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Focus

Early Maya geometric planning conventions at El Palmar, Guatemala

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A R T I C L E I N F O

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A B S T R A C T

Archeology of complex societies has long focused on the actors behind the planning and engineering of architecture in monumental centers. However, the motivations for and conventions used in ancient planning are often lost to modern scholars without the aid of texts of the builders. This is especially true with the early ancient Maya, where large centers with evidence of extensive planning existed as early the Late Preclassic period (ca. 300 BC–250 AD). The current Focus article addresses site planning of monumental Late Preclassic settlements with a case study at El Palmar, Guatemala. Results suggest that apart from cardinal alignments based on solar movement, conventions of planar geometry formed a large part of the planning toolkit. The discussion argues that the dimensions of repeating similar rectangles probably related to the ideal size of ancient Maya agricultural spaces.

1. Introduction

The ancient Maya settlements in the Yucatan peninsula have long interested archaeologists studying site planning across the ancient world (e.g., Smith, 2007). The current research focuses on the large centers of the Late Preclassic period (ca. 300 BC–250 AD) in the Maya Lowlands, located in modern Guatemala, Belize, and southern Mexico. This report examines the nature of planning in these places, which seem to share a similar inventory of architecture and measurement conventions, governed by solar alignments and planar geometry. Using a case study from the site of El Palmar and evidence from the giant site of El Mirador, I argue that the ancient Maya constructed large plazas by laying out a desired rectangle, and then used the original rectangle's dimensions as a proportional foundation for large-scale plans during the Late Preclassic (Fig. 1). Ethnohistoric and ethnographic evidence suggests that these plaza rectangles, probably created with a system of stakes and cords, provide a window into the size of ideal agricultural spaces.

2. Materials and methods

Archaeological research has demonstrated that Maya sociopolitical complexity arose centuries before the Classic Period (ca. 250–900 AD), as groups of settlers cooperated to build monumental centers, elite groups traded and interacted with each other, and dynastic rulers produced and sponsored monumental art and writing (Estrada-Belli, 2011; Saturno et al., 2005, 2006; Taube et al., 2010). Research at the site of El Mirador, discovered in northern Guatemala through aerial and ground reconnaissance in the early twentieth century, has contributed greatly to a new understanding of the early Maya Lowlands (Madeira, 1931; Morley, 1938; Ruppert and Denison, 1943). After the first visitors concluded that it was "one of the largest ceremonial centers in the Maya area" that "has the most massive structures" (Graham, 1967: 46,47), archaeological research has shown that the region around El Mirador contains some of the largest Late Preclassic settlements in the Maya Lowlands (Demarest et al., 1984; Forsyth, 1989; Hansen, 1990, 1998, 2000, 2005; Hansen and Guenter, 2005; Hansen et al., 2008; Howell and Copeland, 1989; Matheny, 1980; Matheny and Matheny, 2011).

A recent study of early Maya planning at El Mirador argues that astronomical alignments based on sunrise observation from the summits of major buildings formed a primary role in guiding Late Preclassic construction (Šprajc et al., 2009: 86; cf. Hansen et al., 2006: 941). The current article builds upon the alignment hypothesis in order to take into account the geometric measurement and placement of foundational platforms that bounded the spaces for gathering and walking. Here, analysis focuses on evidence for geometric proportions utilized in two sites during the Late Preclassic in order to create a model to be tested as more information becomes available about early Maya planning.

The original field data come from the site of El Palmar, Petén, Guatemala, recently surveyed and excavated by the author (Fig. 2).

