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Time and Script in Ancient Mesoamerica

En Mesoamérica se encuentran la única escritura regularizada del trópico del planeta (la de los maya), además de unos sistemas calendáricos notablemente complicados. Dada la íntima conexión entre los dos fenómenos, se intenta demostrar que el factor decisivo en el sistema de los maya, en cuanto a escritura y calendario (el 'Long Count' de la época clásica), fue la ecuación de una entidad aritmética con el día solar, ecuación que falta en otras culturas mesoamericanas (la tolteca, la mixteca) donde se empleaba el sistema de 'cargadores de años' ('year bearers') y de un año solar de 365 'días' que no podían ser siempre iguales. De ahí se sugieren unos paralelos entre esta aritmética rudimentaria, pero tan esencial como fértil en consecuencias lógicas, y la gramática de la escritura jeroglífica de los maya.

To say that ancient Mesoamericans were preoccupied with time hardly runs the risk of controversy. Even modest commentaries on their culture abound with references to their obsession with it, to the hypnosis it exerted on them, to their dependence on it as a prime reality. Now this focus of ours on their 'obsession' coincides with a focus of modern philosophy generally. J.R. Lucas's recent "Treatise on Time and Space" opens with the statement that the former is 'more fundamental' than the latter. For their part, Toulmin and Goodfield have recorded the Western "Discovery of Time" which culminates

in post-Einstein cosmologies. This coincidence of focus is unfortunate insofar as it can obscure the difference between a 'fourth' and a first dimension.

Whatever logical statements may or may not be made about time and space as universal concepts, it is clear that in the Western tradition scientific measurement of the one has been intimately related to that of the other. The sexigesimal system of minutes and seconds which the Babylonians initially derived from celestial co-ordinates still has a temporal as well as a spatial application. Similarly, much of Lucas's flourish in favour of time would be lost if geometry had never existed. For the ancient Mesoamericans, however, time, and time only, was scientifically everything from the start. Elsewhere (Brotherston and Ades 1975; Brotherston 1975a) we have shown that as the only tropical astronomers on the planet they had no verifiable cardinal points, and that their cosmos lacked reliable spatial co-ordinates, and certainly all geometry. Indeed, the notion of 'points' and 'lines or spaces between', in the strict sense, was foreign to them. Cassirer (1964: 107), for example, derives the Old World concept of spatial or temporal interval from the intersecting of the sun's east-west line by that 'perpendicular running from north to south' which the Mesoamericans never drew.

Having no place to stand (Archimedes: 'Give me somewhere to stand and I will move the universe'), the Mesoamericans had other 'grounds' for knowledge and an epistemology that was restricted to their one 'dimension', the single, temporal east-west direction. Hence that enormous concentration of thought into time. While undivided and unmeasured in our terms, time was however systematically expressed in the notations of calendar arithmetic and astronomy. As a result, what might appear to us to be casual or random 'variations' in these notations, as local or idiosyncratic 'usages' within Mesoamerica, will in fact sooner reveal logical distinctions, the consequences of which we may explore.

Our advantage in this matter is that such 'variations' may be very finely gauged because certain methods of reckoning time, notably by means of the 'Calendar Round' of 52 years, were used by many different peoples in Mesoamerica and can be traced back well into the first milennium B.C. Our disadvantage is that pre-Columbian source material is most unevenly spread between these peoples, and that very scanty evidence remains of the nature of the earliest calendars, of the Olmec, the Zapotec, and the pre-classic Maya. Thus, while this enquiry by no means pretends to cover all known conventions of time reckoning in the Mesoamerican area, the pre-Toltec calendar of the Southern Zapotec, for example, or the Maya 'Short Count', it does seek to place and contrast conventions which are apparently similar.

The main reason for doing this is to examine the connection between time recording and script, which Barthel (1968: 283) has called 'nothing less than defining criterion of Ancient Mexico'. The approach may perhaps be premature, in view of the growing discoveries of 'proto-scripts' at Teotihuacan,

Xochicalco, Monte Alban and the Olmec gulf coast sites (Kubler 1962: 37-41). On the other hand enough evidence is available for some sort of comparative analysis of 'essential' forms. We attempt to relate a modest reading of primary sources (in facsimile and photographic form) (1) to fundamental interpretations by Seler (1902), Thompson (1960, 1962 and 1965), Caso (1965 and 1965 a), Nowotny (1961), Barthel (1968), Satterthwaite (1965), and others.

It is hardly anticipating the main argument to say that the most obvious difference between Mesoamerican methods of time reckoning is between those which used Long Count arithmetic and those which didn't. The Long Count, with its attention to units of time and its place notation, seems in fact to have been restricted to the Maya and the Gulf Coast Olmec, even though the peoples surrounding them can hardly have failed to notice or understand it. Now it is precisely the Maya (since almost nothing remains of Olmec writing) who may be said to have produced the only script worthy of the name not just in America, but in the tropical zone of the planet (Diringer 1968). This exclusive development of arithmetic and script was far from random and points to important connections between the two in tropical epistemology. In order to suggest how this may be so we should look at what reckoning and not reckoning with the Long Count meant in practice. In other words we should look again at the Mesoamerican calendar as it existed without Long Count arithmetic.

As social time counts, calendars may usually be described as continuous or discontinuous; or again, as more, or less consistent with astronomical time. Discontinuous calendars present no problem. A run of dates, of civil, agricultural or religious significance, is initiated by some astronomical event, lunar or solar or planetary or stellar or some combinations of these, or by a sign of seasonal change like the Nile Flood. But precisely because such a run or series does not attempt to fill time it need not account for or be responsible to astronomical cycles in their entirety, these being far from easy to match with each other, lunations expressed as solar days being a notorious case. Conversely, astronomical time counts may in themselves become extremely detailed and exact, as they became in China and Mesopotamia, before being integrated into a social system, that is, before being made usable in day-to-day terms. In the West, Ptolemy's 'Canon' of Babylonian astronomy was not put to social and historical use in this sense before 400 A.D. (Toulmin and Goodfield 1965: 28-29).

An expression for 'now' like '2.15 p.m. Monday 30th December 1974' reveals the composite nature of our everyday descriptions of time. Monday, logically a redundant term, like December (since 30th of 12th in 1974 = 364th) belong to rounds of names which are rooted in myth, in the case of the month, some (January) deeper than others (December). Named weekdays are used as a memorable sequence and for their qualities as kinds of days among given societies, social classes and individuals, these qualities deriving in part from usage, but also from residually inherent force. It is of course precisely this force, which itself has nothing to do with astronomical time, which revolutionary calendars have tried to counteract. Although it has this charac-

ter, and although it proceeds in unbroken sequence regardless of anything exterior to it, the week nonetheless has been long fixed in time as a set number of solar days. As a lunar survival, the month has lost all loyalty to that origin and also yields to solar time via the leap year. And it was nothing but the movement of the sun through north-south meridians which gave the yet more exact and completed solar time of 2.15 p.m. We may then say that the basic, non-redundant elements in our usual description of 'the time', division of day, day and year, are not just astronomical but solar in origin. Of course the very calculations which led to early estimates of the length of the solar year also soon disclosed a discrepancy between it and the sidereal year (due to the effect of precession), just as they later allowed for accurate measurement of the difference between solar and mechanical time (at the time mentioned solar anomaly means that the clock is in practice some minutes at variance with the hour and minutes 'post meridiam'). But the generalization holds (see Neugebauer 1951).

In turning to Mesoamerica we may ask, to what extent and how was time reckoned in astronomical terms, and when it was, in terms of what kind of astronomy. If the argument of two previous papers is correct (Brotherston and Ades 1975; Brotherston 1975 a) we should not necessarily expect to find years, days and division of days like ours. All the evidence suggests that the north-south, midnight-midday meridians, or their geometrical equivalents, by which these time units were determined were unknown in Mesoamerica.

THE TWENTY SIGNS, THE SACRED AND THE CALENDAR ROUNDS

A common feature of almost all Mesoamerican calendars was twenty signs. Although the most frequent use of these signs was calendrical with and without the Long Count, as a body or corpus they may be seen to have had inherently nothing to do with time. Their particular origins are still in part obscure. But there can be no doubt that they manifest mythic forces and elements like Wind, Snake, Death, Water, Dog, Flint, Rainstorm and so on. When the origin is celestial, Venus for example, the sign is no more bound to the <u>time</u> of that body than Monday is to the moon. Beyond the fact that it is not temporal, the detail of these origins need not concern us here.

More important is the consistency that the twenty signs display as a sequence of meanings, in quite varied cultures and languages. Though the pre-Toltec signs at Monte Alban diverge somewhat, there is a marked coherence elsewhere, among the Maya from pre-Classic times, the Mixtecs, the Aztecs and other Nahua groups, and peoples yet further afield like the Otomi. Equivalence of the set, between one culture and another, is usually of concept, quite different words being used locally for the same or a recognizably related sign. But it may also be phonetic, the sound of a given sign suggesting a similar but more familiar meaning and sign in another language. The sets of signs vary, then, according to time and place; but not in such a way as to obliterate their existence as a patrimonium commune (Seler 1902: 503). Both in age and range of use they appear as a primary ordering of Mesoamerican reality : a sequence of shapes that was translatable but in any one case initially indispensable.

