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Complexity, Cooperation, and Public Goods: Quality of Place at Nixtun-Ch'ich', Petén, Guatemala

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Public goods are "non-excludable" and "non-rivalrous" resources, including roads, water management systems, and plazas, as well as "symbolic public goods," such as religious architecture and social identity. Public goods occur in greater abundance in cities with more cooperative and inclusive forms of organization, which seems to undermine arguments that elites constructed them to augment their power. Such goods are major "pull" factors drawing migration to modern cities, but ancient cities also had public goods that likely attracted immigrants, increasing their population and diversity. We examine these ideas at Middle Preclassic-period (cal 800–300 BC) Nixtun-Ch'ich', in Petén, Guatemala. This city and other Preclassic metropoles in the Maya lowlands seem to have been on the more-cooperative end of a cooperative–competitive spectrum, compared to most cities of the Classic period (AD 200–900). We also speculate about how symbolic public goods were coopted to create a more exclusive social system in the Late Preclassic period (300 BC–AD 200).

Keywords: public goods (pg), urbanization, cooperative systems, Preclassic Maya, quality of place

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INTRODUCTION

The emergence of complex societies, especially those known as cities and states, has long intrigued scholars. Myths frequently credit early cities to the work of gods, while archaeologists typically ascribe them to authoritarian rulers or kings. Such top-down narratives envision monarchs as agents who build and create as part of their struggles to maximize status and power. Were ancient rulers really the foundations of social complexity? Complexity refers, by definition, to multiple units interlaced into a single system, not a singular entity. What binds complex societies together is cooperation (Stanish et al., 2018), not a self-serving quest for glory.

Here, we dispense with the trope of public works as elite actions to bolster their stature, and instead turn to a different, bottom-up way of viewing social complexity, emphasizing cooperation, and collective action. We do not dispense with leadership, but argue that early leaders were frequently held accountable and focused upon solving problems and improving the societies that they led. Collective action theory focuses on the agency of rational social actors in negotiating with societal leaders (rulers, principals) for benefits in return for their labor, tribute, military service, or other contributions (see Levi, 1988; Ostrom, 1990; DeMarrais and Earle, 2017). Building on these ideas, the editors of this volume have addressed collective action theory in terms of good government and joint production sources of revenue (Blanton et al., 2020, 2021).

Good government is characterized by moral bonds and obligations—moral being relative to each society—between citizens and leaders in provisioning equitable benefits to all. These benefits are typically seen as public goods or public works, such as goods and especially services, including transportation infrastructure, water control, public safety, food security, and support of ritual events and institutions (Blanton et al., 2021, Table 1).They materially represent a society's emphasis on a common greater good, and are more prevalent in societies lying at the "more-cooperative" end of a conceptual cooperative–competitive social-organizational continuum, a heuristic developed through analysis of numerically coded variables in a cross-cultural comparative study of 30 pre-modern states (Blanton and Fargher, 2011; Blanton et al., 2020, 2021).

We explore public goods at Nixtun-Ch'ich', an early lowland Maya city in northern Guatemala, to argue that the city had a more-cooperative system of social and political organization. During the Middle Preclassic period (ca. 900/800–400/300 BC), Nixtun-Ch'ich' was the largest site on Lake Petén Itzá and its environs, and the capital of an archaic primate state (Pugh et al., 2021; Rice and Pugh, 2021). Between cal 800 and 500 BC, the city was planned and constructed as a sacred landscape, with a grid of corridors and monumental architecture. The planning intimates the presence of centralized leadership, but we cannot identify rulers because, as is generally true of the Maya Middle Preclassic period, rulers were anonymous and invisible (Freidel, 2021), absent in art, monuments, and lavish tombs, until the Late Preclassic. Whoever the city's early leaders were, we contend that they were primarily concerned with the greater good rather than self-aggrandizement, and that they, like early elites elsewhere (see Graeber and Wengrow, 2021), often contrived to enhance the lure of ancient cities to maintain population.

