogram, T529 WITZ, as in Figure 18a and in Mayan pictorial art, and of Figure 18b; this suggests that the down-turning ground motif and the split mountain motif are one and the same. The motif’s association with ‘earth’ and ‘land’, therefore, is made through this split mountain element. Surprising because of its lateness (dating to almost a thousand years after the Izapan down-turning ground motif), an example of T23 na from Dos Pilas Stela 8, dated to 726 CE, reflects its Late Preclassic iconic origin quite clearly, as seen in Figure 18c; it shows the split mountain outline.

b. Palace Tablet at Palenque, glyph I14, read as AJ-5-PYRAMID-T23-NAH, with T23 sign.

c. Tikal Stela 26:yB2, read as u-PYRAMID-T23-3.STONE, and showing T23 sign. After drawing in Jones and Satterthwaite (1982, Fig. 45).

d. Middle Preclassic Olmec-style Ahuelican Greenstone Tablet showing PYRAMID-EARTH/CAVE-3.STONE, with down-turning ground motif in the position where T23 is found in the Tikal Stela 26 example.
glyph on the Middle Preclassic Ahuelican Tablet, shown in Figure 19d, it is evident that the two are the same: PYRAMID-EARTH/CAVE-3.STONE. What is found in between the PYRAMID sign and the 3.STONE sign in the green-stone tablet is the down-turning motif — which, as I have explained, corresponds iconically to MS44 and T23 na. Thus it seems that T23 na is not functioning phonetically in any of the glyphs in Figure 19, but instead, iconically, as EARTH/CAVE, confirming that T23 na did in fact originate in the Izapan down-turning ground motif, and also that its sourceword was Mixe-Zoquean *naas ‘earth, land’. It also suggests that Classic Mayan scribes and artists (e.g. Palenque, Dos Pilas) did not misunderstand the original motivation of T23, almost a millennium later.

![Figure 20](image)

**Figure 20.** A possible context in which T23 na may have been borrowed by Mayans from Epi-Olmecs, as suggested by Stross 1990.


b. Mayan SUN.AT.HORIZON sign, from Tikal Temple 4 Lintel 2:A7. After drawing in Stross (1990, Fig. 10a, 51).

c. Mayan SKY:T23 sign, for CHAN/KAN(-na) sign. After drawing in Stross (1990, Fig. 10b, 51).

Lastly, consider the comparison between the Epi-Olmec SUN.AT.HORIZON sign, shown in Figure 20a; the Mayan SUN.AT.HORIZON sign, shown in Figure 20b; and the typical spelling of the Mayan SKY sign, shown in Figure 20c (made by Stross 1990, Figures 8–10). This is suggestive of the context in which Mayans may have borrowed MS44 na as a phonetic sign. Indeed, MS44 EARTH appears below the Epi-Olmec SKY sign in the SUN.AT.HORIZON sign, just as Mayan T23 na appears below the Mayan SKY sign in the typical logosyllabic spelling SKY(-na). As suggested by Stross, the SKY:EARTH graphic relationship in Epi-Olmec iconography could have led to the Mayan SKY:T23 graphic relationship, read as SKY(-na) (cf. proto-Ch’olan chan ‘sky’ < proto-Mayan *ka’n). The Mayan SUN.AT.HORIZON sign, as in Figure 20b, is read PAS(AJ), and uses T526 EARTH (i.e. KAB’(AN) for proto-Ch’olan *kab’ ‘earth’) with a purely iconic function (i.e. T561 SKY over T544 SUN over T526 EARTH), not an orthographic one (i.e. as KAB’(AN)), instead of T23; this suggests that the
iconic use of T23 was indeed contextually frozen.\footnote{16}

The second type of script diffusion of relevance here is diffusion between Ch'olan and Yukatekan scribes. Some suggestions for this type have been put forward by Fox & Justeson 1984a and by Justeson et al. 1985. One of them is the use of T671, phonetic chi, as the day sign DEER. Justeson et al. (1985:15) suggest, based on the identification of the hand gesture of T671 as a sign for 'food, to eat' by Du Bois 1978, that the sign acquired its phonetic reading chi from proto-Yukatekan *\textit{chi}' 'bite, eat meat' (cf. the proto-Ch'olan cognate *\textit{ti'}). Ch'olans then borrowed the sign as \textit{chi} and used it as a logogram for the day name DEER, proto-Ch'olan *\textit{chij} < pre-Ch'olan *\textit{chihj}. Although this is a plausible argument, more evidence is needed to support it.