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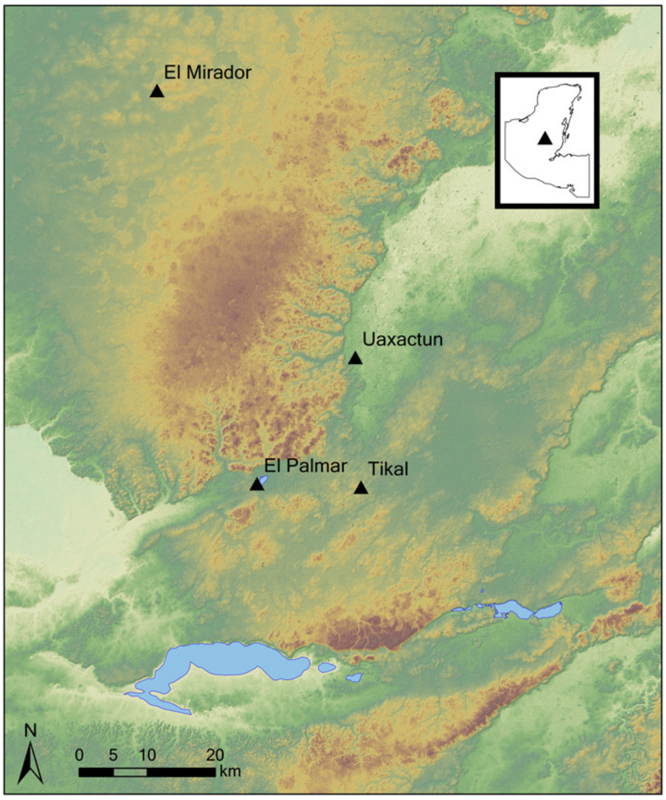

Fig. 1. Map of sites mentioned in the text.

El Palmar is a large Preclassic site located about 15 km to the west of the great Maya city of Tikal and directly south of the region of El Mirador. Archaeological survey and excavation from 2007 to 2011 revealed that the focus of civic life at the settlement was a large plaza known as an "E-Group," named after the original example of such a plaza excavated at the site of Uaxactun, Guatemala in the 1920s–30s (Aimers and Rice, 2006; Aveni et al., 2003; Chase and Chase, 1995; Ricketson and Ricketson, 1937; Ruppert, 1940). Populations leveled natural bedrock during the Middle Preclassic period (ca. 1000–300 BC) to construct these large "E-Group" plazas for civic spaces at many Maya centers like El Palmar (Estrada-Belli, 2011: 74, 2012: 207). Throughout the entire Preclassic period, "E-Group" plazas were central spaces, integral to community life throughout the Maya Lowlands (Aimers and Rice, 2006: 82; Chase and Chase, 1995: 100), and analysis proceeds under the premise that new plans began with these early important plazas in mind (see Estrada-Belli, 2011: 71,72). Relevant to Late Preclassic planning, many of the "E-Group" plazas are almost identical in width, and there is ample evidence that builders took special care to preserve the footprint of the plazas over time (Doyle, 2012). The widths of these plazas correspond to the final phase of building, which, at most of these sites with "E-Groups," is the end of the Late Preclassic period (ca. 1–250 AD).

Excavations confirmed that the residents of El Palmar made a major investment in site-wide planning during the Late Preclassic period, and two radiocarbon dates place the final implementation of the plan well before 1 AD (Doyle et al., 2011, 2012). Accelerator mass spectrometry (AMS) dates on two charcoal samples from sealed construction fills in the "E-Group" plaza at El Palmar yielded uncalibrated dates of: a) 2120 ± 40 BP (Beta-285472, 350–300 and 210–40 BC; 2 sigma [95% probability] calibrated range); and b) 2230 ± 40 BP (Beta-265817, 390–190 BC; 2 sigma [95% probability] calibrated range) (Doyle, 2012: Table 1). Therefore,