The fact that the signs amount to twenty means not so much derivation from the total of man's digits as belief in that quantity as a body, the prime entity. In Yucatec the signs are collectively called the uinal, a close cognate of uinic, man, two words which are actually identical in other Maya languages. In the Book of Chilam Balam of Chumayel (pp. 60-61) the creation of the uinal is not a cumulative process, for its existence precedes and is presupposed by that of its parts. (This may appear the more remarkable when we consider, as we do below, that the uinal of the Maya had undergone more thorough arithmetical analysis than its counterpart elsewhere). In the documents of other cultures, pre- and post-Conquest, we find arrangements of the signs around and fused with single or twin bodies, of gods, animals and men (Laud: 2; Borgia: 17; Vaticanus B: 96; Mexicanus: XII; Fejérváry: 1 (see Nowotny 1961: 214-216, and fig. 1-2).). However, in contrast to similar arrangements in European astrology, of anatomy in relation to the signs of the zodiac for example, the position of the Mesoamerican signs in these drawings is not constant. In other words they are subject to no law above their own, this law being one of sequence. To this extent the logic of the whole body of signs is temporal rather than spatial, since they have no fixed place except next to each other, serially. This quality of the twenty signs taken together makes them admirably suitable for calendrical use, and may indeed have been assured by such use. At the same time we should be alert to their independent existence, with implicit and immutable order, and to their frequent use, right up to the Conquest, independently of astronomical time. Caso (1956: 956) has discussed their purely 'religious and magical significance' on bone carvings at Monte Alban (Tomb 7), a significance most thoroughly vindicated in general by Nowotny (1961: 206).

The temporal logic of the signs was exploited in various ways. Among the Aztecs for example, they identified the succession of epochs or 'suns' of the world, past and present. By far their commonest function, however, was together with numbers, from 1 to 13, to produce 260 moments or distinct combinations, generally called the 'Sacred Round' (the tonalpohualli of the Aztecs). To know the exact relationship of this round to astronomical time, of year or day, once again in non-Long Count systems, is by no means easy.

Arrangements of the Sacred Round in the codices, where it remains uncorrelated with any recognizable temporal period, do not of themselves specify what lengths of time were involved, if indeed unit lengths were involved at all. Sooner than time measurement we find a reflexive concern with internal grouping: four lots of 65, five lots of 52, and so on, the patterns between moments being all-important. Given what we can deduce about the signs as a primary entity, and that the numbers 1 to 13 were themselves apparently thought of as divine rather than unitary, this kind of self-sufficiency need not be surprising. At least, as divinatory documents of professionals in the mantic and ritual arts, they would have had a raison d'être from their inherent qualities alone, from their own immanent magic. For the concern was clearly with divine associations through 'regents' and

emblems, and the propitiousness (good, bad or indifferent) of given moments, alone or in sequences, and in varying general contexts. How these meanings were interpreted, as from cards in the pack, and were applied to present time remains another matter. When we see a fire quenched by water at the moment '8 Water' (Laud: 25) in a series dealing with funeral rites we realize that the fixing of the moment depends on a logic other than that of astronomical time. For the same reason it cannot be too strongly emphasized that the mantic art of the Sacred Round, in the reading of dreams and omens or the divination of fate, was not astrological and had no such dependence on exterior space and time (a distinction blurred more generally by Cassirer (1964: 93)). This view of the Sacred Round is explicitly confirmed by Molina's Vocabulario. Though tonal is associated with 'sun' and poa means 'to count', tonalpohualli, the Sacred Round, is said to be something by which signs and dreams are divined; tonalpoa means 'sacar las fiestas' or decide on the actual date of a particular festival, the implication being that such dates were not obvious from astronomical time alone. Arrangements of the Sacred Round may be linear or tabular, abbreviated or in extenso, partial or whole. But only when the Sacred Round is combined with a known time period may we guess at the actual temporal value of its moments.

In calendrical (as opposed to mantic) use, the Sacred Round was most commonly combined with the solar year, to produce the Calendar Round of 52 years, the largest time period normally available to cultures which did not employ the Long Count. For these calendrical purposes the solar year was expressed as 365 'days', 365 being in fact nearest to the number of whole days in the year. This figure was fixed upon very early, for the Calendar Round also belongs to the pre-Classic stages of Mesoamerican cultures (Satterthwaite 1965: 606). It could have been decided on as a result of a tally of sunrises between two annual heliacal risings of a star, or between a solstitial or other sunrise or set position on the horizon (Merrill 1945), these methods being widely used for the purposes of adjustment in later stages of the culture. Which brings us to the crucial realization that the very methods which produced a figure as 'close' as 365 must have shown from the start that it was only approximate in terms of equal days. In other words, the decision to integrate the Sacred Round with the solar year (every 365th of the continuing succession of 260 'days', with its numeral and sign, was specified as a 'year bearer', to give 18,980, or 365 x 52 four-element combinations) must have been made with the full awareness that these combinations, as days, would be mostly, but not always, equal to periods from sunrise to sunrise (or sunset to sunset). So that while we may fairly speak of the 52 years of the Calendar Round, be they sidereal or solar, we hesitate to identify its days as ours (of which more like 18,993 elapse over 52 years).

What constituted a day in anything but Long Count arithmetic is in any case notoriously uncertain. We don't know when it was supposed to begin or end, or of its relationship to the night period, which apparently had a count

to itself. Mesoamerican astronomy was not of the kind to have led to internal measurement of day or night, or to the formal description of them in equal or equivalent periods of 'hours'. Again, words for day are sometimes related to 'sun' (as in the Zapotec chij), but this sun referred also to world ages (as among the Aztecs), and the solar sign conventionally denoted the year in the Mixtec codices. By contrast the year is firm in vocabulary and design, as is the Calendar Round, always equivalent to itself. Because 365 is divisible by 20 with a remainder of 5, only 4 of the twenty signs, each five positions away from the next, could serve as year bearers, the 52 years of the Calendar Round being a product of these four signs and the 13 numerals. Now in the codices these signs are shown to be interchangeable parts of set, by being encircled or put in boxes, or by being attached the solar sign mentioned above (fig. 3). Formally, they are proposed as the 'same sort of thing', in a way unavailable to other 'day' dates in calendrical use, a point of enormous consequence for our discussion below of the Long Count day. Further, like the Calendar Round or xiuhmolpilli the year could be denoted abstractly as a concept, divorced from any particular date. This appears not to have happened with the 'day' in pre-Conquest times and once again the contrast with Long Count practice is crucial.

In several pre-Columbian contexts the year bearer signs are associated with the likely means of how their position in astronomical time was determined. The diagonals of Fejérváry page 1 (fig. 1) may well be understood to be solstitial. The New Year ceremonies in the Madrid page 34, show an eye connected by a spanner-like device to one of a circle of stars, a possible depiction of an annual heliacal rising. Yet other possible devices are suggested in the Mixtec codices, an eye between crossed sticks, for example, used to discover a star's altitude, ad hoc. Admittedly much of the detail of the adjustments of astronomical time to the calendar (it is better understood this rather than the other way round) remains obscure; but there can be little doubt that they are as old as the Calendar Round itself. All available evidence indicates that from the moment of the first correlation of the Sacred Round with 365 'days' up to the present, the agricultural and religious years of peoles using only that reckoning have not got seriously out of line with astronomical time.

For such agricultural and religious purposes the year of 365 'days' was divided up into 18 months of 20 and 1 month of 5 such days. The names and etymologies of these months, by contrast with those of the twenty signs, vary extremely from group to group, as does their particular fixing in astronomical time, suggesting no conceptual norm. The enormous differences in rainfall patterns and hence agricultural practice from area to another, and, above all, the undifferentiating course of the sun to north and south of the zenith, meant nothing like the 'seasons' of the temperate zones developed as general concepts. Molina's "Vocabulario" lists summer and autumn and winter as tonalco, while wet and dry months were correlated quite differently elsewhere. On the other hand, in the case of any one group, in a given locality, the 19 ceremonial months, appear to have been firmly fixed to astro-

nomical time (with a new year in, say, March or December) via the adjustments proper to the 365 'days' of the Calendar Round year, so that local agriculture and religion did not 'slip' in relation to local seasons. As we shall see below, things were different in the Long Count system, where the need for arithmetical consistency, of day units, led to an effective disregard of the seasons of the solar year. Where this system was not used, however, adjustment seems not even to have been considered a problem.