COOPERATION AND PUBLIC GOODS

Early evidence of social integration often results from autonomous groups gathering in special locations to exchange goods, and feast and labor together—all examples of cooperative behavior (Stanish et al., 2018). Social complexity requires cooperation, which necessitates complex systems of coordination (Hardin, 1990) and deeply interpenetrating infrastructural power. Working together is the foundation of any complex social system, and more-cooperative societies tend to be more stable than those that are more competitive (Feinman and Carballo, 2018, p. 15). Increasing complexity and size in more-cooperative societies requires the development of leaders to organize and prevent cheating (Kohler et al., 2012). Even competitive states require some cooperation, with benefits to those cooperating. Otherwise, the cost of punishing free riders—those who use or benefit from public goods but refuse to contribute their share of the costs—would be too great (Hardin, 1990).

Cooperation and Leadership

More-competitive states expend significant resources on sovereigns in the form of palatial residences, extravagant tombs, and celebratory monuments. These states also exhibit greater inequality, including exclusionary tactics regarding access to ceremonial spaces and prestige goods, and invest considerably less in public goods. In contrast, more-cooperative societies are less exclusive, with less inequality. Resources are invested more in serving the greater welfare through public goods or works and common lands. Visible symbolism focuses more upon the collective and cosmogenesis, rather than upon the lords and their ancestors (Blanton, 1998; Feinman and Carballo, 2018, p. 10). Leaders in cooperative societies receive rewards in the form of resources and status, but not enough to permanently elevate their status substantially above the rest of the community.

Societies can become more or less cooperative over time. When the leadership begins to develop exclusionary tactics, diverting the surplus of cooperative activity to exalt their status and infringing on public goods, then a shift toward a more competitive system of governance has begun. The increasing sacrifice of public goods/works to invest in the ruler, as a matter of divine right, is a prelude to despotism. Collective rituals may be refocused to incorporate the paramount and their ancestors as key players in community formation (communogenesis) and/or cosmogenesis. While the collective can still enjoy local sanctity and solidarity, elites have greater access to and knowledge of these symbolic and ritual goods. Ancestors, for example, act as intermediaries between the community and the supernatural world. Their activities mimic those of mythical heroes and gods, and may contribute to communogenesis. Sovereigns may ritually reenact these actions, assuming the stature of ancestors or deities (Helms, 1998, p. 124–125), but in so doing, they may encroach on public interaction with the spiritual world.

The shift from a more-cooperative to a more-competitive system does not represent the culmination of a unilineal trend, as the public can push back against such leaders. Nor is a competitive shift progressive, as cooperation encourages "higher per-capita payoffs than could otherwise be obtained by working in smaller groups of households" (Stanish et al., 2018, p. E6716). Cooperative leadership strategies can be far more effective in controlling individual behavior than despotic power (Mann, 1984, p. 189).

Public Goods

Public goods are shared resources hypothetically available to all. They generally increase social interaction and enhance quality of life (Florida, 2014, p. 200). Most public goods visible in the archaeological record are material products of public works, built through obligatory collective labor or some form of taxation. These may include hard infrastructure, such as travelways or storage accommodations, as well as services such as education, food distribution, defense, and sanitation. Many public goods double as social infrastructure—investments that enhance social interaction such as gathering places (plazas, streets, and parks) (Klinenberg, 2018).

Pure public goods are non-excludable and non-rivalrous resources (Cornes and Sandler, 1996): that is, a person cannot be excluded from using them, and one person's use of the goods does not exclude use by another person. Pure private goods are those that can be used only by those who have some claim to ownership. Most public and private goods are impure to some degree: they are not clear binaries, but rather exist on a

continuum (Cornes and Sandler, 1996, p. 4). Most goods have a certain degree of excludability. Club goods, for example, are public goods with access reserved to a certain segment of the population (Cornes and Sandler, 1996, p. 12) to limit declining use-value through overuse or crowding. Payments or fees may be required for access. At the same time, private goods may not be entirely private and indivisible: the owner of one piece of land may produce pollution (e.g., of a water system) that impacts the use of nearby lands owned by others.