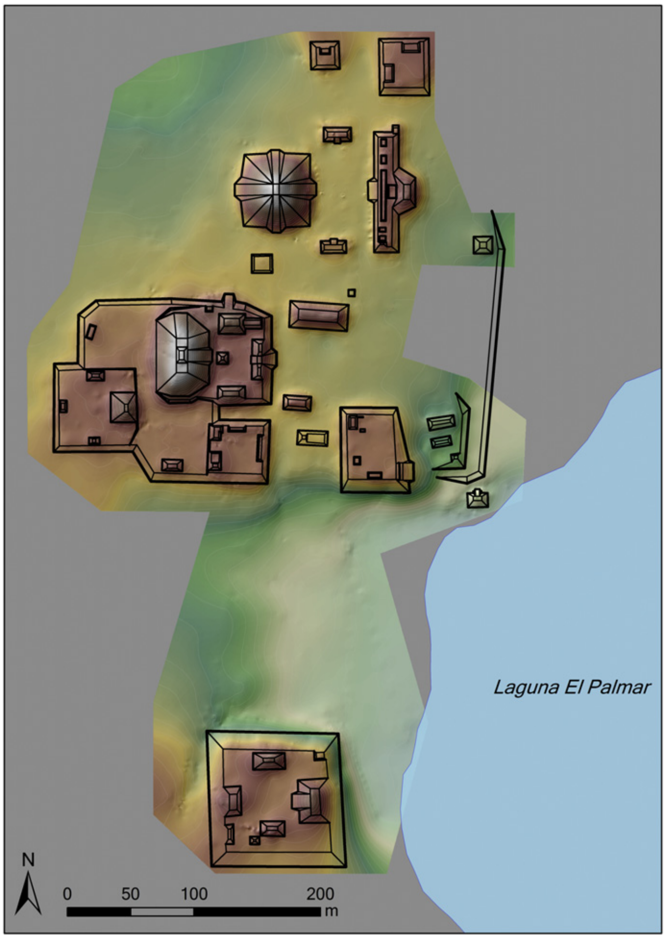

Fig. 2. El Palmar site map.

the final constructions defining the width of the El Palmar "E-Group" plaza fall firmly within the early Late Preclassic period (ca. 300–100 BC). Considering the perceived similarities in plaza dimensions shared across the region, the conventions visible at El Palmar should provide key insight into the minds of ancient planners and builders during that time. Because there is no major Classic Period construction at El Palmar, I argue that the present

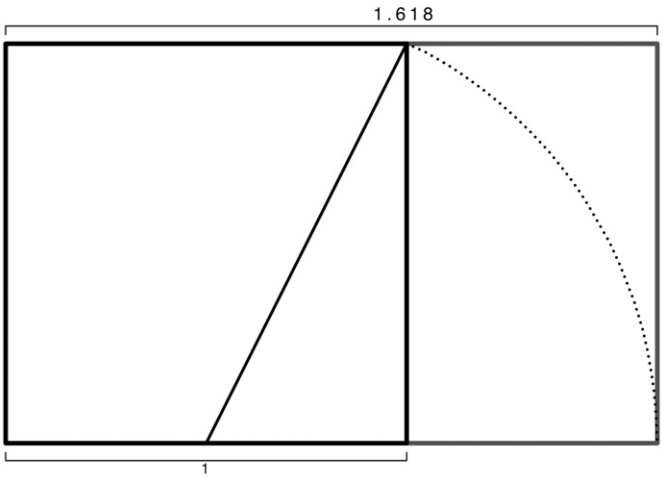

Fig. 3. Diagram of the hypothetical construction of the plaza rectangle.

