The Codex

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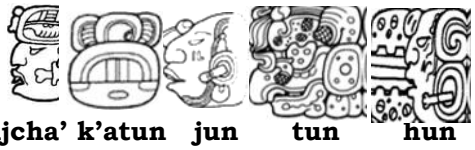
Welcome to the 
lajcha' k'atun jun tun hun
"32 – year book" of ***The Codex.***

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Now in its 32nd year, ***The Codex*** continues to publish materials of substance in the world of Pre-Columbian and Mesoamerican studies. We continue that tradition in this issue.

We apologize for the later than usual appearance of this issue of ***The Codex.*** Although the Covid pandemic has eased, the disease is still with us, and both the editor and one of the authors were struck with stubborn cases of it resulting in an unavoidable delay. However, we persevered, and have produced an issue that is up to our usual standards.

Olga Stavrakis and Cedric Puleston share more pages from Dennis Puleston's journal of his summer at Tikal in 1963, once again showing behind the scenes details of life at a pioneering archaeological project. William Haviland brings us up-to-date on some particulars in part 2 of Dennis Puleston's Summer 1963 journal.

David Mora-Marín's bout of Covid prevented him from working on the 3nd part of his discussion and analysis of the Initial Sign Collocation (ISC). However, he had another paper in process on CVC phonograms in the Maya script, and we are very grateful that he offered to submit it for this issue.

And, Lady Sharp Tongue reports on a royal mystery at Piedras Negras.

Although ***The Codex*** has become a publication of substance in the world of Pre-Columbian and Mesoamerican studies, we do not plan to rest on our laurels. We welcome suggestions for new features and ideas for future issues that will build on our success.

THE CODEX
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The Codex is a publication of the Pre-Columbian Society at the University of Pennsylvania Museum of Archaeology and Anthropology. Each volume of ***The Codex*** consists of 3 issues: October, February, and June.

Subscription/Pre-Columbian Society Membership information can be found on the last page of this issue.

We are proud of our tradition of publishing original papers in ***The Codex*** and are now soliciting contributions for future issues. Manuscripts should be no longer than 15 pages, single-spaced, including illustrations, and may be submitted on CD, on flash/thumb drive, or by e-mail. We welcome submissions on all aspects of Pre-Columbian studies and American studies as they pertain to Native American cultures. Please address all communications regarding ***The Codex*** to:

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ANNOUNCEMENTS:
UPCOMING MEETINGS

Due to the ongoing Covid-19 pandemic, many upcoming meetings and conferences have either been cancelled or moved to virtual, online platforms, or are having in person meetings with COVID safety measures in place To that end, we've listed the most recent information (as of press time) on upcoming meetings, but urge that one check the websites for any updates.

30th Annual Symposium, Pre-Columbian Society of Washington, D.C.: The Rocks Speak: New Insights into Indigenous North American Rock Art, A one-day in-person symposium, September 21, 2024. U.S. Navy Memorial & Naval Heritage Center, Washington, DC. For further information, see the website: http://www.pcswdc.org/

Dumbarton Oaks Pre-Columbian Studies Symposium: Moche Media: Making Meaning across Materials and Communities on the North Coast of Peru, Oct 4, 2024 - Oct 5, 2024. Dumbarton Oaks, 1703 32nd Street, NW, Washington, DC 20007. For further information, see the website: https://www.doaks.org/research/pre-columbian

29th European Maya Conference: "Colour In Mesoamerica," October 7th to 13th 2024. Perugia, Italy. This year's conference is organized by *Wayeb* – the European Association of Mayanists – in cooperation with the *Centro Studi Americanistici "Circolo Amerindiano"* – in Perugia, Italy. For further information, see the website: https://www.wayeb.org

123rd Annual Meeting, American Anthropological Association, November 20-23, 2004. Tampa Convention Center, Tampa, FL. The 2024 AAA Annual Meeting theme is "Praxis: The Application/s of Anthropology in the Present and the Future." For further information, see the website: https://annualmeeting.americananthro.org/

2025 Joint Annual Meeting of the Archaeological Institute of America (AIA) and the Society for Classical Studies (SCS): Theme is "Archaeology and the Environment," January 2–5, 2025. The Philadelphia Marriott Downtown, Philadelphia, PA. The detailed structure and format of the conference, along with registration categories and rates, are still under consideration.. For further information, see the website: https://www.archaeological.org/programs/professionals/annual-meeting/

EXHIBITIONS:

Ancient Andean Textiles, December 7, 2023-December 8, 2024. Cleveland Museum of Art. Between about 3000 BCE and the early 1500s CE, ancient Andean weavers created one of the world's most distinguished textile traditions. Within this time span, the most impressive group of early textiles to survive was made by the Paracas people of Peru's south coast. For further information, see the website: https://www.clevelandart.org/exhibitions/ancient-andean-textiles-1

A Selection of Mexican Ex-Votos, April 12 - October 18, 2024. University of Pennsylvania Holman Biotech Commons (Main level). Gain insight into Mexican religious folk practices through these selections from the Dr. William H. Helfand collection. Ex-votos are votive paintings usually hung in churches and religious venues as a sign of gratitude for received blessings or healings. The William H. Helfand collection is part of the University of Pennsylvania Library's Kislak Center for Special Collections, Rare Books and Manuscripts. For further information, see the website: https://www.library.upenn.edu/events/selection-mexican-ex-votos

SOME OBSERVATIONS ON THE HISTORICAL DEVELOPMENT OF CVC PHONOGRAMS IN MAYAN WRITING

by
David Mora-Marín
UNC-Chapel Hill

Introduction

Epigraphers have long been aware of a number of graphemes which can be argued to be logographic in nature and which can also be used exclusively for their basic CVC value via rebus phoneticism (Justeson 1989:30). The functions of some of these, though, and their historical development, have not been carefully considered in the literature.

Typically, logograms represent lexemes, as in the case of PY3 **K'AYOM** for *kay-om* 'singer' (**Figure 1a**), a single grapheme that represents a root plus a derivational suffix, or T544/XQ3 **K'IN** for *k'in* 'day; sun' (**Figure 1b**), but which in some cases was likely meant to be read **K'INIL** for *k'in-il* 'time' (or 'of the day'), or as **K'INICH** for *k'iin-ich* 'radiant/sun=face (name of Sun God)'.[1]

Figure 1. Typical examples of logograms.

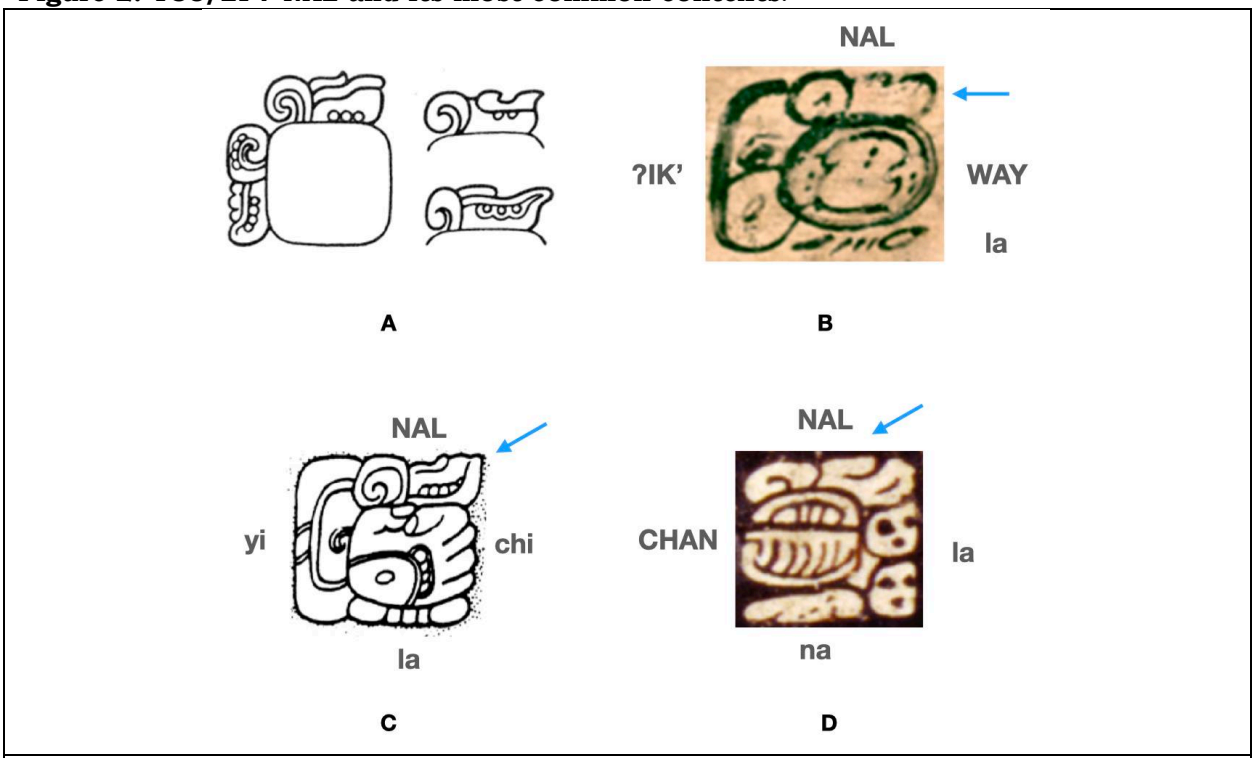
a) PY3 **K'AYOM**. Example from the conch shell trumpet at the Chrysler Museum of Art accession #86.457. Drawing by the author in Mora-Marín (2020). b) T544/XQ3 **K'IN**. Catalog exemplar from Looper and Macri (1991–2024).