Victor M. Castillo (1971) has recently compiled evidence on these matters from a wide variety of sources. His main argument, superbly developed, shows how certain principles operate amongst a mass of intricate and confusing material. His main example from the pre-Conquest period is the Aztecs. They made of every fourth year something like a leap year by extending the limits of a 'day' in the second festival of the month Izcalli, which as a result ran into the period of five vague 'unnamed' days called nemontemi, the ceremonial and agricultural months thus keeping in step with the Calendar Round and the number 365. To have a birthday during this astronomically inconstant time was considered a dangerous fate, and during the Izcalli festival everyone was required to be drunk, even children, so that abnormalities in the limits of the day should not be unduly noticed. For us the important thing is clearly that a day could at all be defined as anything but more or less 24 hours. During the fire-drilling ceremonies which accompanied the start of a new Calendar Round, an additional and special adjustment was made by reading the movement of the constellation mamalhuaztli, so that over milennia 'seasonal' discrepancy would have developed because of effective reliance on sidereal rather than solar time (the difference between the two arising from precession). The Aztec empire did not last long enough for such a discrepancy to become noticeable, and too little is known about other non-Long Count civilizations prior to the conquest to say how it might have been dealt with had it become apparent as a result of practices similar to the Aztecs'. Information on the practice of modern Indians still using a pre-European calendar (Castillo 1971; Villa Rojas 1968; Berlin 1967; Gossen 1974) suggest that nowadays a date in the Christian calendar may provide the same kind of ad hoc annual term, logically and systematically of no consequence, as was and is otherwise provided by a sunrise position or some similar phenomenon.

The non-definitive relationship of the parts of the calendar to equal divisions of astronomical time, and the logical prevalence of the former, is constantly affirmed in the pre-Conquest codices. A good example is again page one of the Fejérváry (fig. 1), with its year bearers symmetrical to anatomy and groups of the twenty signs, unqualified temporally or even numerically. Yet more interesting are the cases where the logic of the calendar is less apparent from spatial patterning alone. The 52 pages of the obverse of the Vienna Codex deal with ten ritual fire-drillings, which among the Aztecs accompanied the start of a new Calendar Round. The section devoted to each may be 'read', right to left, along a boustrophedon course, from preparatory beginnings to the culminating ritual act. And along some of the course

the reading is undoubtedly coincident with time. Examples are the birth of the Mixtecs from the tree of Apoala (p.37), which unquestionably goes in one direction, and the rise of Quetzalcoatl as Venus over 193 days (p.48 : fig. 4), again a movement one way. But such narrative effects, on close inspection, turn out to be entirely local, and in the second case are actually confined to a 'tributary' to the main course of reading. The many year dates in the ten sections in fact violate all chronological sequence within those sections (fig. 5), and cannot be considered as successive moments in a temporal reading stream. These dates, like the birthday names of the characters represented, owe their position and validity not to the chronology of astronomical or even experiential time, but to ritual and the exigencies of mantic religion.

Several of the pre-Columbian codices may nevertheless be described as historical. In the Selden, the Bodley, the reverse of the Vienna, the Becker, and passages of the Nuttall, we find undeniably narrative accounts of the lives and deeds of characters and dynasties, accounts which acknowledge the irreducibly sequential nature of genealogy and political power. After the European conquest, the Mixtecs indeed handed codices in this genre (naandeye) or tonindeye) to Cortes so that he might continue the story. Here the reading order or sequence is again boustrophedon, though often a boustrophedon of a more consistent formality. And the flow is now so strongly in one direction that movement against it may be indicated by gesture, or a contrary trail of feet. Successive dates are supplied by year bearers, marked by one of the conventions noted earlier, and Calendar Rounds follow each other end to end. Caso and others have interpreted large spans of Mixtec history from these sources, matching their years with ours back from the time of the Conquest.

Between the year bearers on the pages of these codices, as it were in suspension, we find internal sequences of days, indicating time elapsed between proximate events. We cannot assign these subsidiary day series to exact days in our calendar without knowing the detail of the method of adjustment used by those who recorded them. In some cases we cannot even be sure which part of a year they belong to since 260 is less than 365 and certain days will always occur twice in any one year. For this reason it is not helpful to refer to these subsidiary narratives as 'Secondary Series', as some have done (Nowotny 1961 a: 10) if this means equating them with the Secondary Series glyphs in the Maya Long Count. What is lacked by all Mesoamerican history narrated with reference to anything but the Long Count is precisely an unvarying correlation of the day with calendrical notation. The suspended day sequences may thus be sooner thought of as 'discontinous' within the conceptual year, or as embellishments on historical narratives which otherwise have more in common with the Winter Count of the Mandan Sioux or the annals of the Palermo stone.

As a genre, Calendar Round histories are doubtless linked with the annals compiled in native and European conventions after the Conquest. In post-

Conquest Aztec documents at least, we find unequivocal confirmation of the primary importance of the year and the 52-year period for history, in uninterrupted rows and blocks of boxed signs to which information is attached only where appropriate, even in a 'space' which is otherwise more like that of a route map, in the Boturini codex for example. In the post-Conquest world, this particular use of the corpus of twenty signs was the one which more interested Europeans, and those Indians who strove to adapt to new conventions and priorities. Conversely, it was precisely the mantic (priestly) use of the signs which fell into oblivion, with the demise of those who possessed the esoteric knowledge necessary for understanding them.

This brief account does not pretend to do justice to all the apparent functions of the twenty signs, alone, in the Sacred Round or in the Calendar Round. The important point is the suggestion that the signs, with or without numerical co-efficients, may not be exclusively identified with our days even if they most often had that value in practice. For it is precisely the capacity to make that identification, invariably and universally, which distinguishes the Long Count system.

THE LONG COUNT

The Long Count is generally said to have come into being through a process of accretion. Satterthwaite speaks of it as a 'Proto-classic addition' to the Calendar Round (1965: 606). Week-like cycles or rounds are supposed to have combined with those which made up the Calendar Round, to produce ever larger periods of time. True or not, this would still not account for the distinctive features of the Long Count in its Mesoamerican context. Similarly Morley's rules (1915) may excellently instruct us how the Long Count worked, with its intricate differences from our time count, without our needing to realize the logical steps that must have been taken to produce that system, once again in its context. Part of our difficulty in treating it here is that even in the very first examples of its use all those steps appear to have been taken already.

The fundamental fact about the Long Count is that it equates one day with one unit. From the first the fact is formally recorded by an encircling of the twenty signs to make 'counters' of them, each equivalent in value to the rest (fig. 6). The essence of the calendar becomes, then, not the year or the Calendar Round, but the day-unit. The encircling of the signs makes of them usable counters in the sense that they are complete, of completed time like our hours and minutes, and dispensable within arithmetical logic. Though their sequence remains the same, the encircling also circumscribes whatever mantic or other power each may possess, making it accountable to a given astronomical event (a day) or conceptually, to itself, and not to the magic of the Sacred Round, for which no term is recognizable in Maya.

The formula '1 day = 1 unit' was applied not just to the 260 combinations of the Sacred Round but to the 19 agricultural and ceremonial months of the

year (18 of 20 and 1 of 5 days): these now became constant in length and so slipped against the solar year, having arithmetical consistency but less and less seasonal relevance. The 365-day 'year', of 19 months each named by an an encircled glyph, was then combined with 260, in a sum reminiscent of the Calendar Round, to produce 18,980 differently named days. Only these really are days now within Long Count arithmetic, which has the effect of making the idea of the 52-year Calendar Round, with its year bearers and 'suspended' days, not so much redundant as logically incompatible. Though the day signs which could belong to the first of the 365-day year (or haab) varied regionally as a set of four (Thompson 1965: 649-650), they were no longer year bearers, but simply special cogs in the wheel. In classic times, when the calendar was officially determined by the Long Count, New Year's day, like any other day in the year, was expressed as a date by a combination of the Sacred Round day with the day of the month to give, say 4 ahau 8 cumhu, where the first of the names (conventionally given in Yucatec) is one of the twenty day signs, with a unitary co-efficient between 1 and 13, and the second is one of the 19 month signs, with a unitary co-efficient between 0 and 19 or 0 and 4.

Having this arithmetical consistency with what is 'actual' time for us, the day, as we may now legitimately call it, may be used to reckon periods of unrestricted length, simply by addition. As we have seen, Mesoamerican thought generally tended towards vigesimal counting. The Aztecs, for example, had special designs for 20 and multiples of 20 (fig.7). But, significantly enough, this method of counting was used only for tribute, sacrificial victims and the like, and never with the calendar, no doubt out of respect for the fact that 20 'days' with them could not be considered an invariable unit of astronomical time. Besides this, we find in inscriptions and codices (Fejérváry, Laud) a system of bars and dots denoting five and one, which in the codices was used as a more elegant form of addition. But similarly, the numerical co-efficients of the 20 signs did not there incorporate the short-hand mark for five, confirming the idea that the 260 moments of the Sacred Round were not so easily reduced to mere arithmetic. (The exact meaning of bar and dot numerals with calendar signs at Monte Albàn has still to be determined: see also below).