Symbolic Public Goods

Public works projects frequently focus on the social and political (and performative) processes of "place-making" as a public good. "Places" are socially constructed spaces that have assigned meanings. They are "politicized, culturally relative, historically specific [spaces that] come into being through praxis" (Rodman, 1992, p. 641–642). Places are lived and experienced, and their meanings can vary over time and according to different users. The processes of spatialization—defining and cognitively ordering spaces, whether natural or human-built—result in an organized landscape of places with real or imagined meanings, often subjective and deeply symbolic, that contribute to a sense of community. Heritage resources and sacred spaces provide good examples of spatialized symbolic public goods. In modern cities, these are externalized and internalized, but also often contested (Siemiatycki, 2005; Alonso Gonzalez, 2014). Some seemingly mundane spaces, such as open plazas and still or moving water, also can become places with symbolic value, for example as boundaries, in the case of the last.

The spatialization of public goods is often encouraged by religious beliefs, such as the concept of the divine city, believed to have been created by divine intervention. Ancient examples include Eridu and Jerusalem in the Near East and Tollan in Mexico. Humans can create divine cities by following religious doctrines. For example, among Renaissance Catholics, Rome displaced Jerusalem as the earthly manifestation of Heavenly Jerusalem as a result of urban planning using numerology, geometry, and harmony, plus the location of the tomb of St. Peter and other relics (Andersen, 2021, p. 349–351). Such actions can become politicized and unpopular, however: many seventeenth-century Scandinavian Protestants rejected Rome's centrality and constructed their own "square-shaped" cities as earthly Jerusalems through similar city planning involving numerology (e.g., numbers 5, 7, 12), symbolism, and harmony (Andersen, 2021, p. 351–367).

The sacred quality of certain public goods is not limited to temples and other highly symbolic places. Creator gods established the orderly Earth and eternal cycles of fertility. For these gifts, humans are perpetually indebted to the gods (Godelier, 1999). Because high gods and other supernaturals are often believed to punish selfish persons like free-riders or shirkers, religious beliefs tend to encourage cooperation (Johnson, 2005). In ancient societies, contributions to the public good would have included following religious rules, participating in rites, and making offerings, along with aiding construction and preparing and providing resources for feasts and other events (Miller, 2021).

Festivals and Feasting

Festivals vary in their themes, but are "collective, participatory celebrations" (Quinn and Wilks, 2013, p. 15), both social and symbolic public goods. Festivals can help integrate persons who had no previous interactions and increase the bonds of those with preexisting associations. They tie the resulting networks/communities to particular places, although the experiences of participants vary (Quinn and Wilks, 2013). Whereas, rituals are communal events, those of more-collective and more-competitive states vary significantly. Those of the former emphasize trust among participants, while the latter vociferously proclaim the legitimacy of the ruler (Blanton, 2016, p. 42).

Archaeologists often emphasize the feasting aspects of rituals, as the serving vessels and faunal remains leave strong traces in the archaeological record. However, we acknowledge that feasts are part of larger ritual programs and perhaps not the most central activity of festivals.

Feasts are unusual instances of food-sharing that most commonly occur in ritual contexts. They are symbolically dynamic and can evoke solidarity, while also signifying inequality (Hayden, 2001). Feasting is linked to early pilgrimage centers, settlement aggregation, and cooperation, including the construction of ceremonial places (Stanish et al., 2018).