Some logograms, though, are used for their CVC values in sequences that cannot be easily glossed as a morpheme (a unit of form and meaning or function), or a lexeme (an abstract set of lexical items based on the same root or stem via derivations and inflections). For instance, T86(:647)/ZF7 **NAL** (**Figure 2a**), can be defined as an iconic logogram based on proto-Ch'olan *näl 'maize ear' (from proto-Mayan *ŋal 'ear of maize'). Nevertheless, in the vast majority of instances, ZF7 **NAL** was not employed to represent the root for 'ear of maize'. Most frequently, it was used in the following

[1] Bold uppercase letters are used to transliterate logograms, bold lowercase letters for syllabograms. Catalog numbers are cited first from Thompson (1962) and second from Looper and Macri (1991–2024). Ch'olan lexemes and morphemes are cited following proto-Ch'olan reconstructions by Kaufman and Norman (1984), and when necessary, other Mayan data are cited from Kaufman with Justeson (2003).

situations: 1) to spell *-na(h)l* '(of a) place' to derive toponyms (**Figure 2b**); 2) the sequence /nal/ in the expression *y-ich-(V)n-al*, where the grapheme represents a sequence divided by a morpheme boundary (**Figure 2c**); and 3) the sequence /nal/ in the expression *chan-al* 'heavenly/skyly' (**Figure 2d**), where it also represents parts of two morphemes.[2] In the second and third cases, especially, where ZF7 **NAL** represents a phonographic sequence divided by a morpheme boundary (i.e. /…n-al/), it would be challenging to conceive of ZF7 as having a logographic value or function: in the case of the *y-ich-Vn-al* expression, ZF7 would represent two grammatical morphemes (indeed, only part of the suffix *-Vn*, and the entirety of *-al*); in the case of the *chan-al* expression, ZF7 would represent the final consonant of the root *chan* 'sky', and the entirety of the *-al* 'adjectivizer' suffix. It seems unlikely that scribes would have considered ZF7 **NAL** in such situations as logograms, and more likely that they were using them exclusively for their phonographic value, like a CVC syllabogram.

Figure 2. T86/ZF7 NAL and its most common contexts.



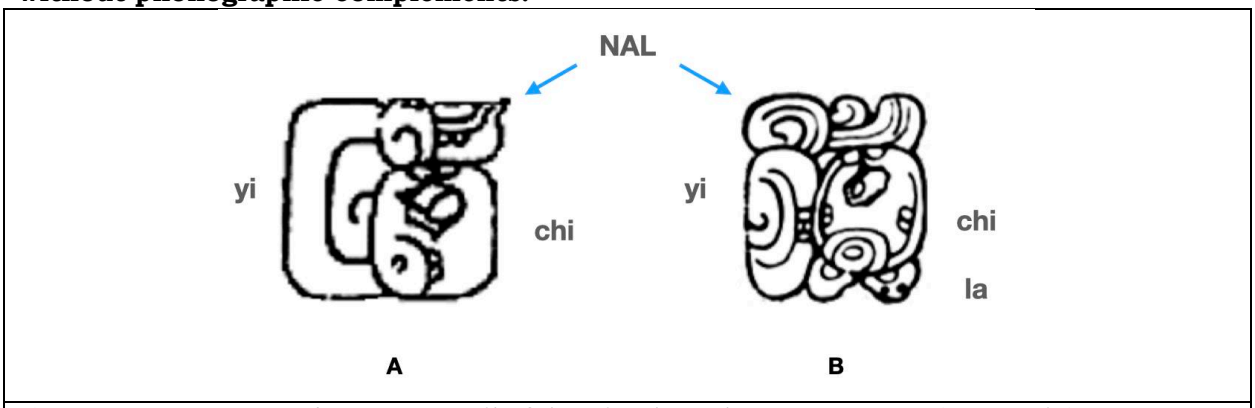
a) Various versions of ZF7 **NAL** from Thompson (1962). b) COLK1609:Fbl, **?IK'-WAY-NAL(-la)** 'his/her burial/grave (place)'. Detail of photograph by Justin Kerr. c) PALPT:H14, **yi-chi-NAL(-la)**. Drawing by Linda Schele, Copyright David Schele (SD-121, SD-124). Photo courtesy Ancient Americas at LACMA (ancientamericas.org). d) COLK2796:Q03, **CHAN-(na-)NAL(-la)**. Detail of photograph by Justin Kerr.

And yet, as Gronemeyer (2014:331–332, Fig. 70) has correctly observed, graphemes like ZF7 **NAL**, and others that perform similar functions, *do* behave like logograms in one important way: they may take regular CV syllabograms as phonographic

[2] Starting with Figure 2, references to inscriptions are made by means of the abbreviation codes employed in the MHD (Looper and Macri 1991–2024). Thus, Figure 2a corresponds to a glyph block from COLK1609. Simply go to mayadatabase.org, select Classic Blocks in the dropdown menu, enter COLK1609 in the objabbr query cell, click select, and you will obtain the information for this inscription, including a bibliography on it.

complements. Indeed, spellings of the *y-ich-Vn-al* 'in front of him/her' expression include, among other possibilities, sequences like **yi-chi-NAL** (**Figure 3a**), with no complementation, or **yi-chi-NAL(-la)** (**Figure 3b**), with complementation as well.[3] This is the behavior expected of a logogram, not a syllabogram. Still, as already observed, ZF7 is representing here part of two grammatical morphemes (i.e. /-Vn-al/), and therefore, arguing for a logographic value would be a bit of a stretch. This is therefore an interesting problem deserving of a closer look—hence the present paper.

Figure 3. Uses of ZF7 NAL in the *y-ich-(V)n-al* 'in his/her presence' expression, with and without phonographic complements.



a) CAYLnt01:C16, **yi-chi-NAL**. Detail of drawing by John Montgomery (JM01150) at http://research.famsi.org/montgomery.html. b) CPNSt07:D09, **yi-chi-NAL(-la)**. Drawing by Linda Schele, Mark Van Stone and David Stuart, Copyright David Schele (SD-1031). Photo courtesy Ancient Americas at LACMA (ancientamericas.org).

Next, I provide an overview of some of the graphemes that behave in the manner described here. Then, I present the basic traits of two cases: T150/2SA, with a logographic value **TAJ** for *taj* 'pine; torch', and T86(:647)/ZF7, with the logographic value **NAL** for *näl* 'ear of maize'. Following this, I carry out a few basic statistical tests of datasets prepared using the Maya Hieroglyphic Database by Looper and Macri (1991–2024) to examine their patterns of use across time and space, and in connection with other factors. Finally, I offer some conclusions and ideas for future research.

More Examples

Multiple examples of this type of grapheme—logograms whose basic CVC values are exploited for phonographic functions—have been treated in the literature. Previously, I have *briefly* mentioned or discussed the possibility of such CVC syllabograms in Mayan writing (Mora-Marín 2000:42, 2001:73, 2003:198, 2012:8–9), as has Justeson

[3] There appears to be only one example of a fully phonographic spelling of the expression *y-ich-n-al* 'in his/her presence', found on the Simojovel Shell inscription (COLSJPL), spelled **yi-chi-na-la**.

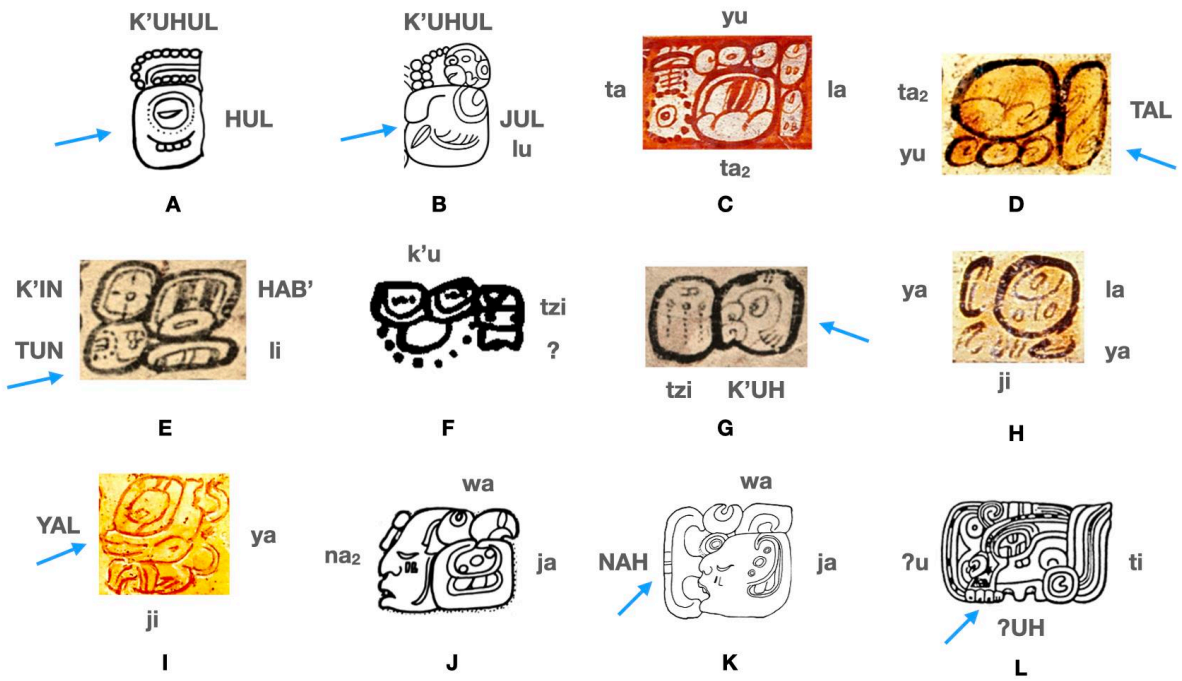
(2012:836), in his discussion of Mesoamerican writing systems, focusing on the presence of CVC syllabograms in Epi-Olmec and Mayan.[4]