By contrast, the encircled days of the Long Count, being thus reduced, are fully interchangeable with arithmetic, even when the arithmetic involves not just short-hand expressions for five, but vigesimal place notation. Consistent with the encircling of the day to make it a unit in the first place, we find a sign for it as a quantity (kin), plus signs for twenty and multiples thereof: the uinal (20), the tun (360), the katun (7,200) and so on, each occupying its place in the ascending scale. In pure arithmetic, place notation yielded straight vigesimal multiples: 20, 400, 8000 and so on. As 360 days the tun was presumably used as the nearest number divisible by 20 to the number of days in the year, to give some rough idea of numbers of years involved in long range calculations. As such a guide the tun could of course be no more than rough. And since both 360 and 400 could occupy the same third place in ar-

ithmetical notation, the supposed Maya 'zero' sign is better said simply to be the 'absence' of one or the other (Ibarra Grasso 1970). But on the other hand, just because the year ceased calendrically to be the link with astronomical time that it was elsewhere, could its length be better related to other cycles (lunar, planetary) in numbers of identical days. Indeed, all claims that the details of such cycles are recorded except in the Long Count system are disputable, though they were doubtless generally known about. At best the so-called Aztec 'Sun Stone', and similar records, may relate whole solar with whole Venus periods. Seler was probably wrong to discover the stations of a Venus period expressed as days in the non-Long Count Borgia Codex (p.53; Nowotny 1961: 37 and 237); and if our argument so far is correct, he would have had to have been, in any case.

Much emphasis has been placed on Maya interest in coincidence in time, on how they used the Long Count to register 'resonance' between cycles of celestial bodies like sun, moon and Venus, these often echoing, no doubt because they are true, similar discoveries in the Old World, like the Metonic cycle and the Chang of the Chinese. In the classic inscriptions and the Dresden Codex, cycles of this kind are correlated with each other and with the Sacred Round, now considered less sacred than an instrument of calculation. At Copan 149 moons are registered as 4,400 solar days ; in effect the lunation was calculated to within .00039 of a day (Coe 1966: 161). Besides giving detailed information on the synodic cycle of Venus, the Dresden Codex equates 405 lunations with 46 x 260 or 11,960 days, and effectively locates eclipse periods within 18 days either side of the node, and possibly even allowed for the recession of the node (Coe 1966: 161; Andrews 1967; Thompson 1972).

This concern with resonance in time has occasionally led to the suspicion that the main content of the classic inscriptions, still largely undeciphered, is astronomical, and that the Maya understanding of time was cyclic rather than progressive or linear. However, from the start it has been clear that the priests at the various classic sites worked with a base date, from which contemporary and other dates were counted forward in days. This date, 4 ahau 8 cumhu, a day in a year c. 3113 B.C., marked the beginning of the present era, of 13 baktuns (1,872,000 days or about 5,000 years), like others notionally prior to it. Recent work on the inscriptions, saliently by Proskouriakoff, has shown that at several sites the patterning of glyphs in their irregularity hardly always suggest astronomical cycles, and would much sooner also record local historical events. This discovery can only increase our amazement at Maya recording of time, for as we noted above, in the Old World history in this sense was not integrated fully into astronomical time reckoning until comparatively late. The Maya rulers may perhaps be said to be the first on the planet to have been honoured with so cosmic a record of their existence.

The form of the inscriptions, on ceremonial stelae and elsewhere at the classic sites, has been excellently described by those who have deciphered them. But it is worth recalling here (fig.8) because of the intimacy, in Me-

soamerica, between time and script. Typically, an inscription opens with an 'Initial Series' glyph, indicating departure from the base date and containing in it a reference to the month to be arrived at in that reading 'series' or clause. This opening glyph is followed by an account of the days, in categories of decending order of magnitude, from baktun to kin, which have elapsed between the base date and the date desired, expressed in the normal way as day in the Sacred Round and day of the month. For example, Thompson reads 1 ahau 3 zip, 1,414,8000 days after the base date, as 15th March 761 A.D., possibly a contemporary date at Quirigua, where it was recorded. Characteristic of the inscriptions is the inserting of further information, on lunar and other matters, between the two parts of the date arrived at, between the Sacred Round day (1 ahau) and the day of the month (3 zip).

An Initial Series clause of this kind may be followed by another clause, commonly called Secondary Series, which carries the reader forward to a later date, also named in the normal way as one of 18,980 days. The series is called secondary because the time distance in days up to this later date was calculated not from the base date of the Long Count but from the date immediately preceeding it. Secondary Series, which may be called dependent clauses, usually read in ascending order of magnitude and are specified by a 'distance number' glyph which comes between the numbers of days and the named date. Unlike the so-called 'Secondary Series' of the non-Long Count reckoning, these additional dates may in principle always be unambiguously correlated with days in our calendar.

Although at first sight complicated and unwieldy, this system, by integrating astronomy (the tropical day) with mathematics (place notation), and both with an inherited calendar, provided its users with a means of expressing time unrivalled in any comparable society on the planet. The delight that was taken in its use is reflected in individual and local styles of glyph carving; the superb capitalization effects of certain glyphs against a smaller norm; the 'head variant' glyphs and indeed their variants which could replace numbers from 0 to 19; the most subtle interweaving of diagonal lines of glyphs, as at Copan and Quirigua (Morley 1915: 97-99, 190-193; fig.9). So vigorous a creative sense in reckonings of great precision was possible only because of the certainty of the basic notation. Though initially arithmetical, this notation came to combine harmoniously information which in other cultures long remained disparate. Which is why the Long Count cannot be separated from script itself.

MAYA SCRIPT

If Maya script is 'perhaps the only exception' (Diringer 1968: 81) in the general history of man's efforts to write, it deserves serious attention as such. Writing originating in other parts of the planet, and of Mesoamerica, shows only a slow approximation, if any, between the initially independent systems of speech and design. At first, and very few scripts went beyond this stage, the correspondence between the two is irregular in the sense

that while a given shape, or 'component' may early be fixed as a concept, or as a word, or even a syllable, it will appear among others where such correspondence is looser or of a different order. Moreover, the continuity of such shapes in syntactical terms, and their sequence, i.e. reading order, rarely developed in such a way as to produce writing as we can recognize it. In this, Chinese ideograms, Babylonian cuneiform and Egyptian hieroglyphs must historically themselves be held exceptional. In each of these scripts we may witness a long process of formation and regularization, as the concepts and categories of thought and speech were graphically ordered. Of course, this process was not always one way historically (towards phonetics) or logically, graphic design doubtless having affected thought and word. But how special a phenomenon this regularization was can best be judged by the fact that the many alphabets of the modern world probably all come from a single source.

What we have seen of the Maya classic inscriptions must suggest that the script used in them presents a contrast on almost all these points. Maya script appears all at once, ready formed, of well defined components, regularly arranged, in texts which are always distinguishable as such. Of course there are differences between the monumental texts of the classic period and the codices of the centuries immediately before the European conquest. But the essential characteristics of the system are there from the start. As Thompson has noted, we have no evidence whatever of stages of evolution prior to first appearance. It is possible, but unlikely, that other forms of Maya script, in this strict sense, preceded the one we know about, and are no longer extant. On present evidence, the least that we may assert is that Maya script, as we know it and in its Mesoamerican context, appears to have depended for its existence, in the first instance, on the Long Count. The Maya decision, then, to make arithmetic, astronomy and the calendar formally consistent with each other within the Long Count must be recognized for the intellectual development it provoked over and above the capacity to reckon astronomy and history in days and dates.

By making a day into a unit the Long Count produced three fundamental categories of formal expression: first, the 'main sign', for the calendar names of the day (within Sacred Round and month) and for day and vigesimal quantities of days; second, the affix, attached to one of the four sides of the squarish circle of the main sign, as its numerical co-efficient or specifier, and later as a particle of non-arithmetical grammar; third, the place or area to which combinations of main sign and affix, or glyphs, belonged, at first the rigorous position of arithmetic. As a system Maya script may fairly be said to be based on these categories, main sign, affix and glyph place, each of which is at least partly defined by the others. (Useful thoughts on this kind of definition, though in other contexts, are in Foucault 1970).

By enclosing of the twenty radical elements of Mesoamerican culture as 'main signs', the Maya made not just counters of them but conceptual identities, calculiform (to recall Brasseur de Bourbourg's epithet) in the fullest

sense. Their surrounding edge gave meaning to them as a series of things-in-themselves, their sameness depending on this formal limit, as a face or an eye, words which in Maya are related to 'within'. Glyph 715 in Thompson's catalogue, in its abstract purity, confirms this to be the case. That Maya main signs were 'heads' in this precise philosophical sense was one of the more genial intuitions of Charles Olson in the Mayan Letters (see also León-Portilla 1968: 46-47). Since the twenty signs, numerically qualified, are laterally equivalent to month days, the series of main signs is continued with signs for the 19 months, each capable of taking a numerical co-efficient or affix. A vertical dimension of equivalence is also there from the very inception of the Long Count, between the main sign for the day unit and signs for its vigesimal multiples, each in their appropiate notational place. From the primary unit 'kin', or day, or sun limited to that period, we move to 'uinal', which elsewhere exists only as a pictographic body, twenty being a different kind of sign; and 'tun', which like 'katun' is founded on the notion of stone as fundamental matter. (Because the exact phonetics of classic Maya can only be guessed at, Yucatec readings of signs are conventionally given: classic words are unlikely to have been very different, though may have been closer to other varieties of Maya, like Chol, a word which itself means 'ordering' and 'reason' - 'tzol' in Yucatec). Together with the convention of affix particles (as prefixes, to left and above, or postfixes to right and below) and a place notation of glyphs as well as of numbers, these two valencies of the day main sign may be said to have provided a lattice or grid, which in the one dimension of Mesoamerican space and time gave the epistemology of script. In this way, the Long Count along produces not just an elemental vocabulary of equivalent substantives or noun-verbs, but a grammar of affixes (in some respects similar to case inflexion) and a syntax to modify and exactly place them. The structure, of glyphs (one or more main signs with or without affixes) and glyph places, was there ready for statements that went beyond the calendar.