Festivals and feasts involve social cohesion, the communication of social information, and the construction of status and inequality. Theoretical models vary in their emphasis on these qualities (Hayden and Villeneuve, 2011, p. 441) but, as with public goods, we must be wary of assumptions that elite agents sponsored them to bolster their own stature. Hypothetical efforts at poor governance—if we can even refer to status-seeking as governance—require direct evidence. Symbols and deities appropriated by divine rulers, such as pools of water among the Maya (see Normark, 2019), when the society takes a despotic turn, cannot be assumed to represent precursors to divine rulership in an earlier time of more collective governance (Pugh, 2021). Such is also true of feasting. All ritual participants are agents and in more-collective organization, rituals do not follow an austerely top-down structure (Feinman, 2016).

Abundant evidence of feasting exists for the Maya. A communal festival called *cuch* focused on deer, and was associated with rain, agriculture, rebirth, and seasonality (Pohl, 1981). Dogs were commonly featured, along with deer, in Middle Preclassic feasts (Sharpe et al., 2018). In Colonial times, dogs were associated with the Underworld, renewal, and cacao (White et al., 2001, p. 92).

CITIES, THEIR MANAGEMENT AND GROWTH

Cities, with dense populations and extensive face-to-face interactions, possess a strong quality of place and inspire awe (Florida, 2014; Yoffee, 2015). They extract resources from the hinterlands, but differ from them in function (Smith, 2014), and possess infrastructure that furthers social interaction (Blanton and Fargher, 2011, p. 507–517; Bettencourt, 2013). Cities are

social reactors that enhance creativity, wealth, production, and consumption, all of which lower hard infrastructural costs (Bettencourt and West, 2010) and tend to have heightened occupational specialization (Algaze, 2018). The lower costs and better returns are similar to those in more-cooperative communities, highlighting that living in close contact and specialization require sharing and cooperation. It is, perhaps, the dramatic returns of intensified collective action that lead to some cities being considered divine.

These advantages can also have negative impacts, such as poor health and increased disease and crime (Bettencourt and West, 2010). Lacking modern medical and waste-management technologies, ancient cities required constant in-migration to sustain their population size and promote economic development (Algaze, 2018). It is often the exchange of ideas and resultant creativity that attracts people, stimulating growth (Lucas, 1988, p. 38). As with the sharing of food in feasts, the exchange of ideas and knowledge can help bind people together. Cities' population densities mean that people in various occupations live in proximity, leading to exchanges of information and access to markets, offering advantages for marketing goods.

Communities seeking to further a city's growth can strengthen quality-of-place "pull factors" to encourage in-migration (Florida, 2014, p. 203). Amenities such as public goods help retain the existing population (Smith et al., 2018, p. 18) and tend to draw people, especially creative individuals (artists, engineers, philosophers, and academics) into modern cities (Florida, 2014; Batabyal et al., 2019). Artisans and their goods embellish the city with respect to technology, art, education, and economic vitality, enhancing daily quality of life, furthering the definition of social identities and statuses, strengthening creation of alliances, and supporting local and regional interactions. "The vibrancy of street life, café culture, arts, music, and outdoor activities" also draws new occupants (Florida, 2014, p. 203). In ancient cities, pull factors would include public goods, creative, economic, social, and religious activities, augmented by the social-reactor features of dense population and interactions, as well as resources.

THE ANCIENT MAYA

Details that might illuminate ancient Maya philosophies of cooperation are long lost. The Popol Vuh, a Maya creation story committed to writing in the highlands during the Colonial period, makes it clear that true humans must work together to maintain the calendar and worship the gods, or face punishment (Tedlock, 1996, p. 67–71). Some modern Maya believe in a *k'u'x* soul: cosmic energy running through everything, but concentrated in people and important places. It is the spiritual bond that ties everything together, especially communities (Fischer, 1999). Cooperation in labor as well as participation in group rituals are said to reflect that a person's *k'u'x* soul is balanced. Persons who do not fulfill these obligations can receive social censure and they may lose part of their soul (Fischer, 1999, p. 483). The ancient Maya, of course, had no knowledge of Heavenly Jerusalem, but they did have their own concept of sacred cities (Davies, 1977, p. 48–49): *si'an-ka'an* "born of heaven." Merida (Yucatan, Mexico), ancient T'iho, was known, just before and after the Spanish conquest, as Ichcanzihoo, a variant of *si'an-ka'an*, heaven-born (*sih/zih*, to be born; *caan/ka'an*, sky, heaven).