\textbf{4.2 Process 6: Internal linguistic change}

A sign may acquire a new reading due to linguistic change. Fox & Justeson (1984a:71) propose T96/103 as an example of this process. Earlier I mentioned that these authors have argued that the phonetic reading \textit{ta} of T96/103 was derived from a logographic reading WAT 'eye'. These authors also suggest that the change of pre-Ch'olan *\textit{wat} > proto-Ch'olan *\textit{wut} may then have provided the basis for polyvalence in Ch'olan usage of the script. However, as the authors themselves admit, there is no evidence for such polyvalence.

Another case can be made for the phonetic reading \textit{ti} of T59, although two iconic motivations have been suggested, one of which would invalidate the possibility that the phonetic reading of T59 is a case of internal linguistic change. First of all, Campbell (1984:11, 13, 14) suggests that T59 depicts a torch, whose linguistic referent may have been based on proto-Mayan *\textit{tyaj} 'pine, torch' (cf. proto-Ch'olan *\textit{täj}). The use of T59 as the generic preposition, reconstructed for proto-Ch'olan as *\textit{tä} (< proto-Mayan *\textit{tya}) would suggest that T59's original phonetic reading may have been \textit{ta}, in order to explain its iconic motivation based on *\textit{täj} 'pine, torch' (Mathews & Justeson 1984:201–2, 227). As John Justeson has pointed out to me (p.c. 2000), Ch'ol and Chontal (Western Ch'olan) and Ch'olti' (Eastern Ch'olan) have *\textit{tä} 'preposition', while Chontal (Western Ch'olan) and Ch'orti' (Eastern Ch'olan) have *\textit{tä} 'preposition' (Kaufman & Norman 1984, Table 2). Thus, \textit{tä} and \textit{ti} may both be reconstructible for proto-Ch'olan. Also, proto-Yukatekan had the cognate *\textit{ti(‘)}). This points to the following alternative scenarios:

\begin{itemize}
  \item a. Proto-Ch'olan inherits proto-Mayan *\textit{tya} as *\textit{tä}, and later innovates *\textit{ti} internally, possibly through assimilation to \textit{t}'s place of articulation.
\end{itemize}
b. Proto-Ch’olan inherits proto-Mayan *tya as *tä ~ *ti (*tya serves as source for both).

c. Proto-Ch’olan inherits proto-Mayan *tya as *tä, and later borrows *ti from Yukatekan *ti(?).

Kaufman & Norman (1984:139) reconstruct the proto-Tzeltalan cognate as *ta with no *ti variant, suggesting that proto-Greater Tzeltalan had *ta only, not *tya or *ta ~ *ti. Scenarios (a)–(b) are more likely. If scenario (a) is correct, then the ti reading of T59 would be a case of Process 6; but if scenario (b) is correct, then it could be a case of Process 5 (if Yukatekan scribes innovated the reading ti for T59, and that reading subsequently became the general phonetic reading for T59), or Process 6 (if Ch’olan speakers borrowed Yukatekan ti, and Ch’olan scribes subsequently innovated the reading ti for T59). In contrast to Campbell’s suggestion, a referee of this paper suggests instead that it could possibly represent “strands of hair above an ear spool.” I think the referee’s suggestion is right on target (cf. spelling of ti in u-ти on vase K5458), and therefore that the case of T59 requires more research.

Figure 21. Example of formal convergence.


c. Use of T124:507 as tzi rather than tzi-tzi on an Early Classic tripod vase from Tikal. After drawing in Culbert (1993, Fig. 19).


