Prepositions *ti* and *ta* in Classic Maya Monument Texts

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The Maya hieroglyphic script, known from texts dating as early as the last centuries BCE, and as late as the sixteenth century, recorded Mayan languages by means of syllabic and logographic signs. Centered primarily in Guatemala, the Yucatan peninsula, and Belize during the Classic period (200–900 CE), texts are also found in neighboring Honduras, and the Mexican states of Chiapas and Tabasco. Although the bulk of these texts is clearly associated with contemporary and colonial languages of the Cholan-Tzeltalan family (Law and Stuart 2017), as with any written records spanning nearly two millennia, across a large geographic area, the Maya texts provide evidence of variation, most of it reflecting Eastern Cholan dialect variation, rather than the presence of multiple languages (Houston, Robertson, and Stuart 2000; Wichmann 2006).[1]

The goal of this investigation is a more nuanced understanding of the two forms of a preposition most frequently found in Classic Maya texts, and to determine if their distribution reflects linguistic, geographic, or temporal groupings. This study expands on an earlier one (Macri 1991) that compared *ti* and *ta* in the colonial Acalan Chontal manuscript (Scholes and Roys 1948; Smailus 1975), across lowland Mayan languages, and in glyphic texts from several Classic Maya sites. Today, the Maya Hieroglyphic Database (hereafter MHD), now recording over 71,000 glyph blocks from Classic period texts, provides

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[1] Greater Tzeltalan languages include the many varieties of Tzeltal and Tzotzil, and the Eastern Cholan languages Ch'orti' and Ch'olti', and the Western Cholan languages Ch'ol and Yokot'an (including Acalan Chontal). The Yukatekan language family includes Mopan, Yukateko, Itzaj, and Lakantun (Kaufman 2017).

not only a significantly larger sample, but also, since most monument texts are associated with a date, a clear picture of changes over time (Looper and Macri 2021).

Typologically, Mayan languages can be described as head-marking: verb-initial word order, nouns occurring before adjectives, possessed nouns before possessors, and prepositions followed by their object. A prepositional phrase includes a noun or phrase preceded by a preposition that indicates some sort of indirect relationship between the noun or phrase and the main arguments of a sentence. Attempting to translate prepositional phrases from Mayan texts into English might seem deceptively simple, but a closer look at syntactic and semantic contexts reveals subtle differences in language usage. For example, in English 'with' can have a concatenate or linking function as in 'they went with Omar to the play'; an instrumental sense as in 'she dug potatoes with her hands'; a genitival sense as in 'a cat with white feet'; or opposition 'he is exploring with his brother'. The range of uses that prepositions have in one language does not necessarily map directly on to prepositions in another language. A number of prepositions occur in the Classic Maya texts, but only one is examined in this report. The proto-Mayan general locative preposition, *tya, realized as *ti*, *ti'*, *tä*, or *ta* in modern Greater Tzeltalan and Yukatekan languages, is by far the most frequently occurring preposition in the ancient Maya texts, where it is represented by graphemes for **ti** and **ta**.[2] This general preposition can indicate a variety of oblique relationships between the noun that follows and the main arguments of the sentence, although it is most frequently used as a temporal or locational preposition. Here we speak of it as a single entity, but the rest of this paper is a comparison of each of the two forms. In most cases they seem to be equivalent, but, at some sites where both forms appear, a case can be made for subtle differences in function.
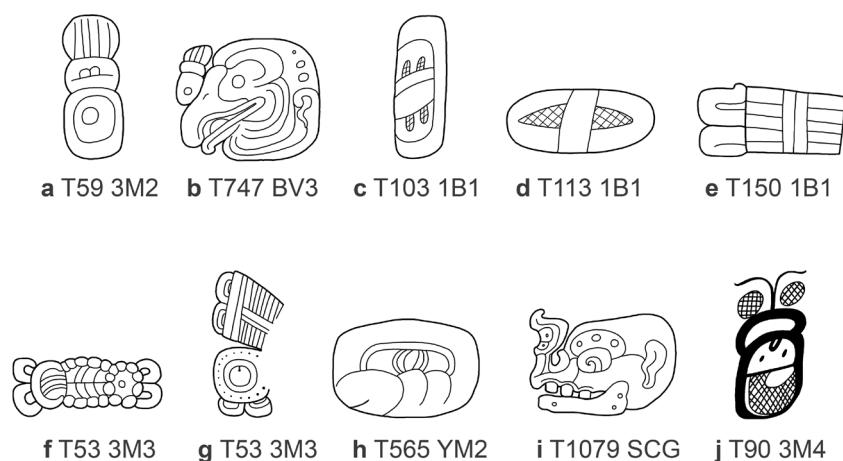

Fig. 1. Signs for **ti**: **a, b**; **ta**: **c, d, e, f, g, h, i**; and **tu**: **j**. Drawings by Matthew Looper, used with permission.

In Classic Maya texts the signs that have the value **ti** can represent the syllable **ti** in spellings of polysyllabic words, or they can represent a morpheme, the preposition *ti*. The most common form is an object with a torch-like element at the top, perhaps representing fire, from proto-Mayan *til and proto-

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[2] Linguistic forms are italicized; values for Maya signs appear in bold type. Linguistic reconstructions, that is, words shown with an asterisk, are not italicized. Reconstructed forms are from Kaufman (2003).