Other important cities were known throughout Mesoamerica as *tollan* "place of reeds" (Davies, 1977). Tollan was a paradigmatic city, a mythic creation place where time and cosmic order began (Uriarte, 2006), thus its form directly reflected divine action. Designating a city as a tollan would have indicated that it had special qualities (Davies, 1977, p. 27). Many great Mesoamerican cities of antiquity were given the title of Tollan, the most famous (though not the most impressive) of which was Tula, outside modern Mexico City, occupied by a people known as Toltec (Kristan-Graham and Kowalski, 2011; Iverson, 2017). Classic and especially Postclassic dynasties often claimed that their ancestors were from a tollan. Tollans were not just replicas of a moment in deep history, but critical artifacts of group history and community formation.

Living in a Mesoamerican tollan or a Heavenly Jerusalem would have bounded inhabitants in a sacred, ordered landscape. These qualities were certainly public goods. Yet, as with all public goods, machinations were likely constant. Cities' sacred topographies were uneven, with some places, such as caves and springs, more sacred than others, and their re-creations in the form of temples, tunnels, and pools were also sacred. Pools/reservoirs are found in the Olmec area and at Middle and Late Preclassic Maya sites (Rice and Pugh, 2017; Inomata et al., 2020; Canuto and Estrada-Belli, 2022, p. 93).

The Maya generally encased old structures in new constructions, meaning that, over time, the sacredness of cyclically reused religious architecture—its *k'ux'*—likely accumulated. Such public buildings with cumulative sacredness and history were communal assets in more-cooperative societies. But this variability in sacrality presented the potential for restriction: persons living outside the sacred places may have enjoyed this good only when they visited—if they were even allowed to visit. Divine rulership may have been imported into the Maya lowlands from the Olmec area during the Late Preclassic period (Freidel, 2018, p. 372). During the Late Preclassic and Early Classic, formerly common areas came to be intruded by royal tombs, noble residences, and stelae depicting kings, signaling the exclusionary tactics of a more-competitive society (Doyle, 2017, p. 140–146).

NIXTUN-CH'ICH'

Nixtun-Ch'ich', on the southwestern edge of Lake Petén Itzá, was the largest settlement in the lake basin during the Middle Preclassic period (cal 800–300 BC) (**Figures 1**, **2**). Earliest occupation and possibly construction on the tip of the eastward-extending Candelaria Peninsula were initiated before 1,000 BC (Rice, 2009), but pottery on the elevated mainland part of the site indicates early residence there, too. The city's most distinctive feature is a gridded urban core formed by intersecting corridors