4.3 Process 7: Formal convergence

Formal convergence occurs when originally distinct signs become graphically identical and the resulting sign has the readings that the formerly distinct signs had. Lacadena 1996 has described trends in the development of formal convergence between two and sometimes more than two signs. However, a process that may be regarded as convergence may also start out with signs that are quite distinct formally but are related in other ways. This is the case of T124:507 or T507:124, both sign compounds read as a single grapheme with the reading tzi; see Figure 21. Indeed, Nikolai Grube (in Schele et al. 1994:114) has proposed that, in addition to having the same phonetic reading tzi, T507 and T124 also constitute a graphemic unit. Unlike T507, which I have shown to depict a gourd (Figure 12, above) T124 can be read phonetically as tzi and logographically as TZIK (Figure 21a); it depicts the lid of an incense burner (cf. Figure 21b), identical to examples recovered archaeologically at Chiapa de Corzo and Kaminaljuyu according to Lowe (1965, Figure 3b). The phonetic reading tzi of T124 may have been derived acrophonically from its logographic reading TZIK, for proto-Ch’olan *tzik ‘to count’. It is possible that the association between its iconic motivation as the lid of an incense burner and its logographic reading TZIK may have been based through rebus on a term attested today only in Tojolob’al as tzik ‘to burn incense’, cited by Schele et al. (1994:2). If so, the phonetic reading of T124 may be an example of Process 2. But regardless of its acrophonic origin, the fact of interest here is that T124 and T507 could form a graphemic unit tzi despite the fact that both had different iconic motivations (T124 as LID, T507 as GOURD). This fact requires illustration.

An Early Classic tripod vessel from Tikal contains the following glyph T51.124:507, shown in Figure 21c. The same spelling, only ordered differently, is also attested as T51.507:124 on vase K8042. In both cases the glyph precedes the glyph ka-wa for *kākāw ‘chocolate’. Based on its component signs, such spellings could read ta-tzi-tzi, since both T124 and T507 are read tzi. However, based on other examples of this glyph in other texts, Grube has suggested that
the actual reading is supposed to be ta-tzi. Indeed, these spellings are probably equivalent to the more common glyphic phrases ta-tzi (e.g. K5006), ti-tzi-hi (e.g. K1728), and ti-tzi-hi-li (e.g. K4542). As shown by Grube 1990 and MacLeod 1990, this phrase stands for ti tzi(-il) ‘for fresh/raw’, and usually serves as an adjectival modifier to the noun ka-ka-w(a) for *käkäw ‘chocolate’ (i.e. ti tzi(-il) käkäw ‘for fresh chocolate’) among others in the Primary Standard Sequence. Because the Tikal and the K8042 examples are immediately followed by ka-w(a) for *käkäw ‘chocolate’, it seems likely that ti-tzi-tzi + ka-w(a) does in fact spell ti-tzi + ka-w(a), for ti tzi(-il) käkäw ‘for fresh chocolate’. Another text, this time on vase K7727 (Figure 21d) confirms the use of T507:124 as a graphemic unit; in it, T507:124 is used in the spelling yi-ka-T507:124 for y-ihkatz ‘his/her/its cargo’, and so a single reading tzi for T507:124 is necessary. This shows that T124:507 ~ T507:124 was intended in these contexts as a single tzi sign, not as a repeated tzi-tzi sequence. Thus T124 and T507, though iconically unrelated, came to be perceived by scribes as a single grapheme composed of two separate signs because of their identical phonetic readings. This separate iconic relation accounts for the fact that they can be arranged either as T124:507 or as T507:124. Other signs with related iconic origins normally have a fixed arrangement: hence we get T168:518 but not T518:168.

There may be other examples of this type of convergence, such as T44 and T44:563b to/TOK: while T44 likely depicts clouds, and thus may be motivated by the sourceword *tokal ‘cloud’ (Houston et al. 2000), T563b does not seem iconically related to T44. Consequently, if T563b has a reading to by itself, it may have been derived from a different sourceword from that of T44.17

Figure 22. Examples of formal divergence:

c. T82 li from Palace Tablet at Palenque, glyph O10. After drawing by Linda Schele.