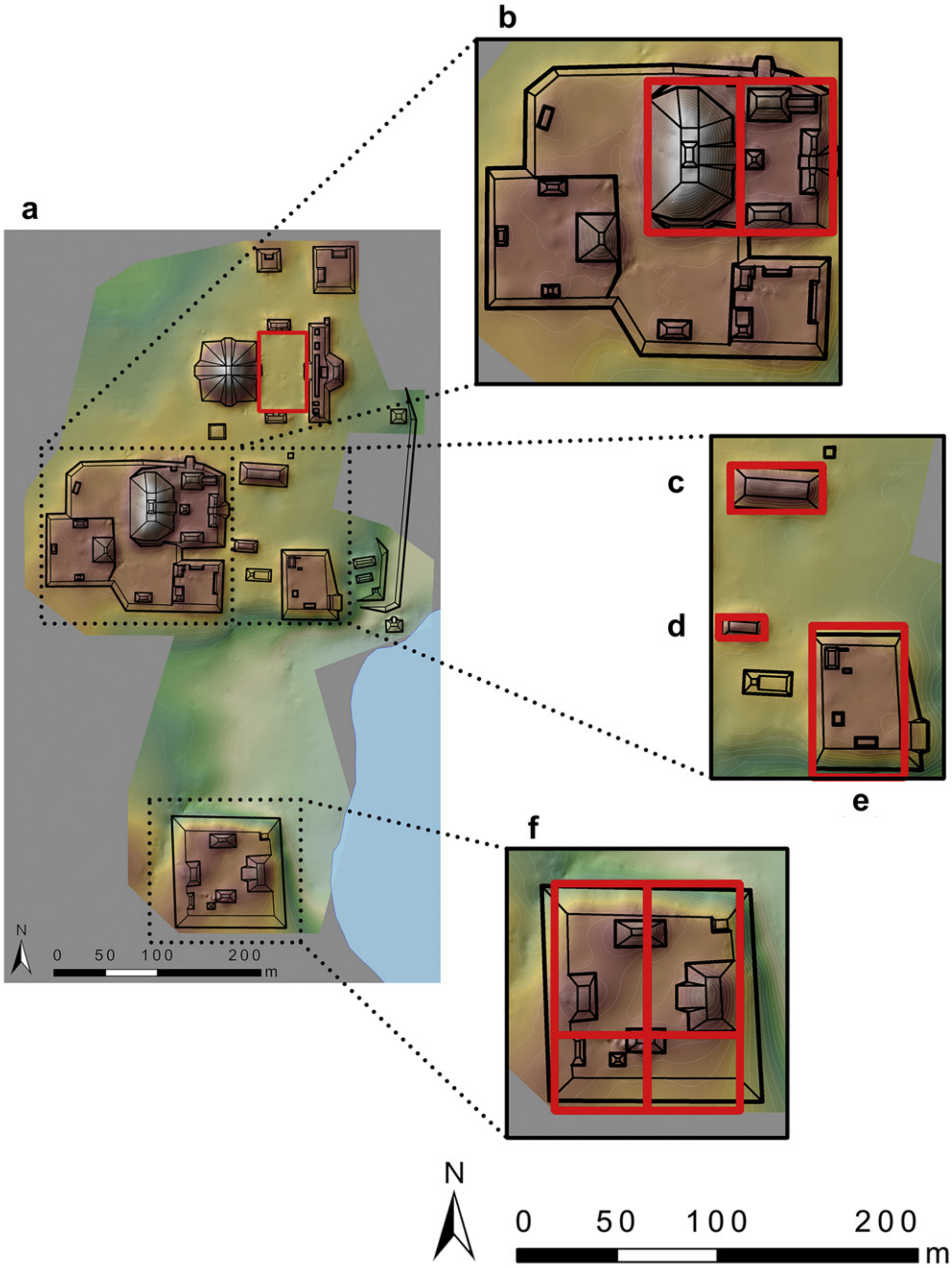

Fig. 4. El Palmar: (a) with "E-Group" plaza highlighted; (b) detail of Triadic Group; detail of (c) Structures E4-5, (d) Structure E5-5, and (e) Platform E5-7; (f) detail of South Group.

dimensions and alignments are the result of the original implementation of a widespread plan in the Late Preclassic period.

3. Results

The final footprint of the El Palmar "E-Group" plaza as revealed by topographic elevation of the site is a rectangle of approximately 48.5 by 78.5 m. The builders could have constructed this rectangle using a simple system of stakes and cords: first, by laying out a square of the desired plaza width; then, by staking a cord on the midpoint of the lower edge of the square; then, by stretching the cord to the upper right corner of the square and swinging the length clockwise until it overlays the original square edge, marking the new corner of the desired rectangle (Fig. 3). These dimensions are almost exactly in proportion with what is known as a "golden" rectangle (or φ, 1 units by 1.618 units), which would be 48.5 by 78.43 m. Past studies have recorded other instances of the golden rectangle and similar geometry in ancient architecture, art, and settlement patterns in the Maya area (Brown and Witschey, 2003; Powell, 2010; Schele and Mathews, 1998: 34–36; cf. Clancy, 1994; Harrison, 1994; O'Brien and Christiansen, 1986).