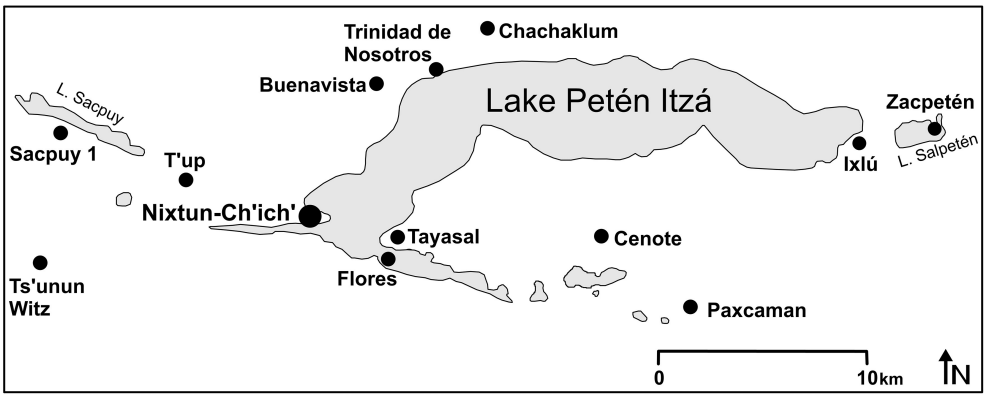
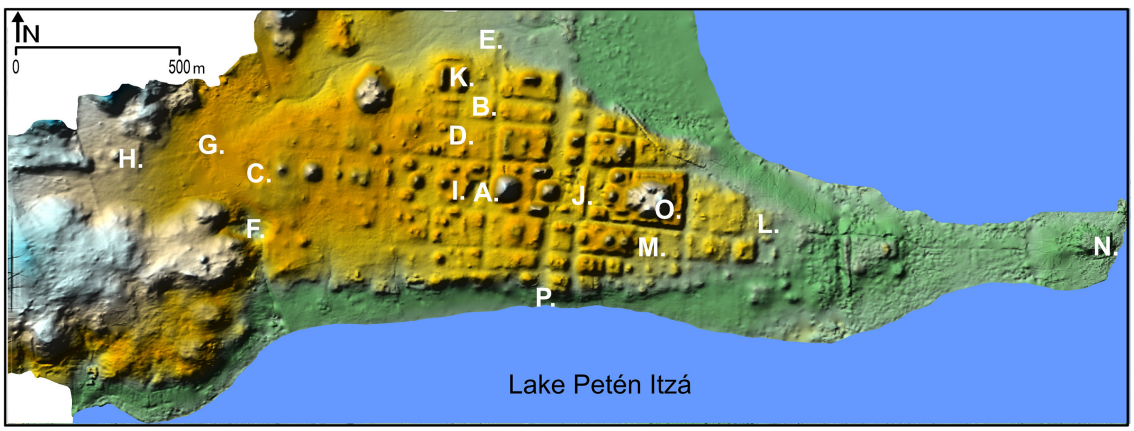


FIGURE 1 | Locations of sites with Preclassic occupations near Nixtun-Ch'ich'.



Fosas
A. Fosa Y
B. Fosa I
C. Fosa V
D. Fosa Q
E. Fosa C
F. Fosa B
G. Fosa U1

E-Groups
H. Group A1
I. Group Y1
J. Group AA1

Ballcourts
K. Ballcourt 1
L. Ballcourt 2
M. Ballcourt 3

Other
N. Structure ZZ1
O. Structure BB1
P. Avenue G, South Entrance

FIGURE 2 | Nixtun Ch'ich', Petén, Guatemala.

(**Figure 3**). The grid centers on a 3 km-long line of 21 buildings and two ponds, which established the city's axis urbis and bilateral symmetry. This axis generally follows the topography of the peninsula, and its orientation of 94°40′, slightly south of east, may have been roughly focused on equinoctial sunrise, or more precisely directed toward sunrise on a particular date. Emplaced between 800 and 500 BC, if not earlier, the axis urbis helped coordinate construction at the site for more than 700 years, with a massive Late Preclassic triadic group (Group BB1) as well as the remodeling of an early architectural complex known as an E-Group (see below) following its lead. Nixtun-Ch'ich' is immediately recognizable as a city because it looks like a modern city; that is, it was obviously planned and constructed according to the same principles: facilitating social interaction (Bettencourt, 2013).