Most of the time, such graphemes are transliterated as logograms, and otherwise left untreated as far as their graphemic nature. This is the approach seen in Lacadena and Davletshin (2013:12) and Kettunen and Helmke (2020:110), in their transliteration of the **HUL** 'to arrive' and **JUL** 'to pierce' logograms used as phonographic complements to **K'UHUL** 'holy' (cf. Grube 2004:80) as **K'UHUL-HUL** (**Figure 4a**) and **K'UHUL-JUL** (**Figure 4b**), the latter spelling adduced by that author to draw attention to evidence of scribes' representation of the Ch'olan *h/*j > /j/ merger. Several additional examples are illustrated in **Figure 4**. For example, the expression **ta-yu-ta-la** (**Figure 4c**) of great frequency on pottery vessel texts, can also be spelled **ta-yu-TAL/tal (Figure 4d)** with T676/YS5 **TAL**, a grapheme that most frequently functions to spell a suffix (either an abstractivizer or numerical classifier) of the general shape *-tal* or *-t-al* in ordinal expressions. Next is the expression **K'IN-TUN/tun-HAB'-li** (**Figure 4e**) for Yucatec(an) *k'iin-t-un y-aʔb'-il* (i.e. <kintun yaabil>) 'drought' (Fox and Justeson 1984:52-53), where T528/ZC1 **TUN** for *tun* 'stone' is employed to represent two suffixes, *-t-un*. In the codices, the Greater Lowland Mayan term *k'uhtz* 'tobacco' is attested both as **k'u-tzi-ʔli** (**Figure 4f**) and **tzi-K'UH/k'uh** (**Figure 4g**). Another well-known case is the child-of-mother logogram, MA2, whose basic value is likely **YAL** for *y-al* 'her child/offspring', and which could be employed as an alternative to **ya-la-ji-ya** (**Figure 4h**), rendering **YAL/yal-ji-ya** (**Figure 4i**), to represent *y-al-aj-Ø-iy* 's/he had said it (earlier)'. We can also compare cases like **na-wa-ja** (**Figure 4j**) and **NAH/nah-wa-ja** (**Figure 4k**), to represent *na[h]w-aj-Ø-Ø* 's/he/it was adorned', with **NAH** employed in the second instance to spell part of the lexical root *naw* 'to adorn', and part of the passivizer morpheme *-h-…-aj*. In fact, the final example, **ʔu-ʔUH/ʔuh-ti** (**Figure 4l**) for *ʔu[h]t-i-Ø-Ø* 'it got finished; it happened', employs the grapheme T[520:]846/SJ2/SJ3 **ʔUH** also as a means for representing part of a lexical root, *ʔut* 'to finish', and a mediopassive morpheme *-h-*.[5]

[4] Mora-Marín (2001:73) stated: "Syllabographs (or syllabic or phonetic signs) are signs with phonetic values only. They spell CV (e.g., T1 **7u**, T25 **ka**, T501 **b'a**) or CVC (e.g., T4 **nah**, T86 **nal**, T528 **tun**, T79 **pat**) sequences […]." Mora-Marín (2012:8–9, footnote 9) suggested mentioned several examples, and in fact, proposed that T521 **WINIK/WINAK** may also function as a CVC syllabogram with the shape **WIN/win**.

[5] Although SJ2/SJ3 **ʔUH** is provided a basic gloss based on *ʔuh 'necklace' in the MHD (Looper and Macri 1991–2024), the fact is that this grapheme is used most often to spell *ʔu[h]t-i-Ø-Ø* 'it got finished; it happened', with only about 6% of examples involving the term for 'necklace'.

Figure 4. Additional examples of uses of CVC graphemes.



a) SBLSt08:A04, **K'UHUL(-hul)** for *k'uh-ul* 'holy' reflecting situation prior to *h/*j > /j/ merger. Drawing by the author after drawing by Ian Graham in Graham (1996:27). b) CPNStH:B01, **K'UJUL(-jul)** for *k'uj-ul* 'holy', reflecting *h/*j > /j/ merger. Drawing by Dana Moot II. c) COLK1837:F, **ta-yu-ta-la**. Detail from photo by Justin Kerr. d) COLK0791:H, **ta-yu-TAL/tal**. Detail from photo by Justin Kerr. e) Dresden 72c03, **K'IN-TUN-HAB'-li** for Yucatec(an) *k'iin-t-un y-aʔb'-il* (i.e. <kintun yaabil>) 'drought'. f) Madrid 096b04, **k'u-tz'i-ʔli** for Greater Lowland Mayan *k'uhtz* 'tobacco' (Ch'olan, Yucatecan, Chuj, Q'anjob'al, Huastec). Drawing by Carlos Villacorta in Villacorta and Villacorta (1930). g) Dresden 15a02, **K'UH-tz'i** for Greater Lowland Mayan *k'uhtz* 'tobacco' (Ch'olan, Yucatecan, Chuj, Q'anjob'al, Huastec). h) COLK0793:F05, **ya-la-ji-ya** for *y-äl-aj-Ø-iy* 'he had said it (earlier)'. Detail of photograph by Justin Kerr. i) COLK8076:O01, **YAL-ji-ya** for *y-al-aj-Ø-iy* 'he had said it (earlier)'. Detail of photograph by Justin Kerr. j) PALSCR:Ap03, **na-wa-j(a)** for na[h]w-aj 's/he/it was adorned'. Drawing by Linda Schele, Copyright David Schele (SD-146). Photo courtesy Ancient Americas at LACMA (ancientamericas.org). k) PALT18S:446, **NAH-wa-j(a)** for *na[h]w-aj* 's/he/it was adorned'. Drawing by Linda Schele (No. 489). http://research.famsi.org/schele.html. l) TIKSt39:zB07, **ʔu-ʔUH/ʔuh-ti** for *ʔu[h]t-i-Ø-Ø* 'it got finished; it happened'. Drawing from Laporte and Fialko (1995:Fig. 47).

Gronemeyer (2014), who has discussed this type of grapheme in more detail than any previous author, considers them to be *morphographs* (*morphograms*), the term he utilizes instead of *logogram*. Although this term is commonly used in the writing systems literature to refer to graphemes that represent morphemes, Gronemeyer uses it more flexibly, referring to a grapheme that "denotes in a sometimes ideographic manner a lexeme and a phoneme string of the structure **CVC** (and the 'vowel initial' **ʔVC**), but also lexicalised derivations of the form **CVCVC**. In some cases, morphographs also spell bound morphemes of the structure **CVC**" (2014:8).[6] What

[6] Since *logogram* is supposed to refer to a grapheme that represents a word, it is potentially problematic, as it could imply that such a grapheme would represent a specific word, in every instance, which is clearly not how Mayan logograms functioned. Instead, as indicated in Gronemeyer's definition of *morphograph*, the Mayan graphemes in

matters is this: how were otherwise "logographic" or "morphographic" graphemes classified by scribes in contexts where they were being used for their phonographic value alone?

Gronemeyer (2014:8, 331) offers two criteria for the problem at hand. He notes that graphemes (his "morphographs") functioning in the manner of relevance here typically: 1) represent a CVC sequence; and 2) they *may* take phonographic complements or determiners (phonetic indicators, phonetic complements).