When tested across the site, the proposed rectangle's proportions coincide with the size of the bases of many major structures at El Palmar (Fig. 4). For example, the Triadic Group measures approximately 100 by 160 m, or double the footprint of the "E-Group" plaza, and residential platform E5-7 covers almost the same area as the original plaza. Planners possibly divided the original width of the plaza to create Structures E4-5 and E5-5, which measure one third and one eighth of the original plaza's area, respectively. Evidence of expanding the dimensions proportionally also occurs in the South Group, which measures around 100 by 120 m, or 2 times the width and 1.5 times the length of the template

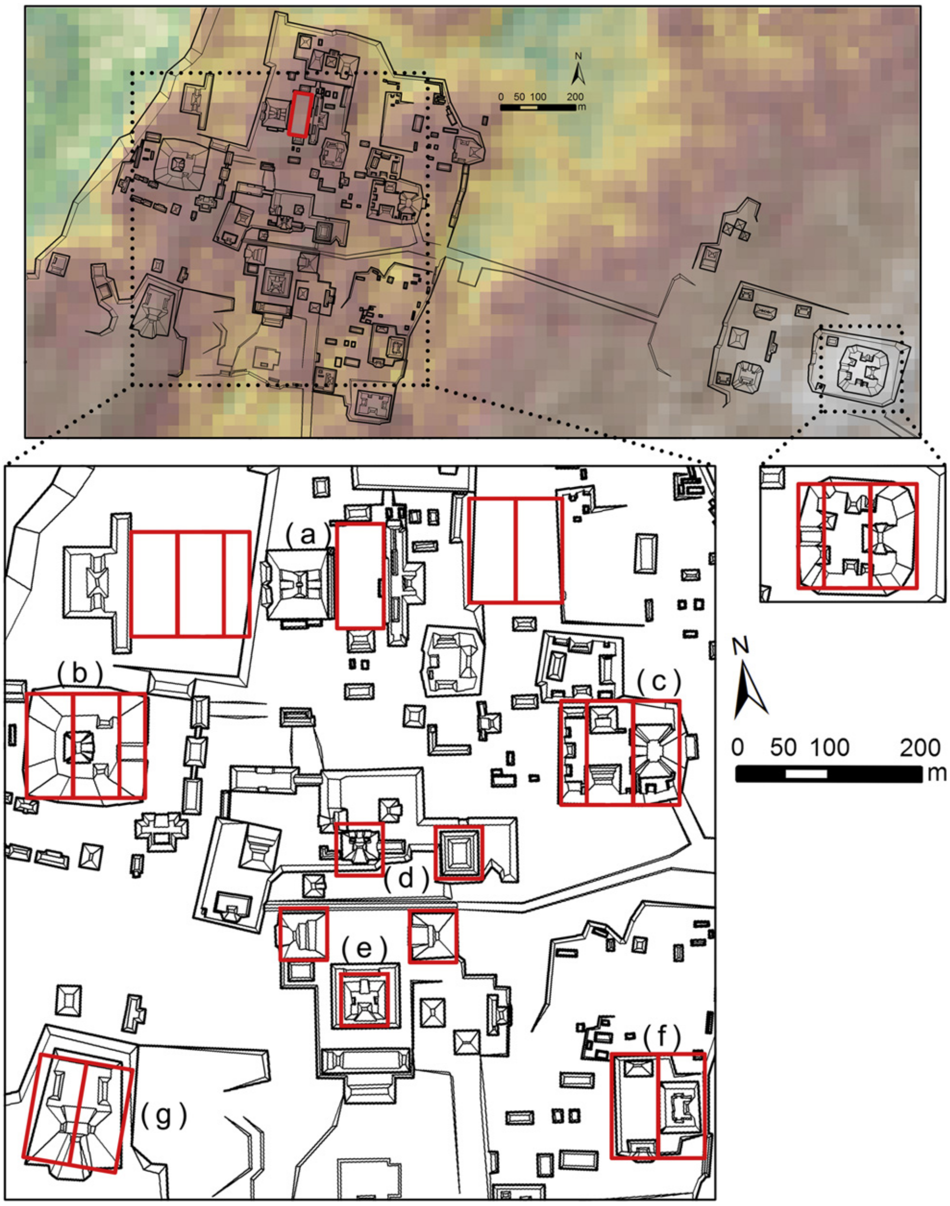

Fig. 5. Central El Mirador with El Leon "E-Group" plaza highlighted (map redrawn by the author after Mejía, 2009, ©FARES, IDEAH Guatemala 2007). Left inset: detail of monumental central precinct, including (a) El Leon pyramid and plaza; (b) El Tigre Group; (c) Las Chicharras Group; (d) Central Acropolis; (e) Tecolote Group; (f) Tres Micos Group; and (g) Monos Group; Right Inset: detail of La Danta Group.

plaza. These basal dimensions would have been an integral part of the planning process as they both defined the extent of platform expansion and formed the edges of open thoroughfares, which would have guided residents through the buildings and social spaces. Therefore the use of the original plaza proportions to expand platforms during the Late Preclassic strongly suggests that one vision, based on an archetypal rectangle divided into similar equal parts, served to guide the planning and building of the final phase of the civic center of El Palmar.

Recent synthetic work addressing over 30 years of research at El Mirador suggests that the plaza comparable to the "E-Group" at El Palmar in the western part of the site, named the El Leon group, was a central focus of early building (Matheny and Matheny, 2011: 177). The rectangular plaza measures approximately 50 by 125 m, much longer on its north–south axis than the plaza at El Palmar. Nonetheless, using the model argued for El Palmar, the replication of the El Leon rectangle's dimensions over several complexes in the central precinct of El Mirador supports the hypothesis that the plaza dimensions served as a pivotal tool for El Mirador planners (Fig. 5). Several major constructions, including nearby plaza spaces, correspond to multiples or fractions of the approximate proportions of the proposed prototype, suggesting the ultimate expansion of these complexes formed part of a unified plan.