Several other Middle Preclassic settlements stood nearby and suggest the existence of a site-size hierarchy (**Figure 1**). Primate settlement distributions are those with capitals markedly larger than secondary and smaller centers, ostentatiously impressive and monopolizing social activities, production, and trade, thereby stunting the growth of secondary centers (Jefferson, 1939; Blanton, 1976, p. 255–256). Our data suggest that Nixtun-Ch'ich' exhibits extreme primacy, as it is around five times as large as the combined size of its two largest secondary centers (following Short and Pinet-Peralta, 2009, p. 1,254–1,256). It has three E-Groups, whereas other nearby centers only have one each. A similar relationship is observed at Cival, which has five E-Groups and nearby centers have one each (Estrada-Belli, 2017, p. 303–308). We have proposed that Nixtun-Ch'ich' was the capital of an early primate state in the western Petén lakes region (Pugh et al., 2020; Rice and Pugh, 2021).

Nixtun-Ch'ich' was creatively planned to fit the natural topography and aquifer into the cityscape. Its design heavily emphasizes linearity and symmetry through the medium of

FIGURE 3 | Plan of corridors, Nixtun-Ch'ich'.

public works—roads, ponds, and ceremonial architecture. Public goods would have included these works as well as plazas (Norwood and Smith, 2021) and water management. Even if some of these goods were purely non-excludable among members of the polity, their concentration in the capital would have distanced them from the larger community. In this respect, the public goods of Nixtun-Ch'ich' were not completely pure.

Road Grid

The most obvious public work at Nixtun-Ch'ich' is its gridded road system (**Figure 3**). The city has six east-to-west corridors that we call streets and identify by number, and at least 11 north-to-south avenues labeled by letter (Pugh, 2019). These were clearly centrally planned and required immense effort to construct, including stripping of old soils, vegetation, and debris (Obrist-Farner and Rice, 2019) and paving with stone and plaster. Road systems have varied functions, but most connect people and allow for easy navigation and efficient movement. Pedestrians and resident cattle still use the city's ancient grid to move easily across the landscape.

The city's highly symmetrical layout results from the coordination of the east–west streets: Third Street with Fourth and Second with Fifth, forming trapezoids. The avenues, by contrast, are all roughly oriented north-to-south, but are inconsistent in their precision. Avenue F, the longest, stands nearly perfectly perpendicular to the axis urbis, thus the avenues' plan was based upon these axes. We consider Avenue F to have been a second, lesser, city axis, differing from the axis urbis not only in direction but because humans could more easily walk its length.

Avenues G and H each have two parts leading into the city, one from the north and the other from the south, joining at the Sector AA E-Group (see below). Both parts of Avenue G, north and south, are wider than the other roads at Nixtun-Ch'ich' and were likely principal site entrances. The two parts of Avenue H were also likely entrances, but they are narrower and perhaps less important. The area of Avenues G and H and its E-Group appears very similar to a "Middle Formative Usumacinta (MFU) pattern" at La Carmelita (see Inomata et al., 2021).

Except for Avenues G and H, the Nixtun-Ch'ich' road system is largely non-focal—it does not emphasize particular landmarks (Pugh, 2019). Focal points within a largely non-focal grid system are also found within modern cities, as is clearly observed in Washington, DC. Most of that city's focal points are emphasized by diagonal corridors highlighting moments in national history. Besides acting as connectors, roads are also critical public spaces of social interaction, from simply hanging out to economic exchange to ritual events (Gehl, 2011). The intersections of some of the wider thoroughfares might have served plaza-like functions as gathering places and perhaps, like plazas, housed periodic market-like activities.

The Nixtun-Ch'ich' road system had still another function: it drained the city. For the most part, water drained down the middle of the corridors, though in some areas water was diverted into canals separate from pedestrian ways. The strongly inclined streets, avenues, and canals acted as a drainage system, channeled runoff from heavy tropical downpours north into the Ensenada San Jerónimo and south into a narrow arm of Lake Petén (Pugh, 2019; Pugh et al., 2021). The drainage at Nixtun-Ch'ich' would have rid the city of unhealthy standing water.