4.4 Process 8: Formal Divergence

As suggested by Justeson 1984, 1989, some signs may have developed from minor formal modifications to pre-existing signs, acquiring new readings in the process. For example, T178 la is a rotated version of T533 AJAW, as shown in Figures 22a–b; and T82 li is for the most part identical in internal elements to T568 lu, as shown in Figs. 22c–d). The only difference between the two is that T82 li appears to be a “flattened (affix) version of T568 lu” (Justeson 1989:322). I think that, in addition to being somewhat flattened, T568 is also rotated 90° clockwise with respect to T82; thus this pair is similar to the T178/T533 pair. T82 and T568 are phonetically similar in terms of their consonantal value, l, and both having high vowels, i and u.18

Figure 23. Examples of use of T19(.741) mu as both mu and b’u during Early Classic:

b. T19:568 b’u-lu for *b’u’ul ‘beans’ on cacao pot from Rio Azul. After drawing by David Stuart.
e. Same expression also from Quirigua Monument 26 showing T19 mu/b’u. After drawing in Schele & Looper (1996:66).
Another pair of signs that exhibits a similar relationship is T19(.741) mu and T21(.741) b'u (see Tables 1–2, Figs. 22e–f). The two are only different formally in the presence of circles with cross-hatching in the case of T21, and phonetically in the first consonant, although both are labial consonants and have the same high back vowel u. In fact, in the first half of the Early Classic period there is generally just one sign, T19(.741), found in the same contexts in which T19 and T21 are used in later texts. I think it is likely that T21 was innovated from T19; T19 mu is attested earlier than T21 in contexts that eventually distinguished the two, as in the T563.19 spelling TZ'AK-mu/b'u for tz'ak-b'u 'follow-caus, i.e. cause to follow', later spelled only as T563.21 TZ'AK-b'u, and in a possible example of T19:568 for b'u-lu 'beans' and T1.62:19 for u-yu-mu, both in a pot from Río Azul; see Figures 23a–c. Thus T19 may have had the readings mu and b'u originally, with the minor formal modifications giving rise to T21 b'u. This is supported by the fact that, to my knowledge, T21 is not once used for mu. The earliest examples of divergence may be found at Quirigua, as shown in Figs. 23d–e); there, on Monument 26 (493 CE), one finds both T19 mu and T21 b'u used in the same context (4-TZ'AK-T19-li and 4-TZ'AK-T21-li). Subsequently, the distinction may have spread from Quirigua to other sites, and was probably spread throughout the entire lowlands by ca. 600 CE. It may be worthwhile to trace this development in a future study.

In the case of T82 and T568 the situation is even clearer: T568 lu is attested from the Early Classic onward, as on Yaxchilan Lintel 37 (537 CE), while T82 li is attested from the early part of the Late Classic onward, as on one of the Site Q panels (603 CE). T568 apparently is not attested during the Early Classic in contexts where T82 is attested during the Late Classic (e.g. hu-li(-ya)); so it is not possible, at this time, to suggest that T568 may have originally a dual reading as lu and li.

Another example may be that of T501 b’a and T502 ma, although at present I prefer not to deal with this pair because it represents a more tentative case than the first two. (T502 also resembles half of T74, which also has the reading ma, and thus T502 could be a case of pars pro toto derivation).

5. Discussion

5.1 Process 4 and the spelling of -VC affixes

Mayan syllabic structure generally precludes vowel-initial syllables (i.e. VC), allowing only consonant-initial syllables (i.e. CV(G)C, CV(G)CVC etc.) While
Process 4 makes it seem as though Mayan scribes were extracting V1C2 phonetic sequences out of V1(G)C2 roots, it only seems that way. In actuality the scribes were applying commutativity automatically, converting the V1C2 sequence of a C1V1(G)C2 root into a C1V2 syllabogram during the process of extraction (e.g. UY > yu, AT > ta, CHAHUK > ku). To test whether VC syllabograms did exist, one would have to find a case of T528 ku, for instance, used as uk. Other signs would not be useful for this type of test; e.g., the logographic reading of T62 yu was probably UY, and similarly for T552 AT/ta. Cases of spellings of affixes on logograms, as in the example of T181 ja in the spelling CHOK-ja, may not necessarily point to VC syllabograms, but simply to the likely scribal practice of spelling out in syllables: just as scribes might have thought or said out loud “cho, ka, ja” while spelling cho[h]k-aj or chok-aj, they may have also said “CHOK, ja” where CHOK simply takes the place of “cho, ka”; it is implied that aj was represented with ja. In English orthography, waived is pronounced [wevd] despite the use of the logogram -ed ‘past tense’. The Mayan example discussed is the exact opposite: CHOK-ja represents cho[h]k-aj or chok-aj despite the use of phonetic ja. Mayan scribes may simply have lacked VC syllabograms. Why could commutativity not apply twice, leading to uy from yu, or to at from ta? I think it is possible that commutativity may have been used in that way. However, the fact is that, whenever commutativity can be shown to occur, it abides by the consonant-initial constraint of syllabification: yu and ta are both consonant-initial syllables.