Notably, the basal platforms of both the El Tigre and La Danta pyramids, the largest buildings at the site, measure very close to 125 m on their east–west axis, or 2.5 times the El Leon plaza width, and approximately 125 m on their north–south axis, the El Leon plaza length (or, alternatively, the length of the El Leon plaza squared). Several pyramids have footprints of identical square size equaling the 50-m width of the El Leon plaza area: possibly two in the Central Acropolis and three in the Tecolote group. Other large groups, such as the Las Chicharras Group and the Tres Micos Group, conform to 2.5 times and twice the footprint of the El Leon plaza, respectively. However, several complexes, such as the Monos complex, do not reflect the same proportions or cardinal alignments. Perhaps, then, according to the hypothesis, these structures were built at a different time under a different plan, as others have noted (see Howell and Copeland, 1989: 59; Šprajc et al., 2009: 86).

Unlike El Palmar and El Mirador, Tikal and Uaxactun both have considerable amounts of later buildings that obscure the Late Preclassic city plans. Some evidence exists relevant to the proposed model, as excavations at Tikal and Uaxactun have demonstrated very early monumental activity in the form of the same "E-Group" plazas (Laporte and Fialko, 1995; Ricketson and Ricketson, 1937). Furthermore, excavators noted at the North Acropolis of Tikal that over time, the platform axes shifted, suggesting that Late Preclassic city planning had overridden earlier constructions and imposed new dimensional standards (Coe, 1990). Unfortunately, the sheer volume of later buildings at Tikal precludes a wider study of the Late Preclassic plan geometry at present. The same is true for Uaxactun, where Classic Period constructions do not permit thorough analysis. However, the pattern noted at El Palmar and El Mirador may be considered a predictive model for Late Preclassic Maya site planning to be tested in the future.