A diagnostic of the first criterion, that such uses are purely phonographic, is Gronemeyer's (2014: 9, footnote 15) observation that "There are occasions where a morphograph overspells one or more (grammatical) morphemes," such as **K'UHUL-HUL** and **K'UHUL-JUL** (**Figures 4a–b**) for *k'uh-ul ~ k'uj-ul*, where the **HUL** grapheme points to both the final /h/ of the root *k'uh* 'god' and the suffix *-ul* 'adjectivizer'; **K'IN-TUN-HAB'-li** (**Figure 4e**) for Yucatec(an) *k'iin-t-un y-aʔb'-il* (i.e. <kintun yaabil>) 'drought', where **TUN** spells the sequence of two morphemes *-t-un*; **YAL-ji-ya** (**Figure 4i**) for *y-al-aj-Ø-iy* 's/he had said it (earlier)', where **YAL** represents the sequence *y-al…* consisting of the third person singular ergative pronominal *y-* and the root *(ʔ)al* 'to say'; and of course, **NAH-wa-ja** (**Figure 4k**) for *na[h]w-aj-Ø-Ø* 's/he was adorned', where **NAH** spells part of the root *naw* 'to adorn' and part of the grammatical morpheme *-h-…-aj* 'passivizer'. This is indeed an important diagnostic because it is very difficult to imagine that graphemes functioning in this manner, representing two morphemes, or parts of two morphemes, one of them lexical and one of them grammatical (e.g. the sequence /hul/ in *k'uh-ul*), or both of them grammatical (e.g. /tun/ in *-t-un* of *k'iin-t-un*), would have been categorized lexically, like morphograms/logograms/lexograms. Instead, their function seems to be completely phonographic, like that of syllabograms; because of this, a more adequate transliteration of **K'UHUL-HUL** would be **K'UHUL(-hul)** (or **K'UHUL^{hul}** following Gronemeyer's practice), to offer one example.

Another interesting observation by Gronemeyer (2014:9, 58) is the fact that several of the examples appear to have been intended to spell phonemes in contexts where they normally would not be spelled by means of CV syllabograms, alluding more specifically to preconsonantal /h/. This is seen in the 'tobacco' example above (**Figure 4g**), **K'UH-tzi** for *k'uhtz*, as well as cases where the preconsonantal /h/ was part of a grammatical morpheme, specifically *-h-….-aj* 'passivizer', as in **NAH-wa-ja** for *na[h]w-aj-Ø-Ø* 's/he was adorned' (**Figure 4k**), or *-h-* 'mediopassivizer', as in **ʔUH-ti** for *ʔu[h]t-i-Ø* 'it got finished; it happened' (**Figure 4l**).

Regarding Gronemeyer's second criterion, one of his examples is T150/2SA **TAJ(AL)** for *taj* 'pine; torch' and *taj-al* 'pine-y; torch-y (fiery?)', when employed in spellings like **ʔAK'-TAJ (Figure 5a)** or **ʔAK'-TAJ-ja** (**Figure 5b**), both for *ʔahk'(o)t-aj-Ø-Ø* 's/he danced'. In such examples, following the suggestion of a completely phonographic function, T150/2SA could be transliterated instead as **taj** (i.e. **ʔAK'-taj** and **ʔAK'-taj(-ja)**).

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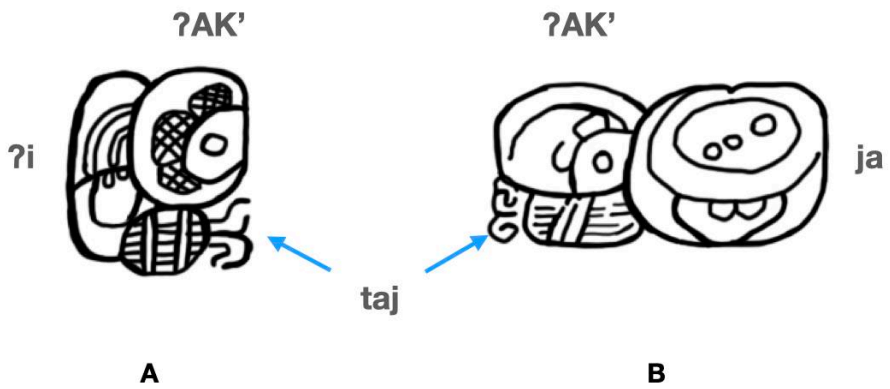
question (whether "morphograms" or "logograms") did not represent, invariably, a specific morpheme or word, but a lexeme, which could consist of multiple morphemes, and could vary by context (recall **K'AYOM** for *k'ay-om* 'singer', consisting of two morphemes, a lexical root *k'ay* and a derivational suffix *-om*). Consequently, a term such as *polymorphemic logogram* (Mora-Marín 2001, 2010) or *lexogram* (Mora-Marín 2023) would be preferable. But for now, this debate is irrelevant.

Figure 5. Examples of phonographic complementation of T150/2SA TAJ used as a CVC phonogram.



a) CRNPan02:F04, **ʔi-ʔAK'-TAJ** for *ʔi ʔahk'(o)t-aj-Ø-Ø* 'and.then s/he danced'. Drawing by the author after drawing in Stuart and Canuto (2017:25). b) DPLHS02ew:B02, **ʔAK'-TAJ-ja** for *ʔahk'(o)t-aj-Ø-Ø* 's/he danced'. Drawing by the author after drawing by Federico Fahsen (2002:16, Fig. 8).

Additional examples of likely logographic graphemes that can function as CVC phonograms discussed by Gronemeyer (2014:9, 285), shown now with the alternative transliteration convention as syllabograms also, include: 1) T516/YG3 **ʔAK'/ʔak'** (cf. **Figures 5a–b**), used in the spellings of *ʔäk'* 'to give; to put' and *ʔahk'ot* 'dance'; 2) T173d/ZQ3 **LAM/lam**, used in the spelling of *tahn=lam* 'to half-diminish' and *chilam* 'interpreter'; 3) T547/ZT3 **TAK/tak**, used in the spelling of *-tak* 'distributive plural' and possibly *täkin* 'dry' (likely the basis for the logographic value of ZT3, given the infixed T544/XQ3 **K'IN** 'sun; day' grapheme); 4) T12/1G1 **ʔAJ/ʔaj**, used in the spelling of *ʔaj*= 'male/large/active proclitic/prepound classifier' and possibly to spell *ʔaj* 'count(ing)' in the second component of the Distance Number Introductory Glyph, *tz'ak=ʔaj* 'to complete/add=count(ing)'; and 5) 1M2/T121 as **WIN** (Mora-Marín 2012), argued to be logographic for *win*= 'eye, face', and used as a CVC syllabogram in spellings of *winak/winik* 'person'. In the remainder of the paper, though, I will focus on the case of T150/2SA **TAJ/taj**.

Present Questions and Methods

The present paper questions the concepts and definitions currently available to us. Gronemeyer (2014) argues that logographic (morphograhic) signs functioning phonographically are still logograms (morphograms) if they bear phonographic (phonetic) complements. I suggest that perhaps scribes were not thinking and behaving on the basis of a simple distinction between logograms as graphemes that could bear phonographic complements, on the one hand, and syllabograms as graphemes that could not, on the other. Instead, I propose that for scribes there was a liminal category of grapheme, somewhere in between what contemporary scholars call logograms and syllabograms.

The criteria for addressing this question must take into account multiple factors, as follows:

1) Linguistic: what is the linguistic (e.g. phonological, morphological, lexical) target of the CVC grapheme in question?
2) Orthographic 1: what are the patterns of phonographic complementation?
3) Orthographic 2: is there evidence that the grapheme was ever used with a strict CV value (and thus more prototypically phonographic in nature) at some point?
4) Time: How are the patterns of phonographic complementation (Orthographic 1) and phonographic value (Orthographic 2) distributed across time?

In addition, though not actually necessary to address the question of the nature of these CVC graphemes, it would be interesting to check for other factors that may have influenced scribal choices, such as region and text class (portable vs. monumental).

To address these questions, I have prepared a dataset utilizing the Maya Hieroglyphic Database (MHD) by Looper and Macri (1991–2024). The dataset includes all 70 examples of T150/2SA present in the MHD, each case categorized according to linguistic, scriptal, regional, temporal, and media factors, as seen in **Table 1**.

Table 1. Variables considered in *T150/2SA TAJ(AL)/taj/ta* Dataset (N = 70)

Variable	Type	Values
a) *Independent Variables* (Non-linguistic, non-script)		
Region	Nominal	West, Usumacinta, Pasion, Central, Northern, Eastern, Southern, Unproveninced
Site	Nominal	Specific site names, Unproveninced
Gregorian	Metric/Interval	Gregorian years (N = 54)
Period	Ordinal	Late Preclassic, Early Classic, Late Classic, Terminal Classic
Text Type	Nominal	Monument, Portable object
Date Type	Nominal	Initial Series, Calendar Round, K'atun Ajaw, Distance Number/Calendar Round, Period Ending, Initial Series/Period Ending, Association, Estimate
b) *Linguistic and Scriptal Variables*		
Target Morpheme/Lexeme	Nominal	Taj(al), ?Tayel, Tajom, 7ahk'(o)taj, ta, chit, Unclear
Context	Nominal	Name, Verb, Preposition, Unclear
CVC/CV	Nominal	CVC, CV, Unclear
Grapheme Type	Nominal	Logogram, CVC Syllabogram, CV Syllabogram, Unclear
Complementation	Nominal	Yes, No, Unclear
T122 (SMOKE)	Nominal	Yes, No, Unclear

All 70 examples were carefully scrutinized for accuracy and clarity. Of the 70, only 54 can be dated, and of these 54 dates, 20 are estimates. Although only 17 sites are represented in the data, all major regions are represented; 23 cases are unprovenienced, only two of which could not be assigned to a major region.