Cholan *til 'burn', T59/3M2 (**Fig**. **1a**).[3] The other is a vulture's head, T747/BV3, with the **ti** sign, T59/3M2, prefixed to its beak (**Fig**. **1b**), discussed below. Likewise, the seven graphemes that read **ta** represent both the syllable *ta* and the preposition *ta*. The acrophonic origin of several of the signs is widely recognized: several forms seem to represent a torch, from *tyaj, proto-Cholan 'pine torch' T103, 113, 150, all coded as 1B1 (**Fig. 1c, d, e**). One depicts a skull with a sign for obsidian on its nose, from proto-Mayan *tyaah 'obsidian' T1079/SCG (**Fig. 1i**). For some signs, however, the origin is uncertain: T53/3M3 and T565/YM2 (**Fig**. **1f, g, h**). A third form of this preposition *tu*, represents the contraction of the preposition to *t-* with a following third person ergative/possessive marker *u-* T90/3M4 (**Fig**. **1j**). This sign may represent *ti + u* or *ta + u*, although the assumption is that the underlying form is consistent with the prepositional form used at that site at that time. As prepositions, **ti**, **ta**, and **tu** nearly always occur as the initial sign in a glyph block. As syllabic signs, they can occur in any position in a glyph block. The first step in identifying patterns of prepositional use is to distinguish **ti** and **ta** signs that occur in syllabic spellings from those cases in which they function as a prepositions.

Patterns of prepositional uses of **ti** and **ta** at first appear to reflect free variation. Even looking at texts from one site can be confusing. When prepositions at a single site are grouped chronologically, however, and when the sites themselves are grouped spatially, patterns begin to emerge. To examine this variation I queried the MHD as follows:

1)   I selected all texts on stone and stucco monuments and murals, excluding texts on portable that cannot be conclusively associated with a place of origin, resulting in 50,949 blocks;
2)   selected all graphemes representing **ti** or **ta** as prepositions (eliminating syllabic occurrences of **ti** or **ta**), a total of 822 glyph blocks;
3)   sorted these by the long count date[4] associated with the text;
4)   sorted up by the name of the site of origin;
5)   grouped sites;
6)   and generated the total number of prepositional phrases in each group. This set of 822 records was further modified to exclude any remaining incomplete phrases or questioned **ti/ta** signs, resulting in 784 items.

Distribution Summary

The resultant 101 sites that have clear examples of the signs **ti** and **ta** are listed in the Appendix, along with their site codes, category, and preferred preposition form by time period. The general locative/temporal prepositions *ti* and *ta* are plentiful across the Maya region; they occur in the monument texts from all sites representing more than 1% of the total number of readable glyph blocks. The data generated by the query above group into four distinct categories: sites where **ti** appears as the preferred form, sites where **ta** appears as the preferred form, sites that prefer **ta** early and change to **ti** later, and sites where a nearly equal number of both forms are in use during the same period.

The circles with site codes on **Maps 1** and **2** show the locations of all the sites with **ti** or **ta** prepositions, each placed by Jessica Munson according to its precise geographic coordinates. The legend reflects the size range of the data sample, and the colors indicate the categories of preposition use: **ti**, **ta**, or mixed.

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[3] Maya signs are referred to by their number in Thompson's catalog (1962) and by the codes listed in two database publications: Macri and Looper (2003) and Macri and Vail (2009).

[4] The Maya long count is a calculation of the total number of days from a starting point in 3114 BCE, in sets of 400 x 360 days, sets of 20 x 360 days, sets of 360 days, sets of 20 days, and single days. The numbers of the three largest sets are sufficient in this report to indicating the equivalent year in the Gregorian calendar.

Map 1 shows that the earliest documented monuments with readable texts from the Classic Period were concentrated in the central Peten, and, with few exceptions, represent the general preposition as **ta**. **Map 2** shows that over time **ti** replaced **ta** throughout the Peten, the Usumacinta, and the Petexbatun regions. Tonina is the only site with early texts that does not change to **ti**. The larger circles on **Map 2** reflect the dramatic increase of the number of texts during the later period. Several added sites in the western region use **ta**. In the western section of the northern Yucatan most sites prefer **ta** or are mixed.

Table 1 lists the 13 sites where **ta** was recorded in early texts, and was later replaced with **ti**. The date for the last occurrence of **ta** and the first occurrence of **ti** is shown in the Maya long count, as well as with the approximate Gregorian year. The break between Early Classic and Late Classic is usually given as about 550 CE (9.6.0). In this report, the terms early and late reflect the change in the usage of **ti** and **ta**, and are not equivalent to the dates of the Early and Late Classic periods. For many sites, the time from the last **ta** to the first **ti** occurs up to a century and half later. This break reflects, but does not strictly correspond to, the period of reduced monument construction in the Peten region referred to as the hiatus. The sites of Copan and Caracol have a period of transition before changing to **ti**, during which both forms of the preposition occur.

Table 1. *Early* to *Late* Sites with Maya long count and Gregorian dates for the last **ta** and the first **ti**.

| SITE	CODE	LAST TA		TRANSITION		FIRST TI	
Aguateca	AGT	Early Classic				9.15.5	736
Altar de Sacrificios	ALS	9.9.15	628			9.11.0	652
Bonampak[5]	BPK	9.13.0	692			9.17.0	771
Chinkultic	CKL	9.7.0	573			9.17.0	771
Calakmul	CLK	9.0.0	435			9.12.0	672
Copan	CPN	9.6.10	564	9.9.0	613	9.11.0	652
Caracol	CRC	9.8.10	603	9.10.0	633	9.12.10	682
La Corona	CRN	9.5.0	534			9.11.3	655
Naranjo	NAR	9.8.4	597			9.13.10	702
El Peru	PRU	9.6.10	564			9.13.0	692
Tamarindito	TAM	9.6.0	554			9.16.11	762
Tikal	TIK	9.4.13	527			9.13.3	695
Yaxchilan	YAX	9.5.2	536			9.14.14	725

A few sites recorded only **ti** during the early period (**Map 1**). The earliest is Quirigua at 495 CE (9.3.0); the rest are significantly later: one example from Dzibanche, 554 CE (9.6.0), one from Pol Box, 573 CE (9.7.0); two, possibly three, from Resbalon from 579 CE (9.7.6); Champerico's three examples are later, from 603 CE (9.8.10) and 613 CE (9.9.0). These sites may represent the region of origin of the scribes/sculptors who used **ti**, and later brought about the change from **ta** to **ti** at a majority of sites.[6] Specific discussion of Yukatekan and Greater Tzeltalan features as they relate to this change requires more attention than can be included in this report.