4. Discussion

Although assessing the meanings of geometric planning in the Late Preclassic is a speculative exercise, ample ethnographic evidence from the colonial and modern periods suggests the possibility that these dimensions were idealized local sizes for agricultural spaces. Diego de Landa notes the use of cords in colonial Yucatan to measure family *milpa* plots, similar to the proposed method of plaza construction, although Tozzer notes a discrepancy in the size of exact measurements (Tozzer, 1941: 96). Cultivation and household plots in highland Chiapas, Mexico and the Huehuetenango department of Guatemala also required the measuring of rectangular or square plots of land with a system of rods and cords (Berlin et al., 1974: 141; Stadelman, 1941: 95). Among the Q'eqchi' speakers of Guatemala, the unit of one "cord" (*cuerda*) comprised thirteen "armspans" (*brazadas*) and measured approximately 23.25 m, or, about half of the proposed width of the original plazas in the case studies presented here (Wilson, 1972: 331). Furthermore, "doubling over" the measuring cords into one-half or one-fourth size were common Q'eqchi' methods to produce a subdivided field with distinct square crop plots (Wilson, 1972: 121). Such evidence demonstrates the continuity of constructing squares or rectangles with systems of cords to create living or working spaces. The documented use of "armspans" as a basic unit of measurement is particularly suggestive, as perhaps Late Preclassic rulers set idiosyncratic lengths based on their own bodies for use in building and planning.

Constructing squares or rectangles also had cosmological and moral implications for the ancient Maya. Staking out and squaring off of the *milpa* farmland (see Hanks, 1990: 355,356), is similar to the description of the creation of the earthly realm in the Quiché Maya creation story, the *Popol Vuh*, where human space is bound by "its four cornerings, its four sidings, its measurings, its four stakings, its doubling over cord measurement, its stretching cord measurement" (Christenson, 2007a: 65, 2007b: 3). Furthermore, Karl Taube notes that "the idealized four-sided town model defines a human and moral community" and that "making *milpa*, houses, art, and other efforts of construction are inherently good and ethically correct human acts" for the Maya (Taube, 2003: 465). Additionally, a central theme in Late Preclassic Maya monumental sculpture and painting is the supernatural propagation of maize and the symbolic division of the world into four quarters (Estrada-Belli, 2011; Saturno et al., 2005; Taube et al., 2010). Thus, the dimensions of the plaza rectangles in Late Preclassic site planning, within which a community interacted in daily life, may pertain to the ideal size of an ancient Mayan four-sided agricultural field (Stephen Houston, pers. comm. 2012). This interpretation complements the conclusions of the alignment study at El Mirador that some sunrise dates recorded in architectural lines were related to marking important times of the year for agriculture (Šprajc et al., 2009: 91).

5. Conclusions

This article contributes to the study of ancient Maya site planning by arguing two main points: a) builders used a technique of measurement involving the construction of a desired rectangle as the expansion of buildings around the main plaza in Late Preclassic Maya civic centers; and b) the builders then replicated the dimensions or proportions of the main plaza throughout the site to create the boundaries for basal platforms. Research at El Palmar discussed here thus supports claims that planar geometry and specific proportions played a major role in Late Preclassic Maya planning, also noted briefly at other sites (Estrada-Belli, 2011: 71,72). The El Leon plaza at El Mirador provides some positive correlation with the El Palmar planning model, although some contradictory evidence could suggest different plans with different primary proportions or orientations over time. Results are perhaps emblematic of a larger pattern, which will complement existing Archaeoastronomical studies and future excavations in Late Preclassic centers in the region. Ethnographic evidence provides a window into possible meanings of planning with planar geometry and similar proportions, as the ancient Maya gave order to the earthly realm. More broadly, the current report approaches a more thorough understanding of the multiplicity of conventions that influenced decisions made by emerging political authorities in the ancient world in order to structure their built environment.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jas.2012.08.006.

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