Lounsbury 1973 and Hopkins 1988 have regarded it as possible that there could be a morphophonemic basis in Mayan for the origin of the synharmonic phonetic complementation practice. They suggested that the “echo syllable” process of Mayan languages, whereby the last vowel of a root/word may be repeated in a voiceless manner (i.e. CV1CV1), could account for the synharmonic tendency in CV-CV spellings of CVC roots and CV(G)CVC words (especially when C2 is a glottalized root-final consonant). Another process that has been remarked on by various epigraphers as a potential source of analogy for synharmonic phonetic complementation is that of vowel harmony of certain -VC inflectional and derivational suffixes which occurs in Mayan languages in general, and is widely attested in the Lowland Mayan languages. This process involves cases where a suffix repeats the vowel of the root to which it attaches, as in CV1C-V1C. Perhaps both processes served Mayan scribes as conscious or unconscious models for spelling words.
5.2 Acrophonic derivation and the *pars pro toto* principle

Also of significant importance is the prevalence of the *pars pro toto* iconographic principle in Mayan writing. It not only explains the phonetic values of iconographically related signs, such as T25 and T203 (both phonetic ka) and T168 and T168:518 (both logographic AJAW ‘lord, king’) but it may also explain the convergence of separate signs such as T124 and T507, where both are phonetic tzi, but each has a separate acrophonic origin. T124 and T507 probably became associated as a single graphemic unit T124:507 because of their identical phonetic reading.

Lastly, while in cases like that of T25 and T203 the *pars pro toto* principle led to identical readings for two iconically related signs, in other cases it led to different readings. For example, T51/57 ta and T79 PAT ‘to form’ may represent the same entity: the tail of a centipede. Yet they acquired different phonetic readings, ta and PAT. Perhaps they were at first a single graphically indistinguishable sign with two related readings; with time, it is possible that the different contexts of use of the two readings may have led to a formal graphic distinction (cf. T19 mu/b’u > T19 mu and T21 b’u).

Other ancient scripts exhibit practices similar to those attested in Mayan texts. The Sumerians developed the use of rebus phoneticism quite early. As noted by Green (1989:46–47), the sign ARROW was used to represent TI ‘arrow’ and the homophonous word TI ‘life’, but also the syllable ti. Keightley (1989:188–89) explains that early Chinese writing used the acrophonic principle and rebus phoneticism extensively. A graph depicting a weed or plant was used for *l6g ‘to come’, based on *l6g ‘to grow grain’. A graph depicting a cauldron, *tieng, was used for ‘cauldron’, ‘to divine’, ‘to regulate’, and ‘then’, which had the same pronunciation. Semantic classifiers were soon developed in Chinese to distinguish words with the same pronunciation. These examples are akin to the example of K’AB’ ‘arm, hand’ for K’AB’A’ ‘name’ mentioned in §2.4, above.

Other scripts show parallels to Processes 1–3 above, where phonetic reduction was involved in the acrophonic process. Egyptian hieroglyphic writing first used MOUTH to represent r or rʰ ‘mouth’; and only subsequently did it develop the use of MOUTH to represent any r plus vowel sequence, if a vowel was necessary (Healey 1990:210). The users of the first alphabetic system, Proto-Sinaitic or Proto-Canaanite, also developed sign readings acrophonically. In essence, each sign was given the phonetic value of the first sound of the word for the sign’s iconic referent. In this way, the sign HOUSE was read b based on
bētu 'house', HOOK/PEG was read w based on wawwu 'hook/peg', WAVE/WATER was read m based on mayyūma 'water', SNAKE was read n based on naḥašu 'snake', and so forth (Healey 1990:211–12). These strategies in Egyptian hieroglyphic writing and Proto-Sinaitic are analogous to Processes 1–3 above. But to my knowledge no other script has been proposed to exhibit a process similar or analogous to Process 4.