These involved further exploiting the semantic potential of the twenty basic signs (indicated by Roman numerals in the list below), defining other symbolic and iconographic elements more sharply, and inventing by analogy: East as kin plus a postfix, and later with ahau (XX); West, as kin with manik (VII) or the closed hand sign; time, as kin with akbal (III) or darkness, conceptually very like a corresponding Chinese ideogram; moon: Venus, as VIII, with the affix 'great'; sky; earth (XVII); dawn, with sky, kin and earth; sunset, with kin and earth (Thompson 1962); eclipse, with kin between light and dark areas; whole vocabularies of side-facing heads of gods, animals and birds, and of hand signs, largely undeciphered; Berlin's place names or emblems of the different ceremonial centres; the birthday and accession glyphs deciphered by Proskouriakoff; Knorosov's glyph for capture; ceremonial fire, as a bundle of sticks; and so on.

Many glyphs still remain opaque. Some elements may serve as a main sign or affix and it isn't always possible to distinguish their use properly. Despite Barthel's useful description of both as graphemes, the 'smallest mean-

ingful formal units' of Maya script (1968: 288), there is too the problem of semblants which may or may not mean the same thing as a standard main sign, and of loosely-defined infixes. Again, glyphs areas were not always respected as exactly equivalent, glyphs being placed together in one place which otherwise may be spread over two or three, without any apparent change of meaning. The style of purely calendrical texts initiates this possibility. From the beginning, Long Count clauses deviate in practice from the notionally standard clause of successive main signs each with affix and each in its notational place. In the Secondary Series especially, quantities of days less than twenty will be added, without a main sign, as an extra affix to the uinal sign; or two main signs will appear, each with affix, in one place. However, nearly all such irregularities may be understood precisely against a prior system of categories. In other words, the variations are quite different from those in other Mesoamerican writing, where such a system was not established.

A brief comparison with non-Long Count script may help to illustrate this. Slabs from Mound J, Monte Alban II, provide examples of another early glyph-like writing, with well-defined elements, often in vertical sequence. Dates and names, of calendar signs, bar and dot numeration, are interspersed among hill or place emblems, hand and other signs. Following Caso, Barthel (1968: 280) has read certain sequences as formulaic sentences proclaiming military conquest. Furthermore, the calendar signs are prominently encircled, like Maya main signs and the year-bearers in the Fejérváry and Laud codices. However the space they occupy is not regular. There is nothing like a 'glyph place' at any level of a 'column', which when next to another need not match it internally or in length and may even swerve into it. Rather the encircled signs merely occur between open and variable shapes which are palpably not of the same order and which are capable neither of affix modification nor of being conjoined conceptually as exactly equivalent items. Even the bar and dot numerals are in no sense affixes, but rather another loose item in the vertical 'reading'. Moreover, some shapes, notably the composite hill or place emblems, bulge out either side of the column into the space of the slab as a whole, belonging as much to it as to a reading line. This kind of extension is crucially different from something like that of the Maya Initial Series glyph over exactly two columns, like a musical stave, in the Long Count. Again, a design on slab 14 from Mound J (Caso 1965: 937; fig. 10) showing a foot descending steps depends for that idea on the angle of the foot to the vertical sense not just of the column but of the whole slab. In Maya monumental texts all 'angles' are internal and fixed within main signs which may then in a column of glyphs themselves lie inconsequentially at any angle to a pictographic base (as in the diagonal interwoven glyphs at Copan). In fact, in marked contrast to other scripts, American and Old World, Maya main signs are constant to their own inner axis, being sometimes inverted in a reading line, or, very rarely, at 90°, probably for stylistic reasons alone.

Maya script may also be well compared with non-Maya codices like the Mixtec histories and ritual documents like the Fejérváry, Laud and Vienna,

dated by Kubler either side of 1350 (1962: 102; see also Robertson 1959); in other words with writing which long postdates not just Monte Alban II and other 'proto-scripts', but the Maya classic inscriptions themselves. The point of this would be to emphasize again the intimate connection between time-reckoning and script; also that in Mesoamerica as in the Old World the 'evolution' towards script as we know it was not always one way, intellectual gain being matched by artistic loss. That the Maya were aware of the loss which their arithmetical script entailed is hinted at in their luxuriant use of 'head variant' glyphs for numbers, and in their constant juxtaposition of text with pictographic design, on stone and pottery and in the post-classic codices. In the historical codices of the Mixtec, and in the associated ritual documents mentioned above, writing as such is in fact inseparable from overall design. The defining conceptual limit is not in the edge of anything like a main sign or affix, or a glyph place, but rather in the often partly open frame provided by boustrophedon marks, a screenfold page or other 'reading' guides: the Laud for example specializes in series of numbered boxes.

Now within and between these larger areas we may discover sets of ideas, each set showing a similarity in formal expression. To use Caso's terms (1965 a: 951) these may be iconographic, symbolic or part phonetic. They often recall elements in Maya glyphs, though are of course not incorporated into a single system: the twenty signs, for themselves, as dates or as names; details of formal attire; lists of objects needed for ceremonial purposes (brushes, chisels, coloured stone, jewels); scenes of kingly accession and conquest; hand gestures; good and bad luck signs; and so on. We may point also to the frequent rows of place names, with their highly-developed use of rebus writing and conventional hill sign. But such sets, often reminiscent in various ways of early Old World writing and of Indian writing elsewhere in America, occur irregularly in space, amongst and fused with openly pictographic designs. The 'hill' place names in the Vienna are sometimes ranged as secondary protuberances on a large single hill beneath, in which further picture events are visible (fig. 11). Hand signs are attached to arms and bodies. Meaning is therefore at least in part contingent. As one of several surface textures, sand may be random or laid according to the internal arrangement of dots, or coloured (Brotherston 1975); but it may be recognized as sand principally by its context. Further, an item 'proper' to one symbolic set may be freely used with another, so that even the twenty calendar signs themselves, when used as names, are qualified as shapes in ways which would be quite impossible were they constant and equivalent identities. Page 32 of the Vienna shows a 'leaning' Flower, with the mark for 'rough' on the stem (usually hills lean and stones are rough); another Flower near it has a four-coloured palette (red blue brown yellow) as part of its base, perhaps to say 'many-coloured' (fig. 12). Clearly an element supposedly 'equivalent' to Flower, like Water, could not be nor was ever qualified in this way as a 'sign' (red water is blood, for example). In Maya script the twenty signs, never used for individual names, have exactly circumscribed meaning as arithmetical counters and main signs.

It might be objected that a script like the Maya which starts all at once with the help of arithmetic, by-passing as it were intermediary stages of development, must pay the price by being constrained by the very arithmetical logic which provoked it. And it is true that after the Conquest the Yucatec Maya, although they remained literate and wrote for themselves in their own language, quite quickly abandoned their glyphs for the European alphabet. But if rigidity there was, it would sooner have been social than intellectual, a point developed in a further paper. In any case, many of the glyphs in the monumental texts have still to be deciphered and are therefore unknown not just as vocabulary, but grammatically. Furthermore, the post-classic codices show the system to be supple and adaptable in its recourse to pre-, in- and postfixes, and to phoneticism where necessary, in verbal and other non-substantive use (see Zimmermann 1971). As for reading order, the arithmetical formality of the monumental texts also proved pliable; for indeed the Long Count had ceased to be the heart of the official calendar, leaving script and 'Long Reckoning' arithmetic as separate resources to the Yucatec. From a syntax in space which depended on such notions as begin, count forward, stop, count backward, conclusion or period (processes that were implicit or indicated by special glyphs), Maya script in the post-classic codices adapted itself to other formats. Most typical of these was the set of t'ols, in the almanacs, which corresponded to chants and invocations later recorded in the Book of Chilam Balam of Chumayel, in European script. On pages 25-28 of the Dresden glyphs are ranged in lines from left to right (fig. 13). The notional glyph place is still firm in the reading line; but the sequence of glyphs and the varying length of the lines correspond primarily to the exigencies of speech.