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[5] It is likely that the late change to **ti** at Bonampak was motivated by local political changes, different from the factors that caused the change from **ta** to **ti** at other sites.

[6] Yo'okop does not contain a long count date, and the estimate of *early* is partially based on the presence of circular cartouches around each of the glyph blocks. Thus, its inclusion on **Map 1** is questionable.
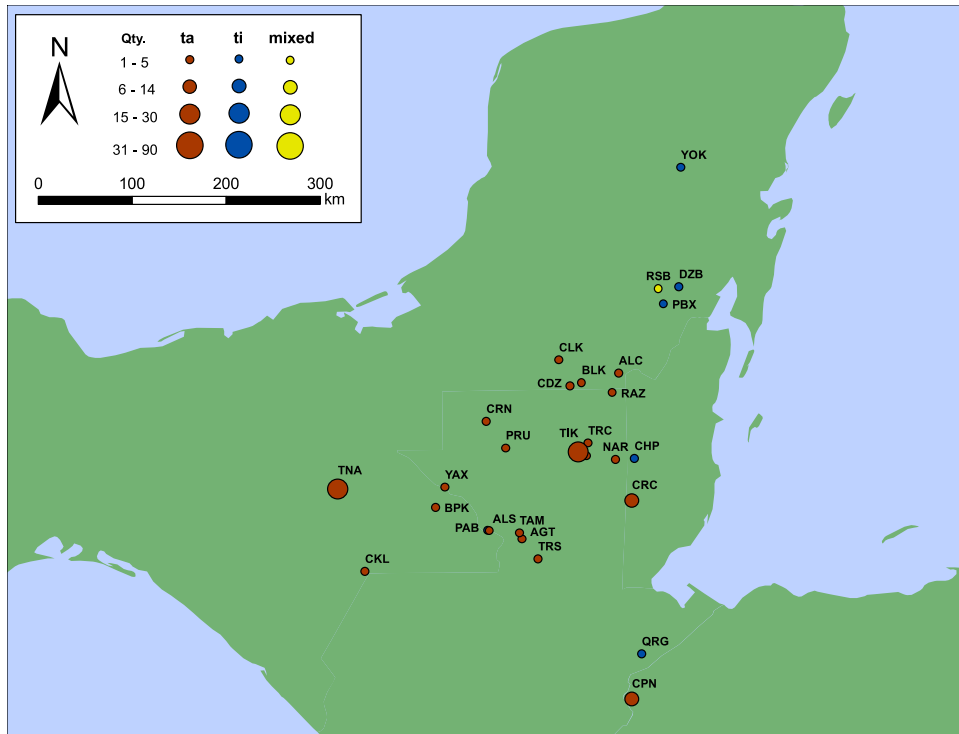
Map 1. Distribution of **ti** and **ta**, on early monuments (Map by Jessica Munson).
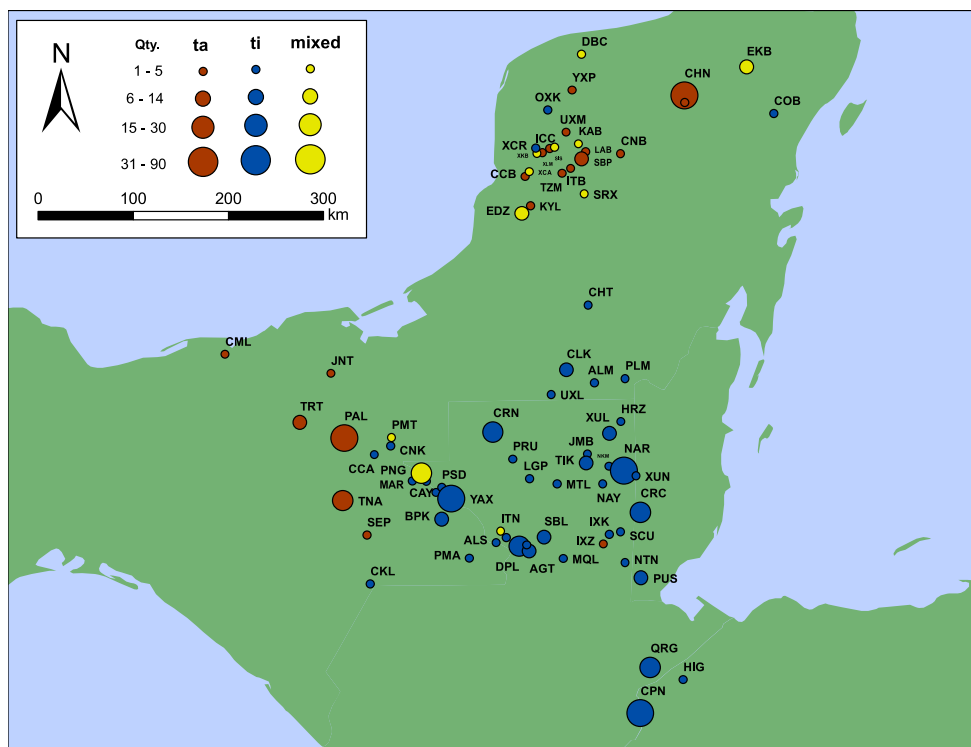
Map 2. Distribution of **ti** and **ta** on late monuments (Map by Jessica Munson).