5.3 Sign origins and linguistic affiliations

As has been observed by several authors before, establishing the acrophonic origin of the reading of a sign does not always lead to a narrow linguistic identification of its inventors. T1 (’)u could have been developed by a scribe from any Mayan language that retains proto-Mayan *u’h ‘bead’ (cf. proto-Ch’olan *uh). However, T62 yu could only have been developed based on proto-Ch’olan *uhy, an innovated variant of *uh (< proto-Mayan *u’h).

Also, if I am correct about the origin of T590 cho from a Greater Tzeltalan descendant of proto-Mayan *köoh ‘tooth (molar)’, then only a Greater Tzeltalan speaker could have innovated the reading, since they retained proto-Mayan *köoh as *chioh > *choh.19 However, T708 CLENCHED.TEETH, read as ko, most likely developed from *köoh either before the Greater Tzeltalan k > ch shift, or subsequently on the basis of proto-Yukatekan, which retained proto-Mayan *köoh as *kọoh ‘fang (of snake)’ (Bricker et al. 1998:131).

In some cases, such as T25/203 ka, a plausible explanation is that Yukatekan speakers innovated the reading based on *kay ‘fish’; yet a proto-Western Mayan or pre-Greater Tzeltalan descendant of proto-Mayan *kar ‘fish’, prior to the Greater Tzeltalan k(’) > ch(’) shift that led to *kay > *chay, could be the source. Besides T25/203 ka and T77/236 k’i, only the T708 ko, can be explained in terms of a Yukatekan origin on phonological grounds — although again, the k(’) in these cases is a retention from proto-Mayan, so a pre-Greater Tzeltalan stage cannot be ruled out.

Several sign readings, in contrast, can be explained exclusively in terms of Ch’olan or Greater Tzeltalan lexical and phonological innovations, supporting the theory of a Greater Tzeltalan or Ch’olan origin of the Mayan script (Justeson et al. 1985, Justeson & Fox 1989). In Tables 1–4 I have attempted to provide a likely linguistic affiliation for the innovators of a reading whenever possible; in the majority of cases, however, one can only say that the innovator was a Mayan speaker.
6. Conclusions

The multiple processes for acrophonic derivation of sign readings in the Mayan tradition offer an interesting comparative case to students of other scripts. Processes 1–3 have clear counterparts in other scripts. The Mayan cases only strengthen previous hypothesis for the process of acrophony. And interestingly, Process 4, if confirmed with future research, would constitute a so far unique case in the world.

This paper, also, can serve to warn epigraphers about attempting to use iconic motivation for decipherment purposes: simply recognizing the iconic motivation of a sign may not necessarily lead to a plausible reading. Still, recognizing the various types of processes for acrophonic derivation may allow epigraphers to apply stricter controls if and when they do use iconic motivation as evidence for a phonetic reading.

Lastly, this paper deals with the issue of the presence of VC phonetic signs that could have been used to spell -VC affixes. Process 4, which allows for the acrophonic derivation of C₂V₁ signs from C₁V₁(G)C₂ roots, could potentially provide a basis for a process of commutativity that could lead to VC phonetic signs. However, as I have shown, the few cases that provide strong support for this process abide by the phonological constraint of consonant-initial syllables followed in Mayan languages in general. While I do not think it impossible that Mayan scribes may have applied an orthographic rule which in a sense contradicted an unconscious phonological rule, the fact is that the known cases for Process 4 do not attest to this yet. So the question remains open as to whether commutativity could in fact lead to -VC affixes.

Notes

* I am grateful to John Justeson for his comments on an early draft of this paper, and also to Lachlan Duncan for his discussion of T918 in a seminar on Mesoamerican scripts; his suggestion that T918 might be logographic TZIMAH ‘gourd’ helped me determine the acrophonic origin of T507 tzi based on tzimah ‘gourd’. Thanks go also to Marc Zender, who sent me several comments via email. I appreciate the input from three anonymous referees of this paper; their corrections and observations have been very useful during the revision process, and I have made every attempt possible to incorporate their feedback.