Glyphic writing as a resource of the literate Maya goes, however, beyond the range of this paper. Here we have been mainly concerned to show the exceptional origins of that script, the calendrical system known as the Long Count, in a situation itself exceptional in cosmological terms. Being unable to rely on fixed cardinal points or on the universal principle of abstract space, the ancient Mesoamericans developed intellectually with priorities of their own, their thought being concentrated into the single space-time dimension of their tropical astronomy. Among them, however, only the Maya pressed for arithmetical consistency in these circumstances, by making the solar day the basic and invariable unit of their calendar; and only they therefore were even in a position to use arithmetical place notation (a discovery apparently exclusive to them and the Mesopotamians) for these units and their vigesimal multiples. Together, the 'identity' of the unvarying unit and the grammar implicit in the calendrical use of place notation provided a grid or lattice, a method of ordering things, which yielded not just the Long Count but the only comprehensive writing system native to the tropical zone of the planet.

A striking confirmation of the intimacy of Maya arithmetic and script comes in the fact that none of the groups who dealt with them (except possibly the vanished Olmec) adapted either for their own purposes. For in the first and last instance both depended on a dedication to logic in time which others may well

have avoided for good political and religious reason. What importance the Maya themselves attached to the ability to write is best judged from the texts they have left (Brotherston 1975), and from their evaluation of literacy in a tradition, in hieroglyphic and then Roman script, which remained unbroken for over two milennia.

NOTE

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REFERENCES

Adelhofer, Otto (ed.)
1963 Codex Vindobonensis Mexicanus I. Graz.

Andrews, Edwin W.
1967 The Maya Secondary Series. In: Tax 1967 : 123-141.

Barthel, Thomas S.
1968 Writing Systems. "Current Trends in Linguistics" (ed. T.A. Sebeok), IV: 275-301. The Hague - Paris.

Becker Codex: see Nowotny 1961 a.

Berlin, Heinrich
1967 The Calendar of the Tzotzil Indians. In: Tax 1967: 155-161.

Brotherston, Gordon
1975 Sacred Sand in Mexican Picture-Writing and Later Literature. "Estudios de Cultura Náhuatl ", XI: 303-309. México.

1975 a Mesoamerican Description of Space I: Myths; Stars and Maps; and Architecture. (In press)

Brotherston, Gordon and Dawn Ades
1975 Mesoamerican Description of Space II: Signs for Direction. (In press)

Burland, Cottie A. (ed.)
1971 Codex Fejérváry-Mayer. Graz.

Caso, Alfonso
1965 Zapotec Writing and Calendar. In : Willey 1965 : 931-947.

1965 a Mixtec Writing and Calendar. In : Willey 1965 : 948-961.

Cassirer, Ernst
1964 Myth as a Form of Intuition. Structure and Articulation of the World of Time and Space in the Mythical Consciousness. Part 2 of The Philosophy of Symbolic Forms, Vol. II. New Haven - London.

Castillo, Víctor M.
1971 El bisiesto náhuatl. "Estudios de Cultura Náhuatl", IX: 75-99. México.

Coe, Michael D.
1966 The Maya. London.

Dresden Codex : see Thompson 1972.

Diringer, David
1968 The Alphabet. Vol.I. London.

Fejérváry-Mayer Codex : see Burland 1971.

Foucault, Michel
1970 The Order of Things. London.

Gossen, Gary H .
1974 Chamulas in the World of the Sun : Time and Space in a Maya Oral Tradition. Cambridge, Mass.

Ibarra Grasso, Dick Edgar
1970 Sobre la inexistencia del cero en la escritura maya precolombina. "Verhandlungen des XXXVIII. Internationalen Amerikanistenkongresses, Stuttgart - München 1968", Band II: 195-200. München.

Kubler, George
1962 The Art and Architecture of Ancient America. "The Pelican History of Art". Harmondsworth.

Léon-Portilla, Miguel
1968 Tiempo y realidad en el pensamiento maya. México.

Lucas, J.R.
1973 A Treatise of Time and Space. London.

Merrill, Robert H.
1945 Maya Sun Calendar Dictum Disproved. "American Antiquity", 10: 307-311. Salt Lake City.

Molina, Fray Alonso de
1944 Vocabulario en lengua castellana y mexicana. Madrid.

Morley, Sylvanus Griswold
1915 An Introduction to the Study of the Maya Hieroglyphs. "Smithsonian Institution, Bureau of American Ethnology, Bulletin 57". Washington.

Neugebauer, Otto
1951 The Exact Sciences in Antiquity. Princeton - London.

Nowotny, Karl Anton
1961 Tlacuilolli. Die mexikanischen Bilderhandschriften, Stil und Inhalt. Mit einem Katalog der Codex-Borgia-Gruppe. "Monumenta Americana", III. Berlin.

1961 a (ed.) Codices Becker. Graz.

Robertson, Donald
1959 Mexican Manuscript Painting of the Early Colonial Period. New Haven, Conn.

Satterthwaite, Linton
1965 Calendrics of the Maya Lowlands. In : Willey 1965 : 603-631.

Seler, Eduard
1902 Die Tageszeichen der aztekischen und der Maya-Handschriften und ihre Gottheiten. "Gesammelte Abhandlungen zur amerikanischen Sprach- und Alterthumskunde", I : 417-503. Berlin.

Tax, Sol (ed.)
1967 The Civilizations of Ancient America. New York.

Thompson, John Eric S.
1960 Maya Hieroglyphic Writing. Norman.

1962 A Catalog of Maya Hieroglyphs. Norman.

1965 Maya Hieroglyphic Writing. In : Willey 1965 : 632-658.

1972 A Commentary on the Dresden Codex. Philadelphia.

Toulmin, Stephen and June Goodfield
1965 The Discovery of Time. London.

Vienna Codex : see Adelhofer 1963.

Villa Rojas, Alfonso
1968 Los conceptos de espacio y tiempo entre los grupos mayances contemporáneos. Appendix to : León-Portilla 1968.

Willey, Gordon R. (ed.)
1965 Archaeology of Southern Mesoamerica. Part Two. "Handbook of Middle American Indians", 3. Austin.

Zimmermann, Günter
1971 La escritura jeroglífica y el calendario como indicadores de tendencias en la historia cultural de los maya. In : Desarrollo cultural de los mayas. (ed. E.Z.Vogt and A.Ruz Lhuillier): 243-256. México.

FIGURES

Fig.1 : The twenty signs in the Fejérváry Codex page 1, arranged in the Sacred Round of 260 positions and anatomically. In this second arrangement, reading inwards in each case, their order is : hand - IX, XVII, V, XIII, I; foot - II, X, XVIII, VI, XIV; rump - XV, III, XI, XIX, VII; head - VIII, XVI, IV, XII, XX. The year bearers (XIII, XVIII, III and VIII) are encircled at the end of the diagonals to which they belong.

Fig.2 : The twenty signs and Tlaloc (Laud p.2).

Fig.3 : Year signs. a : Vienna. b : Fejérváry. c : Mapa de Tepechpan. d : Telleriano-Remensis. e : Vienna (= '1 year').

Fig.4 : Vienna p.48, showing part of a period of Venus (Quetzalcoatl) in a 'suspended' day sequence in the year 6 Rabbit, between 7 Flower and 5 Reed (193 days).

Fig.5 : Vienna p. 33, showing four definitely non-consecutive dates from 10 House 4 Snake (bottom right) to 13 Rabbit 9 Reed, 7 Reed 4 Earthquake and 13 Rabbit 7 Flower, 36, 13, 46 and 13 years respectively after a start date of 1 Reed.

Fig.6 : The twenty signs as day signs (encircled main signs) in the Maya monumental texts (after Morley 1915).

Fig.7 : Aztec number signs. a : 8000. b : 400. c : 20. (Post-Conquest).

Fig.8 : A Long Count Initial Series inscription. Temple 18, Palenque (after A. Ruz Lhuillier and J.E.S.Thompson). A1-B1 : Initial Series Glyph. A3 : 9 baktuns. B3 : 12 katuns. A4: 6 tuns. B4: 5 uinals. A5: 8 kins (a total of 1,384,668 days). B5 and A9 give the date after the base date as one of the twenty signs and a month, each with numerical co-efficient.

Fig.9 : An interwoven Initial Series inscription. Stela J, Copan (after Morley 1915).

Fig.10 : Slab 14, Monte Alban (after Caso 1965). The middle column contains a large composite place sign.

Fig.11 : 'Hill' place signs as protuberances on a larger hill (Vienna p.14).

Fig.12 : Additional information incorporated into the sign Flower (XX). Vienna p.32).

Fig.13 : Two lines of glyphs, reading from left to right, of unequal length (Dresden p.27).