Certainly, the picture here is incomplete—artificially so because we have not included unprovenienced monuments and non-monument texts, and historically incomplete because, undoubtedly, monuments were carved that have not been, or may never be, recovered. Excavations at some sites are far more extensive than at others, resulting in a skewed sample size. Deliberate mutilation in ancient times, as well as poor preservation at some sites, most notably Calakmul, further limit our view. Nevertheless, the gaps between the time of the last **ta** to the first **ti** are astounding. In these early to late sites, the stelae record the same script, but with a few differences. The favored form of the preposition is, however, the only one of these variations documented in this report.[7]

Choice of the preferred prepositional form may reflect: minor or major diachronic language change, either that of the community, the elite, or the scribe, or a shift from one language to another; a political change with accompanying language or cultural differences; or copying from an early or non-local text; or simply a scribal choice to use an archaic form. When both prepositional forms appear in the same text, or in two or more texts at a site from the same period, we are challenged to look more closely for some motivating factor. Nearly all large sites favoring one form or the other exhibit a few counter examples. A small number of these can be explained by identifying a syllabic spelling of a previously unrecognized lexical form, or the use of a frequently occurring phrase borrowed from another site. Another source of counterexamples is a difference in function, either to introduce a verbal phrase, or to indicate causality or an instrumental relationship. Finally, some exceptions appear to reflect phonetic conditioning. Each of these phenomena is illustrated below.

A Lexicalized Phrase

Some occurrences of the non-dominant form of the preposition can be explained by recognizing that they occur as part of a phrase in frequent use at sites using the opposite form, where it functions as if it were a single word, a lexicalized phrase. An oval-shaped sign with a line of circles designated 1GE, possibly reading **WAL** appears in several contexts meaning 'in, into, inside' or 'during' (Boot 2005:308; Graña Behrens 2002:69; Grube, Lacadena García-Gallo, and Martin 2003:II–23, 71; Lacadena García-Gallo 2004). It occurs 26 times in Classic texts. Twice it occurs on Yaxchilan Lintel 10, in a context that is not well understood (**Fig. 2a**). It appears in prepositional phrases on a Cancuen-area panel (Fundación La Ruta Maya 16.2.5.244), where the sign functions specifically as a locative in several phrases, e.g., 'in the grass', 'in the pool' (**Fig. 2b, c**). One time it occurs at Palenque, a **ta**-site, preceded by **ta** in *ta wal k'ahk'naahb* 'into the ocean' (**Fig. 2d**). On five Ek Balam capstones, **WAL** occurs without a preceding preposition but introduces a numbered tun (year) (**Fig. 2e**). It occurs at least eleven times at Yula, Chichen Itza, and Halakal (**Fig. 2f-h**), where it is preceded by **ti**—unexpectedly since Chichen Itza and Yula are otherwise **ta**-favoring sites.[8] At these northern sites the phrase carries a temporal sense, usually followed by the numbered year of a k'atun, e.g. 'in the thirteenth year'. Grube et al. note that the phrase

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[7] Nicholas Carter (2010) discusses the diachronic distribution of the forms of the locative prepositions *ti* and *ta* during the Classic period. His conclusions are consistent with those reached here, though he provides additional political and linguistic explanations for the change. The present study, however, has the advantage of providing more comprehensive coverage of texts.

[8] Citations from the MHD are listed with the site code, monument/structure, abbreviation (e.g., ballcourt marker, BM; bench, *B*, capstone, *CS;* Caracol building, *CRC*; Casa Colorada, *CC*; element, *E*; fragment, *f*; lintel, *Lnt*; panel, *P;* stela, *St*; temple, *T*; Temple of the Inscriptions, *TI;* throne, *Th*, watering trough, *WT*), and block coordinates.

occurs in expressions of numbered tuns in the Chilam Balam of Tizimin, written in the Yukateko language (Grube, Lacadena García-Gallo, and Martin 2003:II–23). The concordance of the Chilam Balam of Tizimin lists 22 examples of *ti ual* (Bricker 1990:330). Several similar words from Yukateko, Ch'orti', and Acalan Chontal appear to have meanings relating to time (**Table 2**). The Ch'orti' forms are prefixed by *ta-* as would be expected.[9] The suggestion here is that this phrase is used by Chichen Itza area sculptors who recognized that the *ti* here has a function different from that of the general locative/temporal preposition, which for them is *ta*.
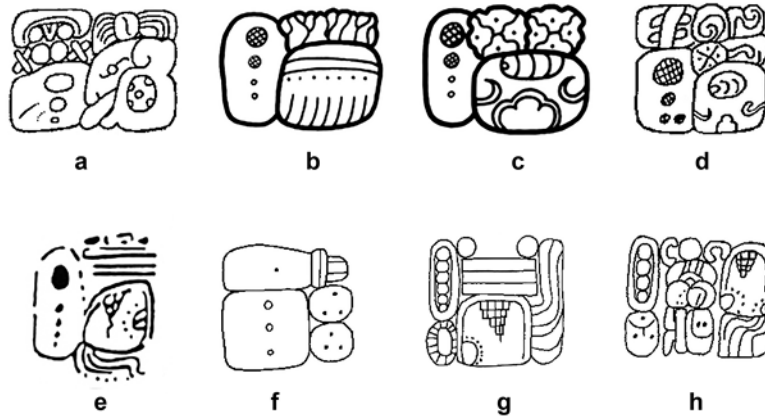