1. I follow the transcription conventions of Thompson (1962:32–33), which require the use of the numerical labels from his Catalog, indicated by a preceding “T” to transcribe individual glyphs, glyphic phrases, and entire texts. Thompson’s catalog has been updated in Ringle
The origin of Mayan syllabograms and orthographic conventions

& Smith-Stark (1996:333), whose revisions I reference several times in this paper. I refer readers to these works for signs not illustrated in this paper. The numerical labels for Epi-Olmec glyphs are from Macri & Stark 1993. I also follow the transliteration conventions by Fox & Justeson 1984 and by G. Stuart 1988. The most important ones for this paper are that logograms are transliterated with capital boldface letters (e.g. Mayan T544 K’IN ‘sun, day’), and syllabograms with small case boldface letters (e.g. Mayan T25 ka). I use the following linguistic abbreviations: 1 = first person marker, 2 = second person marker, 3 = third person marker; abs = absolutive marker, C = consonant, cmp = completive, encl = enclitic, erg = ergative marker, G = glide (/h y w/ and vowel length), inc = incompletive, ivzr = intransitivizer, mPASS = mediopassive, pass = passive, prep = preposition, procl = proclitic, s = singular, trvzr = transitivizer, V = vowel. I use square brackets [ ] to set off infixes, and angled brackets < > to set off linguistic forms cited from a manuscript using conventional orthography. I use ch for IPA [tʃ], j for IPA [χ], x for IPA [ʃ], b’ for IPA [b], and tz for IPA [ts]. Finally, all proto-Chol and proto-Mayan reconstructions cited in this paper are from Kaufman & Norman 1984. Proto-Mayan reconstructions are useful because proto-Ch’olan, proto-Tzeltalan, and proto-Yukatekan forms can usually be arrived at from a proto-Mayan form (cf. Kaufman 1976, Kaufman & Norman 1984, Justeson et al. 1985:15), and because recent debates on the historical stage of the language represented in the script makes it relevant to keep in mind the various phonological changes that took place from proto-Mayan to proto-Ch’olan times. Any proto-Yukatekan reconstructions are based on Yukatekan phonological changes summarized by Justeson et al. (1985:15). In the conventional transcription of Chinese, I use IPA ŋ for shwa, whereas for proto-Ch’olan reconstructions I use ą for shwa.

2. The Lowland Mayan script was used in what is now Mexico, Guatemala, Belize, and Honduras. The periods of its use are named and characterized as follows: Late Preclassic (400 BCE–200 CE), Early Classic (200–600 CE), Late Classic (600–900 CE), and Postclassic (900–1700 CE).

3. In a paper currently under revision (Mora-Marín 2002), I have recently proposed that many of the morphological traits characteristic of Classic Lowland Mayan texts have not been preserved in any of the modern Ch’olan languages, whether Western Ch’olan or Eastern Ch’olan (e.g. -is ~ -as and -is ~ -as ‘uncertain possession markers’), while some appear in one branch or the other, but not both (e.g. hin- ‘3sg.’ in Western Ch’olan, -b’u ‘causativizer of positionals’ in Eastern Ch’olan), and thus could be either innovations of each branch or retentions from proto-Ch’olan that were preserved differentially between the branches. Such a pattern of preservation suggests, if one follows a least-moves approach, that Classic texts are based on a language that preceded the breakup of Ch’olan into its Eastern and Western branches.

4. Diacritics and semantic determiners play no role in the present paper.

5. Portable texts on pottery, for example, sometimes exhibit a different tendency: glyph blocks exhibit less regard in demarcating syntactic units, and sometimes are occupied by single phonetic signs. Interestingly, a similar disregard for demarcating syntactic units by glyph block divisions is often visible in Late Classic texts in the northern Yukatekan, e.g. at Xcambucun and Chichen Itza, as pointed out by Justeson 1989. I think that these late northern texts reflect the portable pottery text tradition in terms of orthographic conventions.
and subject matter; as Schele & Freidel 1990 have pointed out, these northern texts characteristically consist of dedicatory statements, just like pottery texts.

6. In certain positions, such as preconsonantal and root-final, any of these segments could be equated to zero (Campbell 1984:12–13, 16; Fox & Justeson 1984a:69; Justeson 1989:30).