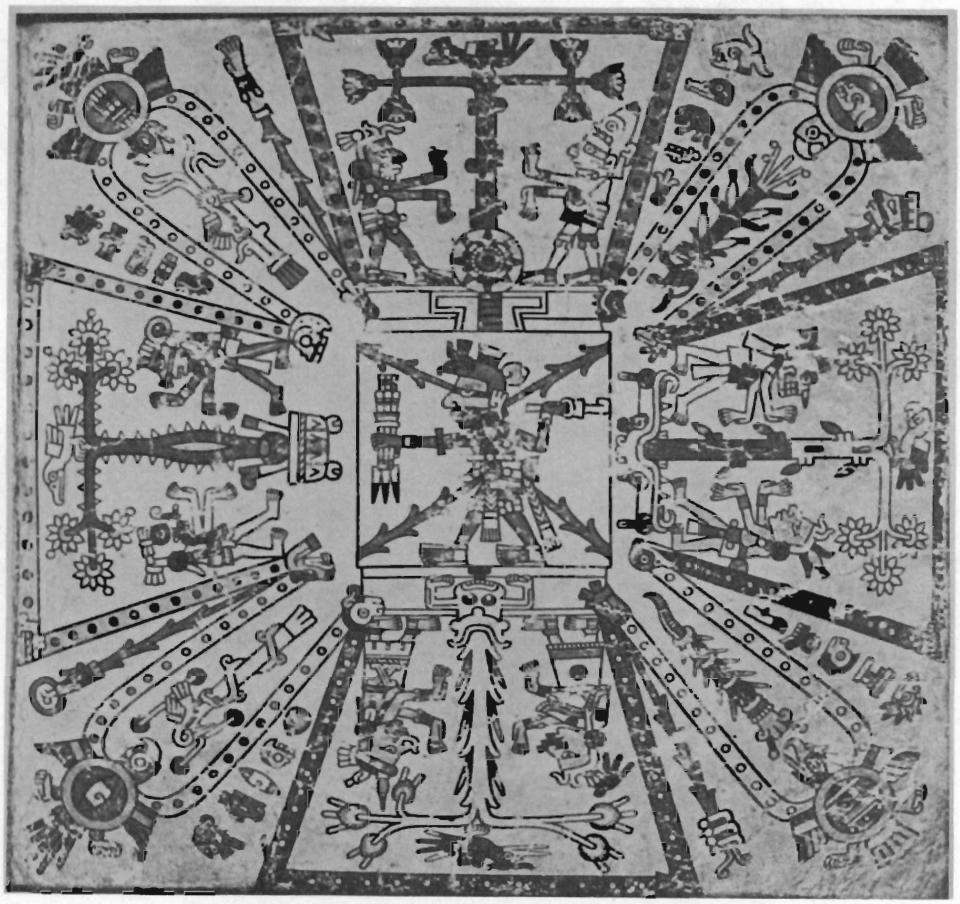

Fig. 1

Fig. 2

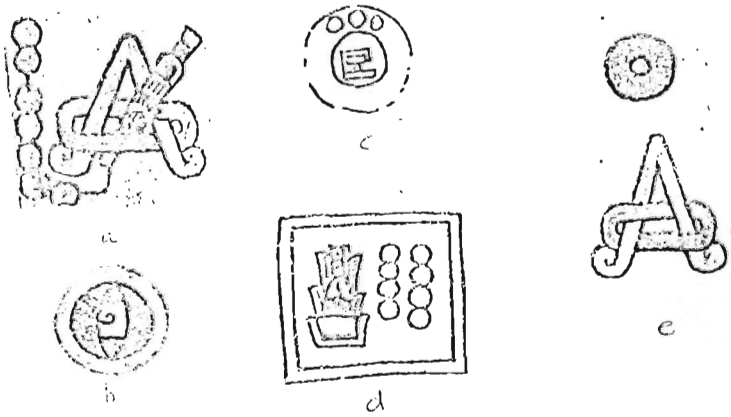

Fig. 3

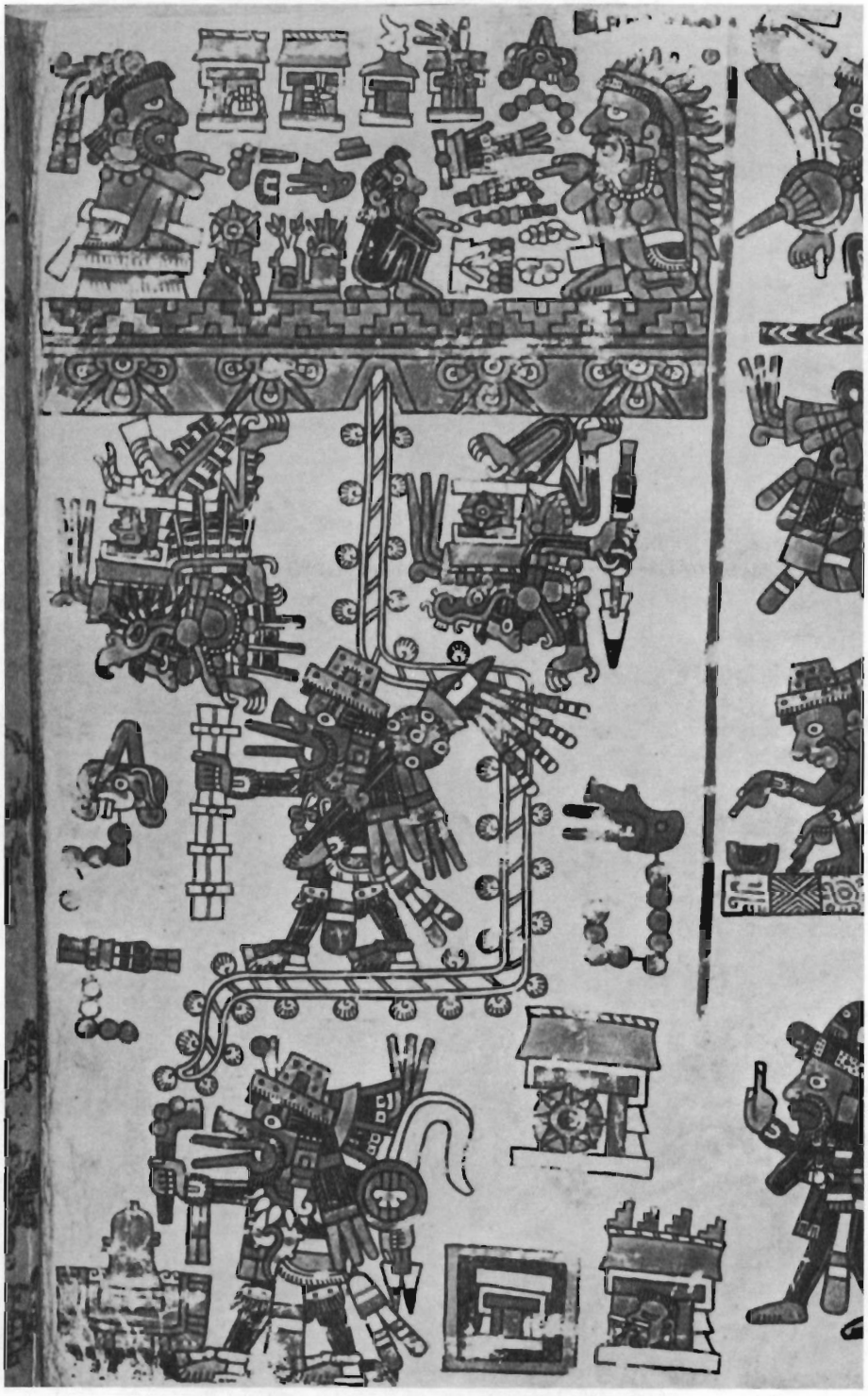

Fig. 4

Fig. 5


I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX

Fig. 6

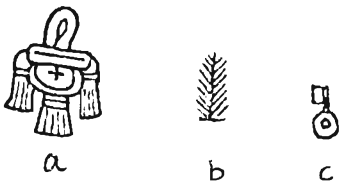