Fig. 2. Examples of 1GE. **a**. YAXLnt10 B2 after Ian Graham (Graham 1979:31), **b**. CNCP1 H3 by Yuriy Polyukhovych, used with permission, **c**. CNCP1 H4 by Yuriy Polyukhovych, used with permission, **d**. PALTIw P12 after Linda Schele (Schele 2000:154), **e**. EKBCS1 A3 after Alfonso Lacadena (Lacadena García-Gallo 2004), **f**. YULLnt1 B2 after Ruth Krochock, used with permission, **g**. CHNWT C1, after Ruth Krochock, used with permission **h**. HLKLnt G1 after Ruth Krochock, used with permission.

Table 2. Words possibly related to the hieroglyphic phrase *ti wal*.

<valel->	ahora (eso)	Acalan Chontal (Smailus 1975:175)
<tawar>	es tiempo; hay tiempo	Ch'orti' (Pérez Martínez et al. 1996:200)
<tawarto>	there is still time, still a chance	Ch'orti' (Hull 2016:396)
<wal>	pospuesta significa hoy; después	Yukateko (Barrera Vásquez, Bastarrachea Manzano, and Brito Sansores 1980:909)

Differences in Function

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[9] Note that *w* is spelled *v* in Acalan Chontal, and that *r* in Ch'orti' corresponds to *l* in Yukateko and the other Cholan languages.

As Macri (1991) suggested, one prepositional form might refer to location in space and time, with the other form signifying a different oblique relationship between the following noun and the sentence. Choices might include such functions as instrumental, 'with', or causative, 'by', 'because of'. One example of a strictly non locational preposition comes from Chichen Itza and Yula with the phrase *ti k'ahk'*, spelled **ti k'a-k'a** (CHNCC 31) and **ti k'a-K'AK'** (YULLnt1 A5). Both Yula and Chichen Itza clearly favor **ta**. This phrase might be better translated as 'because of' or 'by (the) fire(s)'. Whatever the precise meaning, the relationship between fire and the action taking place, **ti** appears to have a function distinct from the general temporal/locative preposition. At Yaxchilan (YAXLnt43 C2–A2) in the phrase *[ahk'taj] ti chakat* '[he dances] with the basket staff', **ti** is used in an instrumental or, possibly, a concatenative sense.

An example of the preposition introducing an action, rather than a time or location is the 'dance' expression, *ti ahk'ot* (Grube 1992), written **ti AK'-ta**, **ti AK'-ti**, and **ti AK'**, on monumental texts dating after 9.11.0 (652 CE). The phrase always begins with **ti** regardless of which preposition is otherwise used at a site. This preposition occurring before a possible verbal form, again suggests something beyond a temporal or locative meaning, probably 'by dance/dancing', 'with dancing', or 'while dancing'. Examples of the phrase can be found at sites labelled mixed (Edzna, Pomona Tabasco), early **ta** to late **ti** (Bonampak, Copan, La Corona, Yaxchilan) and late (Uxul, Xultun). Additional examples of **ti** introducing a verb come from the site of Ixkun, where the verb *chok* 'to scatter' is twice preceded by **ti** in *ubaah ti chok* (IXKSt1 C1–C2, IXKSt4 E1–E2) 'it is his image (while) scattering'. These two examples cannot, however, be considered diagnostic of a pattern, since the site has only six monuments with legible texts, and these are the only examples with either **ti** or **ta**. Consequently, there is no reason not to consider Ixkun among the sites favoring the general preposition **ti**, that is, not an exceptional example.

Phonological Conditioning

Another phenomenon that may account for exceptions to otherwise consistent patterns is phonological conditioning. Phonologically the difference between the two signs is that **ta** has a low vowel, and **ti** has a high front vowel. We can tell from the known words that the two signs were used to spell, that the respective vowels were probably short. We can also determine by the use of the grapheme spelling for **ʔi** following **ti** in spellings of *ti'* 'edge, mouth, border' that the sign **ti** did not itself indicate a final glottal stop. What we do not know is whether the vowel of either sign, more likely **ta**, when used as a preposition, might have sometimes represented *t* plus a central vowel, *ä*.[10] Accepting, nevertheless, a clear contrast between the vowels of the two forms, it appears that some of the irregular occurrences may reflect phonological conditioning. Assimilation would be the change of *ta* to *ti* before *i* or *y*. Vowel dissimilation would be seen in a change from *ti* to *ta* before *i* or *y*, that is, the changing of the vowel of the usual (expected) preposition to contrast with the initial sound of the following word. Vowel assimilation could be the cause of **ti** appearing in the expression *ti yunen* 'for/to his son' on a Caracol monument dated 9.8.10 (603 CE), a time when this site was otherwise using **ta**. Here the vowel in *ta* becomes similar to the initial sound in the following word.

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[10] Bricker and Orie (2014) provide evidence for non-phonemic schwa in Yukateko, Colonial Chontal, and Maya hieroglyphic texts.

Caracol (CRCSt6 C13)

ta > ti /_y   ti yu-ne

Vowel dissimilation occurs in several contexts. The phrase *ta yihk'in*, 'at twilight/night' is found during the late period on monuments from Copan, Naranjo, Pomona Tabasco, and Yaxchilan. Pomona Tabasco has only two examples of prepositions, one **ti**, and one **ta**, but the other three sites would definitely be expected to have **ti** at this time. This could be explained by phonological dissimilation, in which the vowel in *ti* becomes *a*, that is, it becomes more distinct from the initial *y* or *i* of the following word. Five additional examples of possible vowel dissimilation from four different sites are listed below.