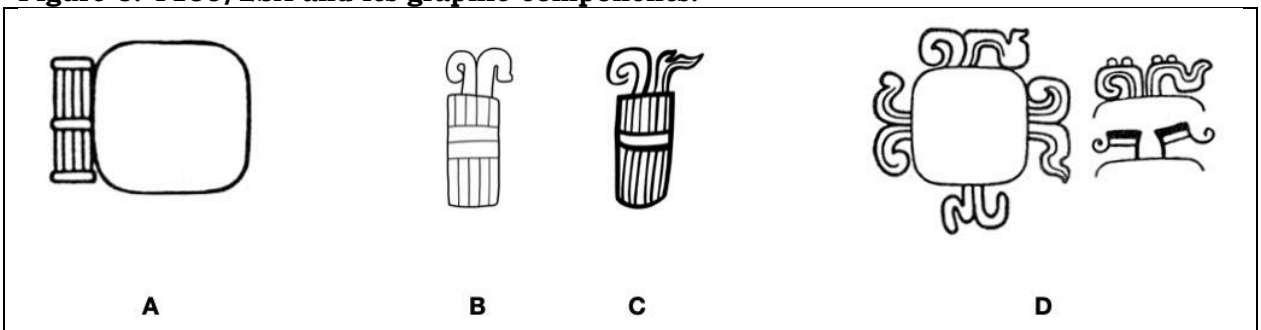
This link will take the reader to the appendices (Appendix 1, cited in the paper, and Appendix 2, the dataset as a CSV file):
https://davidmm.web.unc.edu/2024/07/20/appendices-for-paper-some-observations-on-the-historical-development-of-cvc-phonograms-in-mayan-writing-mora-marin-2024/

Following the review of the evidence for the values and uses of T150/2SA, I will utilize a statistics calculator called DATAtab (DATAtab Team 2024) to test for significant trends in its contexts and spelling patterns, as well as possible factors (temporal, geographic, scriptal, linguistic) influencing such trends. The goal is to understand the orthographic development of a grapheme with regard to its logographic and phonographic values.

T150/2SA *TAJ/taj/ta*

T150/2SA (**Figure 6a**) depicts a bundle of pine sticks (Fox and Justeson 1984:327), while T122.150 (**Figures 6b–c**) depicts smoke atop such a bundle, a composition that appears iconographically as the object held by a ruler on Naranjo Stela 35, as noted by Mathews and Justeson (1984:199), who also referred to it as a 'torch'. The SMOKE element (**Figure 6d**) is cataloged as a separate grapheme, T122/ZBB, and given the value **K'AK'** for *k'ahk'* 'fire'. Nevertheless, it is possible that T122/ZBB was polyvalent/polyfunctional, and that it may have functioned as a determinative or classifier in some contexts.

Figure 6. T150/2SA and its graphic components.

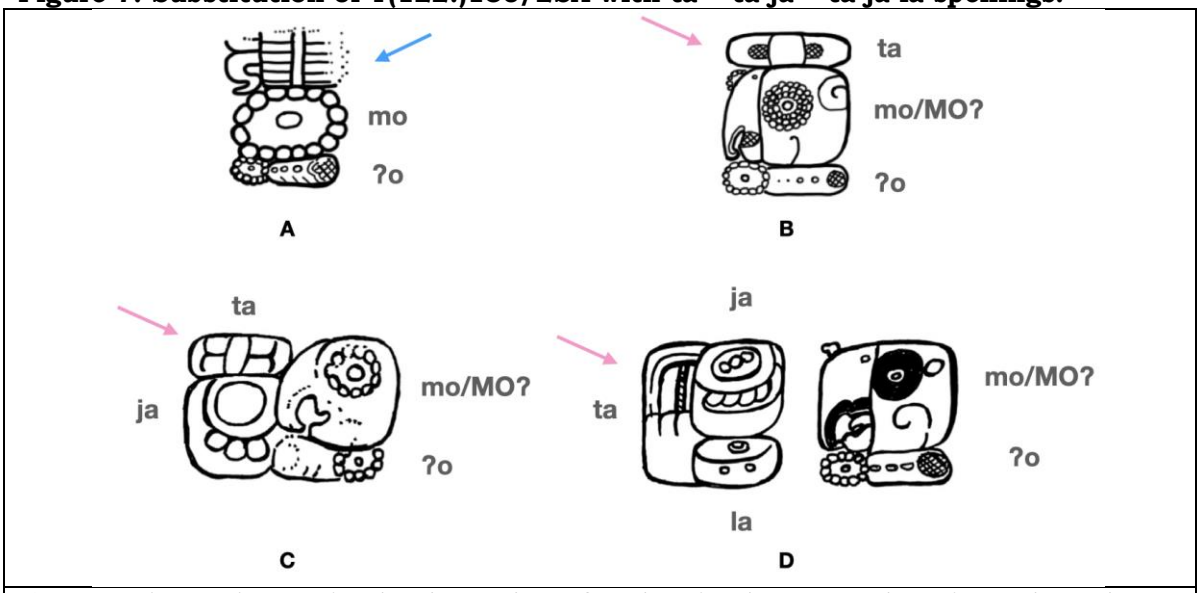


a) T150. Bundle of pine sticks. From Thompson (1962). b)-c) T122:150/2SA. A torch: bundle of pine sticks and smoke/fire. Both drawings from Catalog in Looper and Macri (1991-2024). d) T122/ZBB. Fire or smoke. From Thompson (1962).

Mathews and Justeson (1984:195, Fig. 8) also remarked on the substitutional relationship between T150/2SA and the variable sequence **ta** and **ta-ja** and **ta-ja-la** in captive names at Machaquila and Yaxchilan (**Figure 7**), and proposed a value based on proto-Mayan *tyaj 'torch; pine' (1984:200–201). They also suggested that it was T150/2SA itself, rather than the graphic compound of T122.150, that bore the logographic value **TAJ** 'torch; pine', and in fact, transliterated the T122 SMOKE grapheme as a semantic determinative (i.e. SMOKE**TAH**, showing /h/ instead of /j/ given that at the time, epigraphers had not discovered sufficient evidence to determine that scribes in fact distinguished between /h/ and /j/) (1984:201). Although those authors considered the possibility that T150/2SA could bear a value of the shape /tahaG/ (G = weak consonant, /h j ʔ y/), they favored a CVC shape. I believe that the

substitutional evidence those authors presented is supportive of the idea that T150/2SA could be read either **TAJ** or **TAJAL** depending on its context, and will assume such value, transliterated as **TAJ(AL)**.

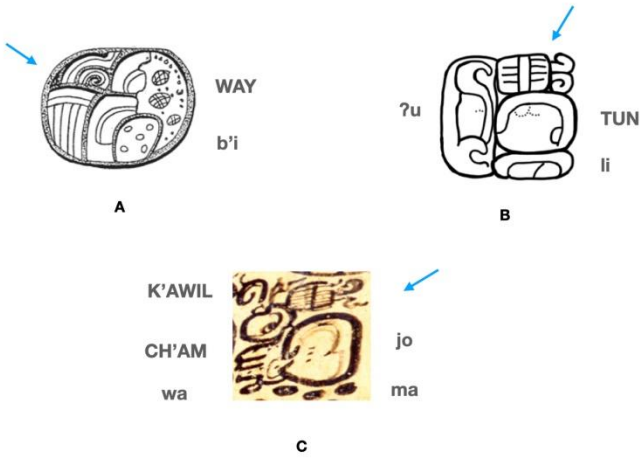
Figure 7. Substitution of T(122:)150/2SA with ta ~ ta-ja ~ ta-ja-la spellings.



a) YAXSt07:Cp05. Drawing by the author after drawing by Ian Graham in Fash et al. (2022:225). b) MQLHB:01. Drawing by the author after drawing by Ian Graham (1967:58, Fig. 39).c) YAXHS5:84. Drawing by the author after drawing in Graham (1982:179). d) MQLHB:StoneV:02-03. Drawing by the author after drawing in Graham (1967:58, Fig. 39).

There exist a number of examples for which it is assumed, though it is by no means obvious (due to a lack of variable spellings exhibiting phonographic complementation or substitutions), that a value **TAJ(AL)** should be applied. Two of these are seen in **Figures 8a-b**. Another instance is *supportive* of a value **TAJ** (**Figure 8c**), if it is assumed that the spelling is **TAJ-(j)o-m(a)** for a word *tajom*, with the /j/ of **TAJ** and the /j/ of **jo** meant to to match in the spelling of the final consonant of the root *taj*.