a
b
c

Fig. 7

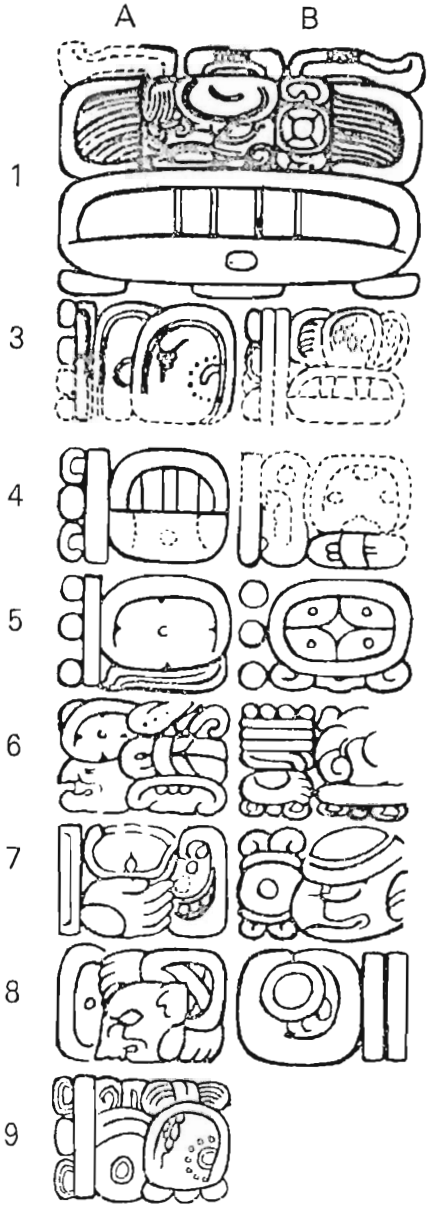

Fig. 8

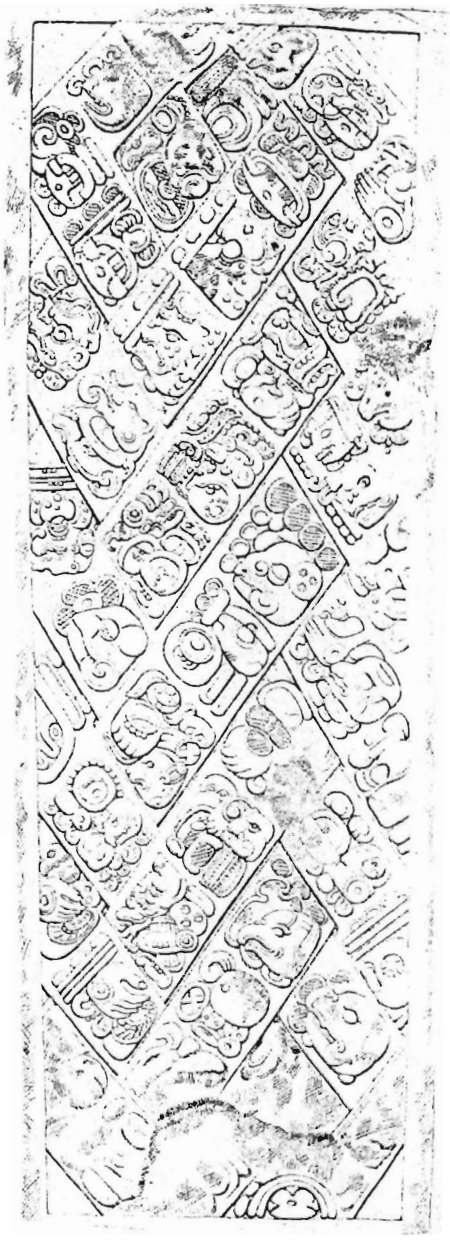

Fig. 9

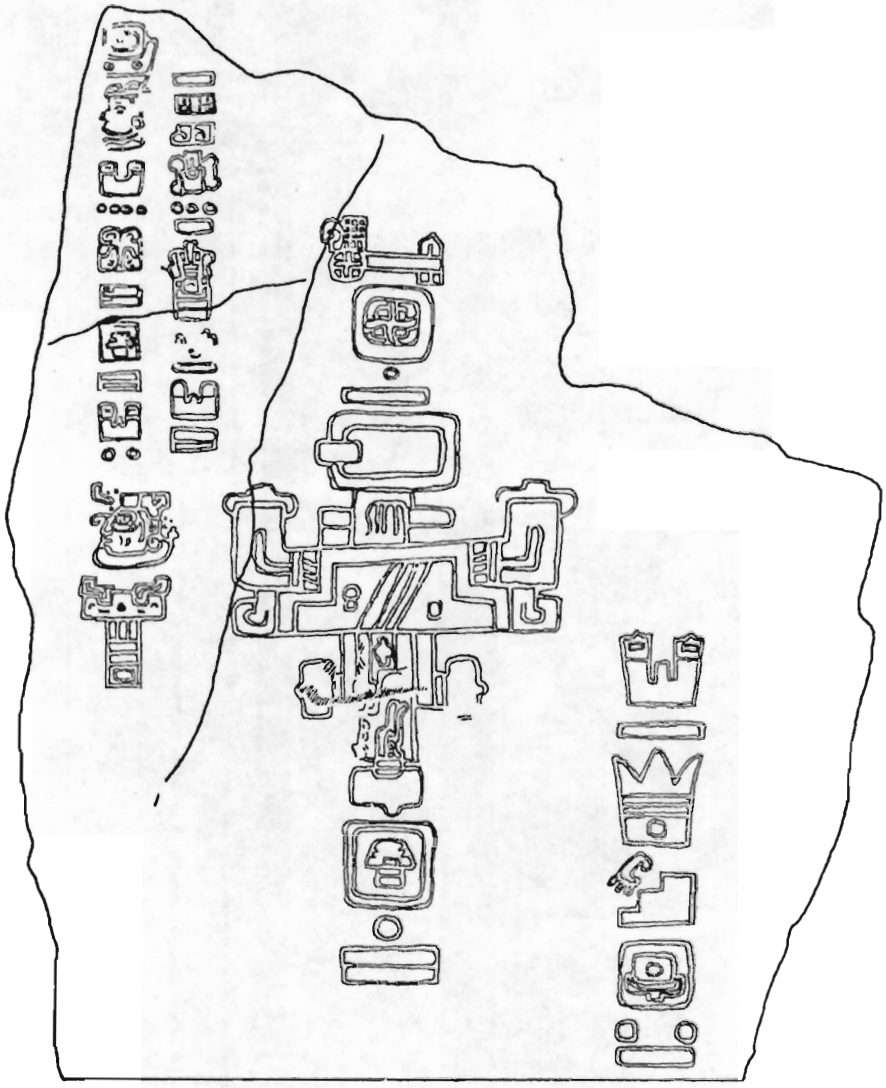

Fig. 10

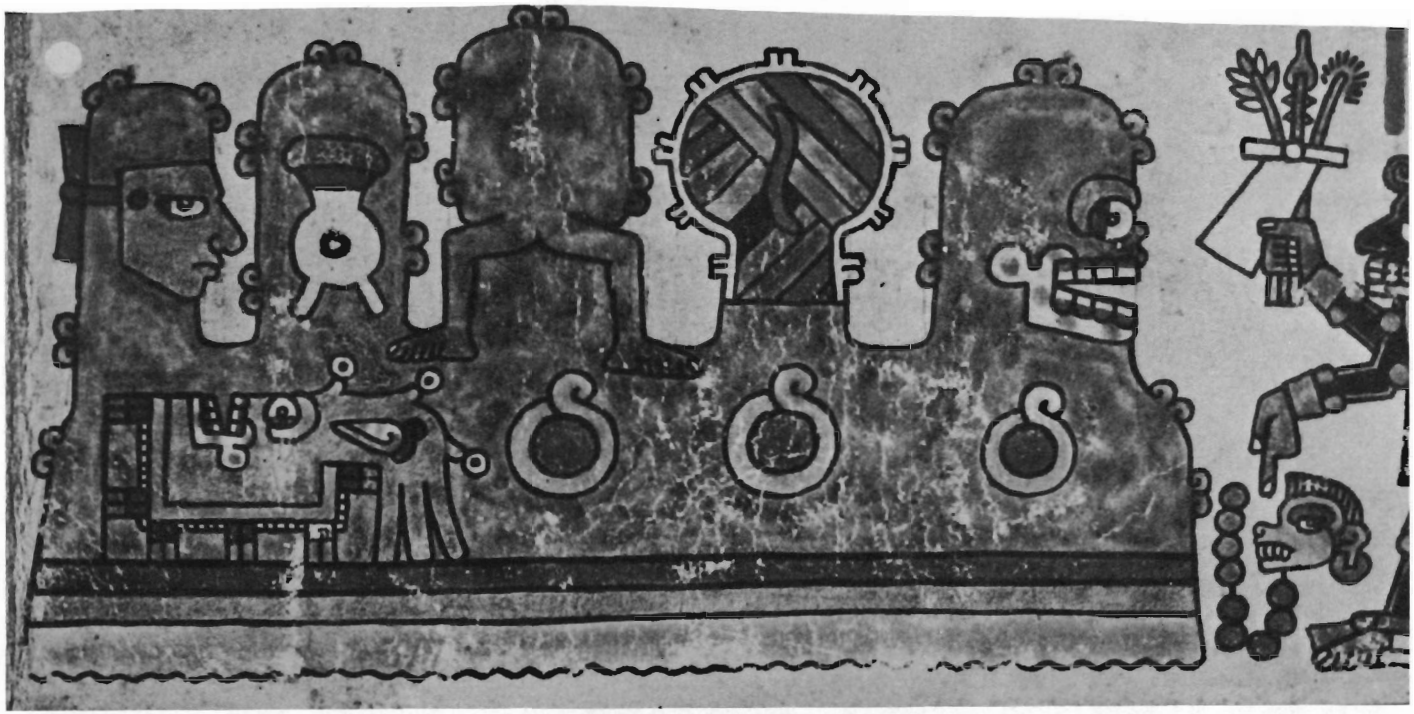

Fig. 11

Fig. 12

Fig. 13