Piedras Negras (PNGTh1 J6, Z1)
ti > ta /_ʔi   ta ib

Quirigua (QRGStJ A14)
ti > ta /_ʔi   ta ib

Tikal (TIKSt5 A10, TIKf27 D)
ti > ta/_y   ta yotoot
*   ta yajaw*

Yaxchilan (YAXSt18 A1)
ti > ta /_y   ta yihk'in

The claim here is not that phonological conditioning occurs in all Maya texts, simply that some of the unexpected forms of the preposition might reflect this phonological phenomena in the speech of those who were carving the monuments. Certainly, as mentioned above, several factors can explain breaks in the expected patterns.

Vulture with *ti* Sign

One sign commonly read as **ti** that was not included in the overall counts of **ti** and **ta** is the image of a vulture with **ti** T59/3M2 on its forehead, T747/BV3, frequently conflated with the bow of the inauguration sign T684/ZB1, shown in **Figure 3a, b**, and **f**. The occurrences of this sign are notable in that in the Late Classic, in addition to being used as **ti** prepositionally and syllabically in initial, medial, and final positions, it occurs as the locative preposition in texts from sites favoring the form **ta**. The first clear usage as the syllable **ti** occurs in Late Classic (CPNStI 9.12.3). T747/BV3 also appears at several sites where **ta** is used exclusively, and frequently accounts for the only exceptions to the use of **ta**. This is true for four early examples at Tikal, and one at Copan (**Fig. 3a-d**). It is also found in the Late Classic at

Palenque—again in texts in which **ta** would be expected (**Fig. 3e, f**). The proto-Mayan word *tzaa'/*taa*' 'excrement' seems to figure in the origin of the vulture sign, the vulture being known colloquially as 'shit head' because of its feeding habits and the skin on its featherless head.[11] One explanation for this sign's use at **ta** sites is that it may originally have been read **ta**, and later reinterpreted as **ti**.
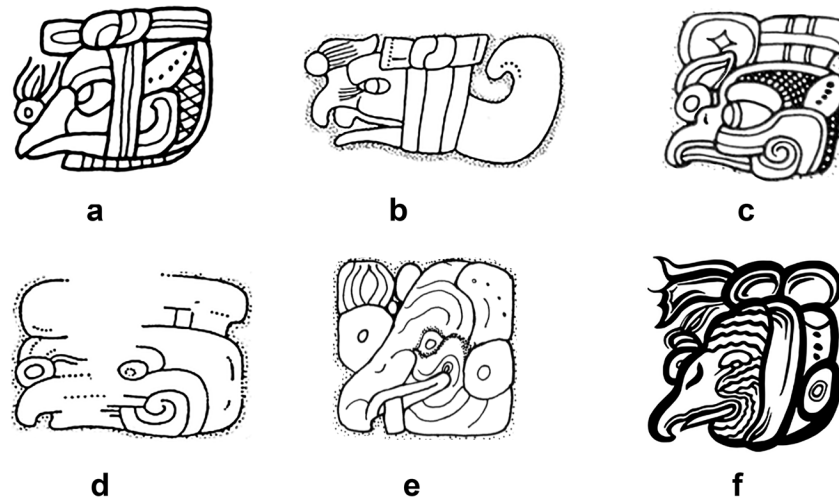

Fig. 3. T747/BV3: **a**. TIKBM E2, after Linda Schele (Schele and Freidel 1990:150 fig. 4:19a), **b**. TIKSt4 A5, after William Coe (Jones and Satterthwaite 1982:fig. 5), **c**. TIKSt31 E10 after William Coe (Jones and Satterthwaite 1982:fig. 52), **d**. CPNSt24 C2 after David Stuart (Schele and Grube 1990), **e**. PALTIw N12 after Merle Greene Robertson (1983:fig. 95), **f**. PALT21b G9 Drawing by Dana Moot II, used with permission.

Comparison of *ti*-like and *ta*-like forms in Mayan languages

Table 3 compares *ti*-like and *ta*-like prepositions in Greater Tzeltalan and Yukatekan languages. These dictionary entries are by necessity abbreviated, and seldom record the entire range of the sometimes subtly contrasting uses. Yukatekan languages use a form of *ti,* either *ti* or *ti'*. The various dialects of Tzotzil and Tzeltal use only *ta*. It is the Cholan languages that use forms of both *ti* and *ta* to express a variety of prepositional relationships, best reflecting the situation we observe in the glyphic texts.

Language variation was probably no less present in the Maya region in the Classic Period than it is today. We do not know to what degree the language or language dialect of the Maya texts reflect the language variety of the elite or the general population of any given community. The data assembled for this report show that the earliest carved texts used **ta**, almost universally. This was followed by a period of reduced carving activity. Then, in the seventh century when monument carving began to be widespread again, in most texts in most sites in the central region, **ti** replaced **ta**. This change did not reach the extreme western sites.

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[11] Justeson (1984:355) cited Lyle Campbell as suggesting **TA'HOL** as a rebus of *ta hol* 'at head, and Jim Fox, John Justeson, Floyd Lounsbury, Peter Matthews, and Berthold Riese noting the term *ta'hol* for vulture as a motivator for the value **ta**. Stross (1989:154) also suggested *ta'* 'excrement' as a motivator for the vulture name and the syllabic value **ta**.