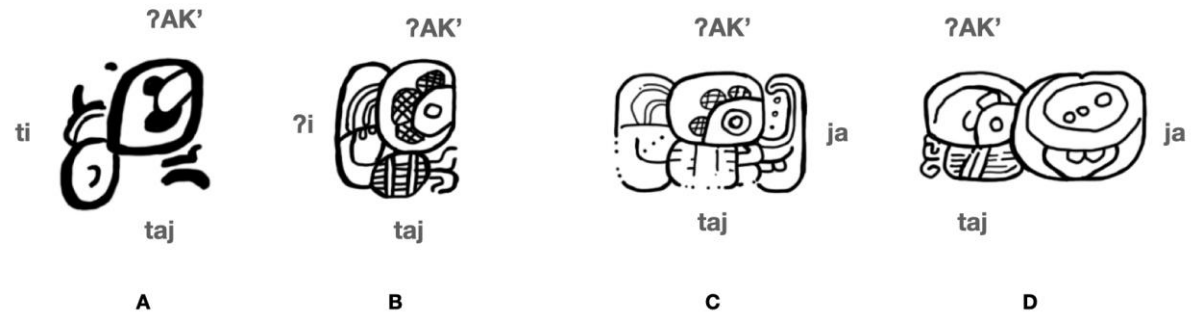
Figure 8. Additional instances of T150/2SA with likely value TAJ(AL).



a) COLK2849:A. Drawing by Donald Hales used with his permission. b) DPLPan18:G01. Drawing by the author based on drawing by David Stuart in Houston (1993:101, Fig. 4-4). c) COLK6751:J05. Detail of photphotograph by Justin Kerr.

Then there are the spellings involving the lexeme 'dance', typically appearing as *ʔahk'(o)t-aj-Ø-Ø* for 's/he danced' in Classic texts, two examples of which were already provided in **Figure 5**, reproduced in **Figure 9**, with additional cases, suggesting (**Figures 9a–b**) that T150/2SA could, on its own, spell the sequence /taj/ corresponding to the final consonant /t/ of the root *ʔahk'ot* and the /aj/ sequence of the intransitivizing suffix *-aj*. In other cases, T150/2SA was followed by **ja** (**Figures 9c–d**), seeming functioning as a phonographic complement to **TAJ/taj**, resulting in **ʔAK'-taj(-ja)**.

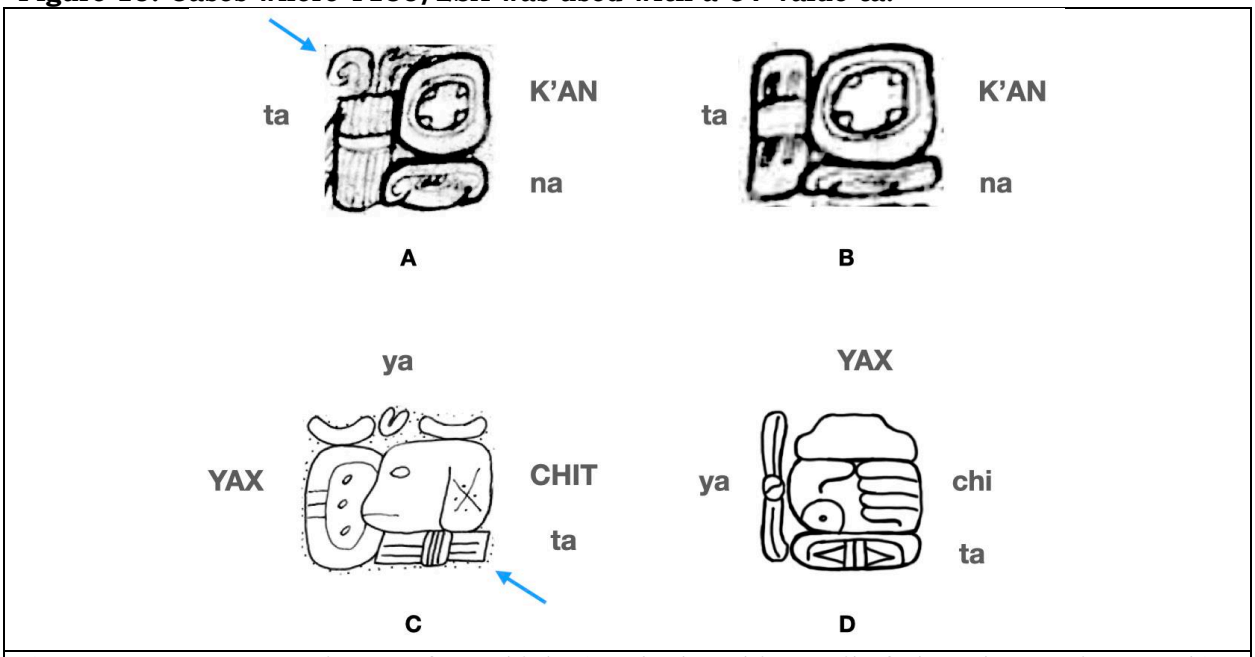
Figure 9. T150/2SA in spellings of *ʔahk'(o)t-aj* 's/he danced'.



a) BPKMur (Room 1 Caption 42):A02, **ti-ʔAK'-taj** for *ti ʔahk'(o)t-aj* 'a-dancing'. Drawing by the author after drawing by Stephen Houston and John Montgomery in Miller (1986:57). b) CRNPan02:F04, **ʔi-ʔAK'-TAJ** for *ʔi ʔahk'(o)t-aj-Ø-Ø* 'and.then s/he danced'. Drawing by the author after drawing in Stuart and Canuto (2017:25). c) DPLHS04B:I02, **ʔi-ʔAK'-TAJ** for *ʔi ʔahk'(o)t-aj-Ø-Ø* 'and.then s/he danced'. Drawing by the author after drawing by Stephen Houston (1993:109, Fig. 4-11). d) DPLHS02ew:B02, **ʔAK'-TAJ(-ja)** for *ʔahk'(o)t-aj-Ø-Ø* 'and.then s/he danced'. Drawing by the author after drawing by Federico Fahsen (2002:16, Fig. 8).

There are a few instances where it is clear or likely that T150/2SA was deployed with a CV value, **ta**, as illustrated by the equivalence between the expressions for *tä k'ahn* 'on the bench' (**Figures 10a–b**), and in the word-final contexts of the expressions *yäx chit* (**Figures 10c–d**).

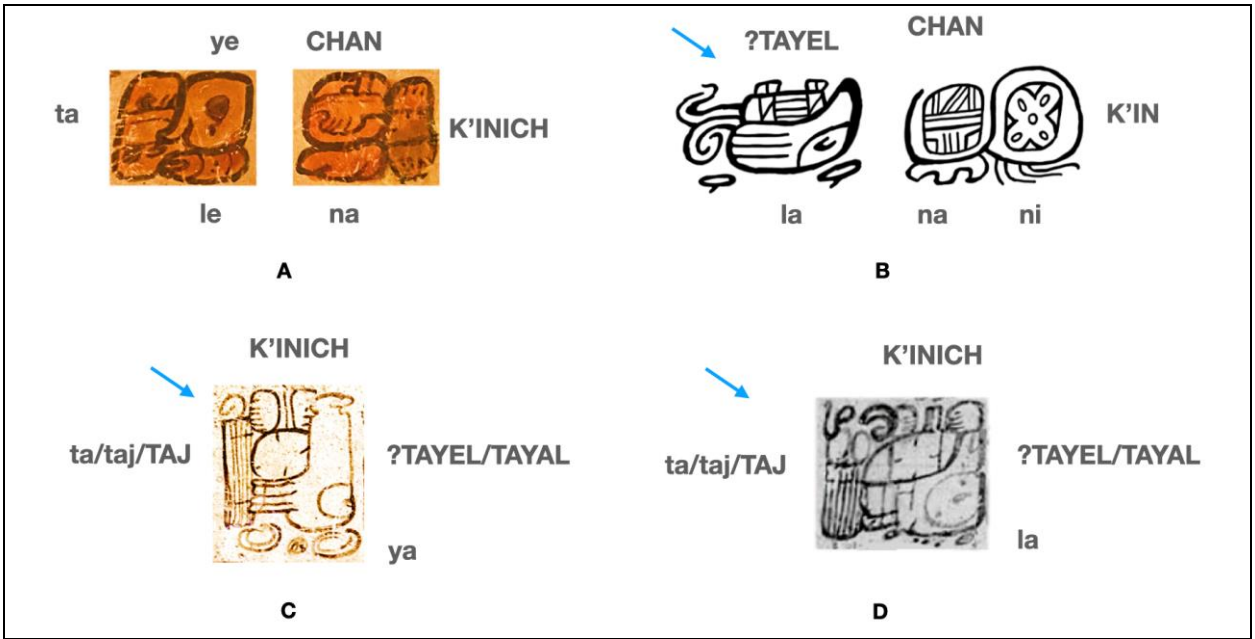
Figure 10. Cases where T150/2SA was used with a CV value ta.



a) COLK1440:R3, **ta$_2$-K'AN-na** for *tä k'ahn* 'on the bench'. Detail of photo by Justin Kerr. b) COLK1440:R4, **ta-K'AN-na** for *tä k'ahn* 'on the bench'. Detail of photo by Justin Kerr. c) CHNT4LLnt01:E06, **(ya-)YAX-CHIT(-ta$_2$)**. Drawing by the author after drawing by Ruth Krochock (1989:Fig. 4). d) CHNSt01:L03, **(ya-)YAX-chi-t(a)**. Drawing by the author after drawing by Alexander Voss (2001:170, Fig. 6)

Lastly, there is another context where it is unclear, so far, what the intended value of T150/2SA was supposed to be. There is evidence for a substitutional relationship between T150/2SA and a sequence **ta-ye-le**, as well as with a likely logographic sign based on T670/MA3. This substitutional relationship is found in the specific context of the spellings of the name and titles of a ruler from Motul de San José, *Tayel Chan K'inich* (Tokovinine and Zender 2012:41–43; Tokovinine 2016:17, 23, 24), as well as the names of a few other rulers mentioned at several sites (La Corona, Calakmul, Tikal), not to mention several pottery vessels inscribed with the famous king lists from the Snake Kingdom (cf. Martin 1997). Because of the uncertainties about its function and value in this context, I have not incorporated the 16 examples of T150/2SA in this context in my analysis. That said, given that the **ta-ye-le** spellings do not suggest the presence of a sequence /taj/, it is possible that these are cases in which T150/2SA functions as a CV syllabogram, **ta**.