7. A referee also points out that Houston et al. 2000 actually read T44(:563b) as to/TOK.

8. Macri 2000 has suggested that T24 li could have been derived from "litz’ ‘shine’, given that all forms of T24, whether as the hook-shaped form or the cartouche-shaped form, show diagonal bands which mark the object represented by the sign as made of a polished material.

9. The referee also suggests that T528 ku, which depicts a stone, may have been derived from a term like -kul' ‘numeral classifier for round objects’ attested in modern Itzaj (Hofling & Tesucún 1997:366). Below I discuss the T528 ku example as derived through Process 4, which is more likely in my opinion, since such a process directly associates the phonetic reading ku with the logographic reading CHAHUK.

10. One of the referees of the paper has expressed a strong reservation toward this example; the referee disagrees with the suggestion that the apparent b’a reading was based on *b’ak ‘bone’. The referee notes that this is a “highly idiosyncratic” use of JAWLESS.SKULL, and adds that “the reason for its b’a usage remains obscure.” Nevertheless, based on the logographic reading B’AK for the JAWLESS.SKULL sign, a phonetic reading b’a can be easily explained through Process 2.

11. The spelling cha-hu-ku is actually attested on Piedras Negras Throne 1. It suggests that some logograms for the Rain God were intended as CHAHUK instead of CHAK for chahk, and it supports the hypothesis by Closs that the purely phonetic reading ku was derived from the logographic reading CHAHUK.

12. David Stuart and Stephen Houston have drawn attention as well (in D. Stuart 2002) to an example of the common Piedras Negras title K’IN-AJAW spelled as T77-K’IN-ni-AJAW, i.e. (k’i-)K’IN(-ni)-AJAW in one case at Piedras Negras.

13. There is a likely case of T79 as pat rather than PAT, i.e. of T79 being used purely phonetically, on Yaxchilan Lintel 37:A5a, where it is part of the spelling of a person’s name. This is suggested by the fact that the glyph that follows is u-ya-AJAW-TE’, a glyph that normally intervenes between two named individuals — one a subordinate lord and the other an overlord.

14. One of the anonymous referees of this paper states: “Several scholars have identified [T568] as a catfish (dorsal fin and big head with open mouth) from Yukatekan lu’ ‘catfish’ (e.g. Hofling & Tesucún 1997:425).” The referee is also correct in stating that, if T568 were in fact derived from lu’ ‘catfish’, it would not involve anything but Process 1. I do not know the iconographic evidence behind the CATFISH identification for T568, nor does the referee mention the sources for such evidence. Nevertheless, I think the HEART identification is secure based on the examples from Xcalumkin.

15. A referee of this paper does not agree with the transfer of Epi-Olmec MS44 na to Mayan. He states that the “equivalence hinges on a purported occurrence of the Maya ‘rising sun’ sign in the inscription of the La Mojarra stela,” which he regards as “highly dubious.” While Stross’s original argument may have hinged in part on the ‘rising sun’ sign, my examples do not, and they are sufficient to demonstrate the formal and semantic association. I do think
that the SKY.OVER.EARTH glyph — common to both, though slightly different in the two script traditions — could have offered a graphic textual context for the diffusion process.

16. The term pas-aj may be related to the Ch’ol verb pas-el ‘salir (el sol)’ (Aulie & Aulie 1978:92).

17. I do not know whether T563b in fact has a reading to by itself, or if so, what its iconic referent and sourceword would be. T44:563b may function more like T168:518 AJAW, since T518 is not known to have a reading AJAW on its own, but is always used with T168 if that is present.

18. It is harder to find a phonetic relationship or similarity between T533 AJAW and T178 la, although there is evidence (cf. Mora-Marín 2002) that some signs that had the logographic reading AJAW (e.g. T168:518 and T533) were actually logographic AJAW or AJAWAL; if so, then T178 may have been derived through the process of phonetic complementation or commutativity: AJAWAL(-la).

19. Tojolobal has choh-tik (Fox 1978:120). Thus it is possible to say that Tojolobal could have been the source for the sign reading in question. However, this is very unlikely, given abundant evidence for Lowland Mayan (Ch’olan, Yukatekan) scribes as the only Mayan speakers known to have used hieroglyphic script.

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