Among many possible scenarios, minimally we can say that the majority of scribes/sculptors of the Peten in the Early Classic were speakers of a dialect that maintained *ta* as a preposition, a particular trait characteristic of Greater Tzeltalan languages. Whether this preference for **ta** reflected the speech of all or any inhabitants of the locations of these monuments is not known. Later we see an increase in the number of texts, and an increase in texts produced by sculptors using **ti**. Carvers at Tonina continued to use **ta** throughout its history, with **ta** usage at Palenque and neighboring sites documented later. In the northern Yucatan peninsula several sites that seem especially associated with the Peten (e.g., Coba, Ek Balam) use **ti**, while Chichen Itza and a majority of sites to the west use **ta** or are mixed. We do not have evidence that the **ta**-using sites of the north, most of them quite late, can be directly associated with the **ta**-using sites in the south. This phenomenon may be the result of an entirely unrelated political, linguistic, or scribal history. The goal of this paper is not to argue for any one of the multiple possible explanations for the variety of prepositions in the monumental texts of the Classic period, nor to associate the differences with specific Mayan languages. The aim is simply to sort through a large amount of data to shed light on patterns of variation.

Table 3. Prepositions similar to *ti* and *ta* in Greater Tzeltalan and Yukatekan languages.[12]

LANGUAGE SOURCE	TI	TRANSLATION	TA	TRANSLATION
Cholan Languages				
Proto-Cholan				
(Kaufman and Norman 1984:139)			*tä	preposition
Ch'orti'				
(Hull 2016:402, 383)	ti	in, at, for	ta	in, on, at, to, about, for, from, with, according to
Ch'olti'				
(Morán 1935:26)	ti	in/on	tama	in/on
(Sattler 2004:398, 399, 404)	ti	local, instrumental, partitive; introduces conditional subordinate clauses	tama	position in a 3-dimensional space
			taka	with, also
(Robertson, Law, and Haertel 2010:196)	ti	in, on, at, by, for, etc.	ta, tama	in, inside
Ch'ol				
(Warkentin and Scott 1980:98)	ti	in, toward, for, from		
Yokot'an				
(Knowles 1984:232, 461, 463, 465)	ti'	beside, at the edge	tä	to, from, by
			ta	for, belongs to
			tan, tama	in, inside
(Keller and Luciano G. 1997:221, 228, 239)	ti'	on the edge, beside	ta	for, from, in/on
			tä	toward, in/on, from
Acalan Chontal				
(Smailus 1975)	ti	a variant of ta	ta	in/on, to, toward
(Macri 1991)	ti[13]	partitive, benefactive	ta	locative, temporal preposition

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[12] Translations from Spanish are by the author. These forms do not exhaust the number of prepositions and prepositional constructions that occur in these languages.

[13] Bricker and Orie (2014:193) offer the example of *ta kah* and *ti kah* as evidence that *ti* and *ta* both signify schwa. The presence of schwa may account for this specific variation, but it is not evidence that *ti* and *ta* are not otherwise contrastive. Macri (1991:267) notes that in the Acalan manuscript *ta* occurs 80 times in locative expressions, while *ti* occurs 16 times in temporal expressions, nine times with name of office, and six times to describe a manner of speaking.

introduces subordinate clauses

Tzeltalan Languages

Tzeltal
    (Polian 2018:543)   ta   locative preposition
Tzotzil
    (Laughlin 1975:327)   ta   among, at, before, by, from, in, to
    (Laughlin and Haviland 1988:305)   ta   preposition, from, with

Yukatekan Languages

Mopan
    (Hofling 2011:407, 408)   ti/ti' to, at, for, from
                                                                      ti'i(j) for
    (Ulrich and Dixon de Ulrich 1971:318)   ti   in/on
Yukateko
    Cordemex (1980:78)   ti'   toward, in/on, with
  (Bricker, Po'ot, and Dzul de Po'ot 1998:274) ti'   to, at, in, from, for
Itzaj
    (Hofling and Tesucún 1997:572, 590, 593) t-/ti to, at, on, from
                                                                      ti'   in, at, on, to, from
Lakantun
    (Hofling 2014:332)   ti'   over there, to, toward, for

Further Research

Several avenues of investigation remain to be explored. The period of reduced monument dedication followed by the replacement of **ta** by **ti** suggests a number of intriguing cultural and political questions. What was different about the script and the social setting in these sites once carving resumed? Was the knowledge of reading and writing maintained at the sites during the hiatus, perhaps in books, or did it die out in some places only to be reintroduced by newcomers? As tantalizing as these topics are, they are beyond the reach of this report, focused as it is only on identifying and presenting data on patterns of prepositional usage.

The presence of complementizers, of words that introduce verbal constructions or phrases has only been touched on in this report. This and other non-locational/non-temporal functions, even of the *ti/ta* preposition, has only been hinted at. Finally, a number of other prepositions and preposition-like constructions occur in Classic texts. These include relational nouns, for example, **u-pa-ti** 'behind', as well as more common prepositions: **yi-chi-NAL** 'in front of', and **TAHN** 'in the middle'. Looking at geographic and temporal distributions of these items can offer further insight into scribal practices and potential dialect and ethnic boundaries.

Many texts on portable objects have proveniences or have likely proveniences. A few of them have dates, and many can be dated approximately by text and iconographic style, and occasionally by the names of known rulers. Adding these texts to this data set would, however, introduce another question: did the script recorded by the monument sculptors differ from the script employed by painters or carvers of small objects? We cannot assume that the differences or similarities between these traditions were the same across the entire Maya region. An even more complex problem is understanding how these relationships might have changed over time.