Figure 11. Cases of T150/2SA in substitution with ta-ye-le expression in the names of some rulers.



a) COLK4996:U–V, **ta-ye-le CHAN-na-K'INICH**. Detail of photograph by Justin Kerr. b) TIKSF:C03–D03, **TAJ/taj/ta-?TAYEL/TAYAL-la CHAN-na-K'INICH-ni**. Drawing by the author after drawing by Rene Ozaeta, Rafael Pinelo, and Rolando Caal in Fahsen (1988:45, Fig. 4). c) COLK2094:A05, **TAJ/taj/ta-?TAYEL/TAYAL-ya K'INICH-ni**. Detail of photograph by Justin Kerr. d) COLK1302:C02, **TAJ/taj/ta-?TAYEL/TAYAL-la K'INICH-ni**. Detail of photograph by Justin Kerr.

Temporal Distribution

Table 2 presents the temporal distribution T150/2SA during the Classic period (no cases are present in the Postclassic codices, according to the MHD).

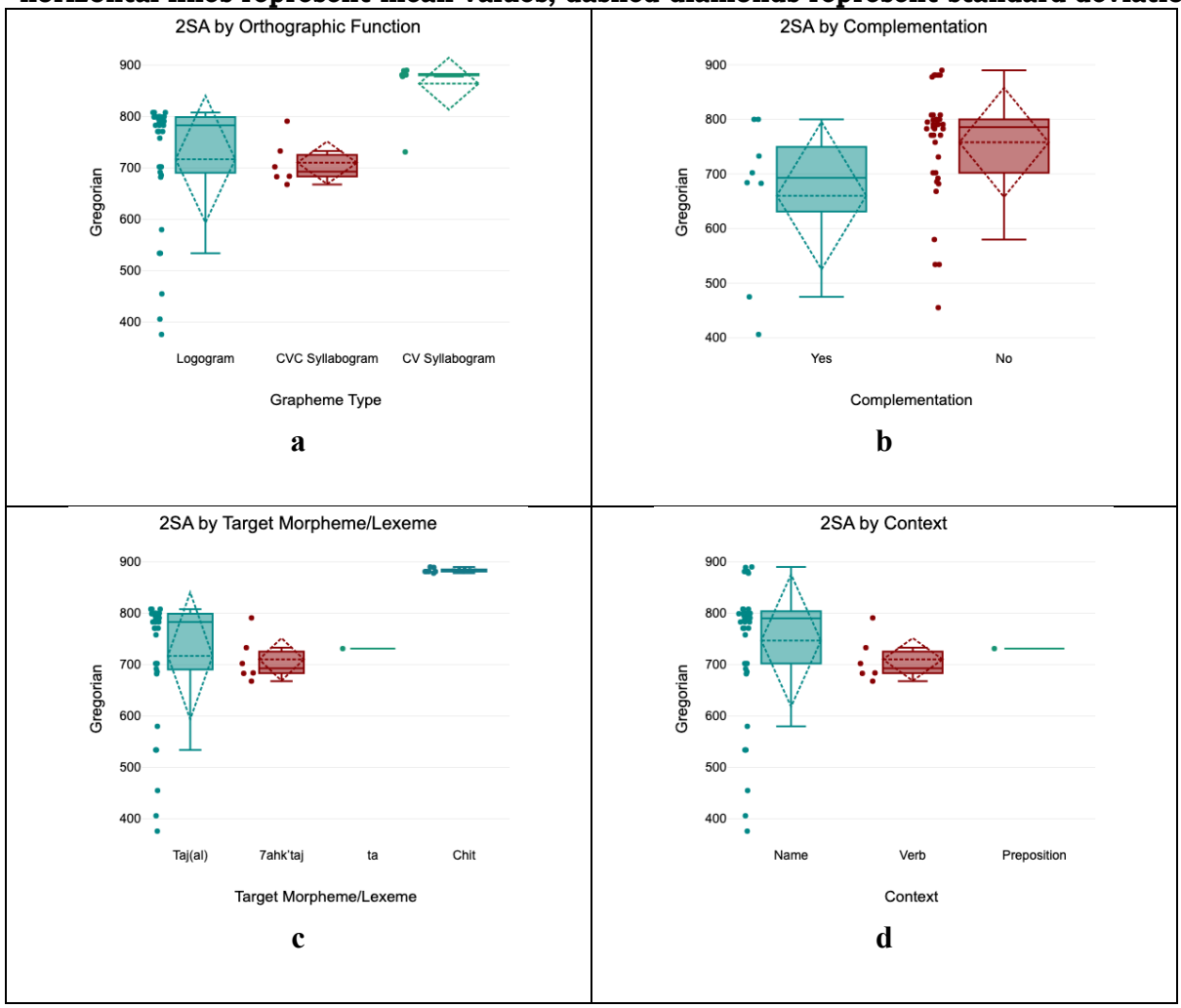
Table 2. Temporal distribution of T150/2SA in Classic texts in all texts (Early Classic vs. Late Classic) and dated texts (Gregorian years, with Mean, Standard Deviation, Minimum, and Maximum values).

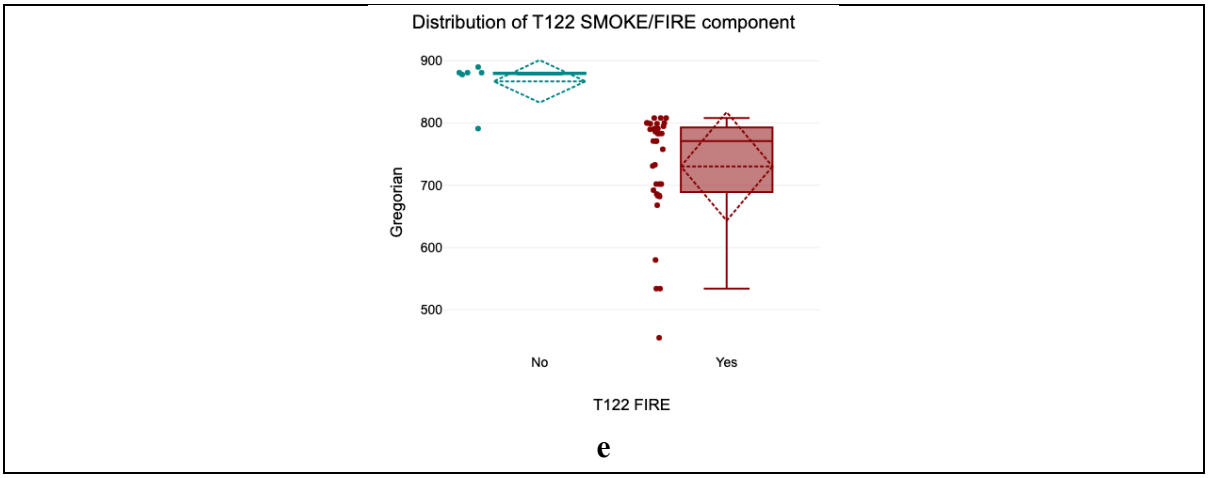
		Frequency	Mean	Std. Deviation	Minimum	Maximum
Gregorian	Late Classic	58	775.65	66.9	623	890
	Early Classic	11	485.3	72.86	376	580

Since the goal of this paper is to understand the development of logograms that can be used phonographically as CVC graphemes, I classified all cases according to function into four categories: Logogram, CVC syllabogram, CV syllabogram, Unclear. In the dated examples, these categories are distributed as shown in **Figure 12a**, after excluding the 20 Unclear cases (including the 16 cases as part of the *Tayel* ruler names). In addition, I have also classified all cases according to the presence or absence of phonographic complements applied to T150/2SA itself into three categories: Yes, No, Unclear. Again, the dated examples of categories Yes or No exhibit the temporal distribution in **Figure 12b**. The dataset was also classified according to

target morpheme or lexeme into four categories (not counting the Unclear cases): *taj(al)* 'torch; pine; fiery', *ʔahk'(o)taj* 's/he danced', *chit* (unknown lexical referent), *tä* 'generic preposition'. Their temporal distribution is seen in **Figure 12c**. **Figure 12d** presents the temporal distribution of the dataset when categorized according to general lexical or grammatical context into Names, Verbs, and Prepositions. Finally, **Figure 12e** presents the temporal distribution of the dataset when categorized according to the presence or absence of the T122/ZBB SMOKE/FIRE graphic element.