A thorough examination of the **ti** and **ta** prepositions in each of the three Maya codices has been done by Macarena Soledad López Oliva (2012). Her judgement seems to be that in the codices the variation between **ti** and **ta** is not distinctive. A second look at the codical data may show whether some of the explanations for variation suggested above applies to some of the "non-distinctive" examples. Such a discussion might reduce the impression of randomness, and may ultimately offer a clearer understanding of the origins of and relationships between the various almanacs.

The methodology shown here, made possible by the MHD, includes both a comprehensive account of a single feature across time and space, and the documentation of an early to late change observed at sites with texts dating from the Early to Late Classic. This report offers a model for evaluating previous investigations with respect to time and location,[14] and more importantly, a template for future research into the linguistic, cultural, and political spheres of the Classic Maya.

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[14] Examples of a few of these studies include: contrasting times and locations of verbal suffixes **la-ja** (*laj*) and **wa-ni** (*wän*) (Mora-Marín, Hopkins, and Josserand 2009), Pierre Colas' proposal of an east-west ethnic boundary based on naming practices of rulers (Colas 2006), and an examination of Classic Maya ritual traditions (Munson et al. 2016).

Appendix. Sites used in this study

Site Name	Code	Cat.	Early	Late
Aguateca	AGT	EL	ta	ti
Altamira	ALM	ti		ti
Altar de Sacrificios	ALS	EL	ta	ti
Balakbal	BLK	ta		ta
Bonampak	BPK	EL	ta	ti
Cacabbeec	CCB	ta		ta
Cahal Pech	CLP	ti		ti
Calakmul	CLK	EL	ta	ti
Candzibaantun	CDZ	ta		ta
Caracol	CRC	EL	ta	ti
Chactun	CHT	ti		ti
Champerico	CHP	ti	ti	
Chancala	CCA	ti		ti
Chichen Itza	CHN	ta		ta
Chinikiha	CNK	ti		ti
Chinkultic	CKL	EL	ta	ti
Chuncanob	CNB	ta		ta
Coba	COB	ti		ti
Comalcalco	CML	ta		ta
Copan	CPN	EL	ta	ti
Dos Caobas	DCB	ti		ti
Dos Pilas	DPL	ti		ti
Dzibanche	DZB	ti	ti	
Dzibilchaltun	DBC	M		M
Edzna	EDZ	M		M
Ek Balam	EKB	M		M
El Caribe	CRB	ti		ti
El Cayo	CAY	ti		ti
El Chicozapote	CZP	ti		ti
El Kinel	KIN	ti		ti
El Manantial / Ch'anal	MAN	ti		ti
El Pabellon	PAB	ti	ti	
El Palma	PMA	ti		ti
El Palmar	PLM	ti		ti
El Peru	PRU	EL	ta	ti
El Temblor	TMB	ta	ta	
H-Wasil	HWS	ta		ta
Halakal	HLK	M		M
Ichmac	ICC	ta		ta
Ichmul	ICL	ta		ta
Itzan	ITN	M		M
Itzimte Bolonchen	ITB	ta		ta
Ixkun	IXK	ti		ti
Ixtutz	IXZ	ta		ta
Jimbal	JMB	ti		ti
Jonuta	JNT	ta		ta
Kabah	KAB	M		M
Kajtun	KJT	ti		ti
Kayal	KYL	ta		ta
La Amelia	AML	ti		ti
La Corona	CRN	EL	ta	ti
La Honradez	HRZ	ti		ti
La Mar	MAR	ti		ti
La Naya	NAY	ti		ti
La Pasadita	PSD	ti		ti
Labna	LAB	ta		ta
Lacanja Tzeltal	LTZ	ta		ta
Laguna Perdida	LGP	ti		ti
Los Alacranes	ALC	ta	ta	
Los Higos	HIG	ti		ti
Machaquila	MQL	ti		ti
Motul de San Jose	MTL	ti		ti
Naj Tunich	NTN	ti		ti
Nakum	NKM	ti		ti
Naranjo	NAR	EL	ta	ti
Oxkintok	OXK	ti		ti
Palenque	PAL	ta		ta
Piedras Negras	PNG	M		M
Pol Box	PBX	ti	ti	
Pomona, Tab.	PMT	M		M
Pusilha	PUS	ti		ti
Quirigua	QRG	ti	ti	ti
Resbalon	RSB	M	M	
Rio Azul	RAZ	ta	ta	
Sabana Piletas	SBP	ta		ta
Sacul	SCU	ti		ti
Santa Elena Poco Uinic	SEP	ta		ta
Santa Rosa Xtampak	SRX	M		M
Seibal / Ceibal	SBL	ti		ti
Sisilha	SIS	M		M
Tamarindito	TAM	EL	ta	ti
Tikal	TIK	EL	ta	ti
Tonina	TNA	ta	ta	ta
Tortuguero	TRT	ta		ta
Tres Cabezas	TRC	ta	ta	
Tres Islas	TRS	ta	ta	
Tulum	TUL	ti	ti	
Tzum	TZM	ta		ta
Uolantun	UOL	ta	ta	
Uxmal	UXM	ta		ta
Uxul	UXL	ti		ti
Xcalumkin	XLM	ta		ta
Xcocha	XCA	M		M
Xcoralche	XCR	ti		ti
Xkombec	XKB	M		M
Xultun	XUL	ti		ti
Xunantunich	XUN	ti		ti
Yaxchilan	YAX	EL	ta	ti
Yaxcopoil	YXP	ta		ta
Yo'okop	YOK	ti	ti	
Yula	YUL	ta		ta

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