Figure 12. Box Plots of temporal distribution of T150/2SA according to scriptal and linguistc categories variables. Prepared with DATAtab (DATAtab Team 2024). Dashed horizontal lines represent mean values; dashed diamonds represent standard deviations.





e

Two types of statistical tests were carried out to explore the significance of these patterns of distribution with respect to time in dated texts. First, since the distribution of the temporal data is not parametric (normal), only tests that rely on non-parametric distributions can be applied. If the dependent variable consists of two categories, the Mann-Whitney U-Test was applied; if it consists of three or more categories, the Kruskal-Wallis Test was applied. The results are presented in full in the **Appendix** (**Tables A1–A5**), but are summarized in **Table 3**.

Table 3. Summary of non-parametric tests to determine significance of differences in temporal distribution between or among dependent variables.

	Dependent Variable	Relevant Category	Time	Result	Test	*p*-value	Effect size	Appendix Table
a.	Orthographic function	All categories	Gregorian	Significant difference	Kruskal-Wallis Test	.001	—	A1
		Logogram vs. CV		Logogram < CV	Dunn-Bonferroni Tests	.005		
		CVC vs. CV		CVC < CV	Dunn-Bonferroni Tests	.002		
b.	Complementation	Yes	Gregorian	Lower values	Mann-Whitney U-Test	.17	r = 0.21 (small)	A2
		No		Higher values				
c.	Lexical and morphemic targets	All categories	Gregorian	Significant difference	Kruskal-Wallis Test	.001	—	A3
		Taj(al) vs. Chit		Taj(al) < Chit	Dunn-Bonferroni Tests	.003		
		7ahk'taj vs. Chit		7ahk'taj < Chit	Dunn-Bonferroni Tests	.001		
d.	Context	Verb	Gregorian	Lower values	Mann-Whitney U-Test	.197	r = 0.19 (small)	A4
		Name		Higher values				
e.	Presence of T122/ZBB SMOKE	Yes	Gregorian	Lower values	Mann-Whitney U-Test	.007	r = 0.41 (medium effect)	A5
		No		Higher values				

The results in **Table 3a** suggest that the uses of T150/2SA as a CV syllabogram, **ta**, are significantly later than its uses with a logographic value and its uses as a CVC syllabogram. In fact, although one such use, attested on K1440, dated to the eighth century, is from the Central region, the remaining examples are from Chichen Itza, in the Northern region, dating to the ninth century. Thus, this case study supports a development of CV acrophonic derivation of a grapheme following its use both as a logogram and as a CVC syllabogram. It should be noted too that the Northern region saw a later and higher rate of phoneticism relative to other regions, as previously noted by Justeson and Fox (1989) and Wichmann and Davletshin (2006). In fact, at the moment, T150/2SA is only known from the Northern region as a CV syllabogram.

Although the results in **Table 3a** did not point to a statistically significant difference between logographic and CVC syllabographic uses of T150/2SA, the fact is that the earliest attested logographic case (Tikal Stela 39) precedes the earliest CVC syllabographic case (La Corona Panel 2) by about 292 years. Thus, it stands to reason that we are in fact seeing a progression of the type Logogram > CVC Syllabogram > CV Syllabogram.

The results in **Table 3b** suggest that there is no significant temporal difference between cases of complementation of T150/2SA and cases lacking complementation, regardless of its orthographic function (e.g. Logogram vs. CVC Syllabogram), despite cases of complementation showing lower Mean and Median Gregorian values.

The results of **Table 3c** suggest that the application of T150/2SA to lexemes based on *taj(al)* and *ʔahk'otaj* preceded those with *chit* by a statistically significant amount of time. This correlates with the results from **Table 3a**, since the application of T150/2SA to the spellings of *chit* was as a CV syllabogram.

The results of **Table 3d** suggest that there was no significant temporal priority in the use of T150/2SA in nominal spellings with respect to verbal spellings, despite the latter's lower Mean Gregorian values.

Last, the results of **Table 3e** suggest that there was a significant difference between instances of T150/2SA showing T122/ZBB and cases not showing it, with the latter being significantly later overall. That said, there is a fifth-century instance lacking T122/ZBB that suggests that this was likely already a practice, just not a very common practice early on. In the examination of "Other Factors" below, that is, other than temporal or geographic, it will be suggested that though the data are few, it would seem that the absence of T122/ZBB could correlate with a function as a CV syllabogram.

Geographic Distribution

Although all seven regions are represented in the dataset, most of them are represented by too few data points to find interesting patterns. At a glance, the only pattern that seems very significant is pretty obvious: the Northern region only has instances of T150/2SA as a CV syllabogram **ta**, and all but one of them lack T122/ZBB SMOKE/FIRE. Outside the Northern region, there is only one clear instance of T150/2SA as a CV syllabogram **ta**, as well as only one clear instance lacking T122/ZBB.

Other Factors

Media Type (Monumental vs. Portable) does not appear to be influential on any of the dependent variables of interest. There is one pattern that is likely significant but the data are too few to allow for statistical validation: of the 6 cases of 2SA lacking T122/ZBB SMOKE/FIRE, 5 examples are cases where it functions as a CV syllabogram **ta**, out of 6 cases where it has this orthographic function. It would appear that when it bears such a value, the SMOKE/FIRE graphic element is disfavored, which could support Mathews and Justeson's (1984:201) suggestion that T122/ZBB may have functioned as a semantic determinative when applied to T150/2SA.

It is also worth observing that of the 8 clear instances in which T150/2SA takes a phonographic complement (i.e. T181/ZU1 **ja**), 4 of them occur in cases where it likely represents its lexical sourceword *taj(al)* 'torch(y)', and would therefore constitute typical cases of phonographic complementation, and 4 of them occur with cases where it represents the sequence /taj/ in *ʔahk'(o)t-aj*, representing the final consonant of the lexical root and the entirety of the suffix *-aj* 'intransitivizer', and thus the cases where it bears the typical function of a CVC syllabogram. It does not bear phonographic complements in any of the 16 instances in which it appears in the spelling of the name that has been transcribed as *tayel/tayal* based on the substitution with the sequence **ta-ye-le** on three occasions. Nor does it bear evidence of complementation in any of the 6 instances in which it can be argued to have a CV syllabographic value **ta**. Once again, the data are insufficient to validate these patterns statistically. Nonetheless, these patterns could suggest that in the 16 instances in which it appears in the ruler name *tayel/tayal*, it could be functioning as a CV syllabogram **ta**, perhaps complementing the logogram based on T670/MA3 that usually follows it in these contexts.

Discussion and Conclusions

CVC syllabograms were derived from the root values of logograms, and for this reason, they originally functioned with CVC shapes and continued to take, optionally, phonographic complements, just like logograms. The difference lies in that the targets of CVC syllabograms were not individual morphemes or lexemes, but often, CVC phonographic sequences cutting across morpheme boundaries (e.g. *ʔahk'(o)t-aj*, *y-ich-(V)n-al*), as noted by Gronemeyer (2014).

These graphemes lie in a liminal position, behaving both like logograms and syllabograms, and thus, they call into question contemporary scholars' conventional concepts and definitions. I propose transliterating them with lowercase bold letters (e.g. 2SA in **ʔAK'-taj(-ja)** for *ʔahk'(o)taj* 's/he danced'), and referring to them as CVC syllabograms; their continued use of phonographic complements could be argued to represent a holdover from their prior exclusive use as a logogram. Eventually, scribes began to think of 2SA also as CV syllabogram. A full transliteration of 2SA's orthographic values would thus be **TAJ(AL)/taj/ta**, in which the *logogram/CVC syllabogram/CV syllabogram* order also reflects their historical development. The statistical tests in fact support that both the logographic value and the CVC syllabographic value were significantly earlier than the CV syllabographic value. Indeed, by the Late Classic period, at least, 2SA was already functioning as a syllabogram **ta**, marked as such, it seems, by the absence of T122/ZBB

SMOKE/FIRE. Thus, it is appropriate to include T150/2SA (i.e. 2SA without T122/ZBB) in syllabary charts at least for the Late Classic period, and certainly for the Northern region.

What is needed next is further problematization of their nature, and a more comprehensive treatment of these types of graphemes. Like the case of 2SA **TAJ/taj/ta**, these types of graphemes could give us clues to the processes of acrophonic derivations of CV syllabograms. Though it is entirely possible that some (or many) such syllabograms did not experience a full process of Logogram > CVC Syllabogram > CV syllabogram derivation, but were simply innovated as CV syllabograms from the get-go, or experienced an abridged Logogram > CV Syllabogram derivation, it is quite possible that many did experience the full three-part progression. The Maya Hieroglyphic Database by Looper and Macri (1991–2024) comprises an ideal tool to test this idea. And while the dataset of instances of T150/2SA is surprisingly small, the approach illustrated here can be extended to examples showing greater frequency, a task for a future paper.

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