The Nixtun-Ch'ich' travelways could have been sources of conflict between public and private interests. From the Middle to Late Preclassic periods, the bordering platforms were gradually enlarged and expanded outward, narrowing the corridors (Pugh,

2019). Many platform uses were more private, as they supported residences, but the platforms of ceremonial architecture also expanded. The process seems to have occurred equally along the lengths of streets and avenues, so it appears to have been coordinated/planned. This privatization by encroachment seems to have benefited all occupants of the urban core at the expense of public goods.

Symbolic Public Goods

Nixtun-Ch'ich' functioned as a ritual-religious center throughout the Preclassic period, and abounded with symbolic public goods. Its mythical creation-crocodilian layout (Rice, 2018a, 2020) would have conferred a number of qualities upon its occupants including sanctity, tollan-like or *si'an-ka'an*-like status, group history, identity, and collectiveness.

Streets and Avenues

The road system was not only of practical benefit to the citizens of Nixtun-Ch'ich', it had symbolic value as well as being an emblem of order. Human labor transformed the entangled, dark, chaotic, natural world of the primordium into an orderly form (Taube, 2003, 2004), with straight lines, right angles, and white limestone-brightness of settled communities. The axis urbis and roads of Nixtun-Ch'ich' were not only very straight, the corridors were gridded, forming a woven mat- or *petate*-like design, a symbol of authority (Coe, 1965, p. 105; Robiscek, 1975; Hammond et al., 1992, p. 961–964). In Yucatec and Tzeltal Mayan languages, the word *toj* "straight" signifies truth, order, and morality, relating to space ordered as a rectangle and "the social wellbeing and harmony of communities" (Taube, 2003, p. 465).

The road grid of Nixtun-Ch'ich' had another symbolic function: modeling the layout of the city to mimic the dorsal surface of a crocodile facing east (Rice, 2018a, 2020). The corridors define and separate 50-some alphabetically named sectors comprising quadrilateral platforms and ceremonial structures that correspond to the raised scutes on a crocodile's back. The reptile was important in Maya (and Mesoamerican) Creation mythology because, according to one myth, a crocodilian slain by the gods rose from the primordial sea to become land (Taube, 1989). The bilateral symmetry of the city's construction around its axis urbis replicates the bilateral symmetry of the creature's back.

The gridded layout and ceremonial structures along the Nixtun-Ch'ich' axis urbis changed over time and expanded in size from the original Middle Preclassic construction through the Late Preclassic. Encased in each structure and platform were earlier versions built by previous generations back to the founding ancestors. Creating a tollan was not a single action solely of the founders, but a repetitive exercise of (re)production by each generation that built and rebuilt in the rhythm of a tollan. The axis endured and the gridded roads, while narrowing over time, remained straight. This tollan was not just a replica of the moment of Creation in deep history, but a critical artifact of group historical consciousness.

The streets and avenues, as well as the early platforms they link, emphasize horizontality rather than verticality (see Joyce, 2004). Temples elevated on high platforms tend to exclude, because the activities carried out inside are not visible to the public, whereas horizontal monuments are inclusive (Estrada-Belli, 2006, p. 64), being visible to, and usable by, the general public. Thus, they emphasize the collectivity that constructed and used them. The tallest building in the city, Structure BB1/1-1, the eastern edifice of a triadic group, currently stands at 27 m. However, the latest Middle Preclassic-period temple buried under the plaza of this triadic group stood only 17.5 m tall. The raised plaza of the BB1/1 group stood 18 m above the adjacent streets and was enclosed on four sides. Thus, this public work housed greater exclusivity in participation and exemplifies the Late Preclassic beginnings of exclusionary tactics by the leadership.

E-Groups

Nixtun-Ch'ich' has three architectural complexes known as E-Groups lying along the axis urbis in Sector AA in the eastern part of the city, Sector Y in the center, and Sector A in the west. These long-lived complexes, often remodeled, consist of two structures, east and west, facing each other across a plaza. In their final iterations, which date to the Late Preclassic or Early Classic periods, the eastern building is an elongated north–south platform with structures at its ends and center, and the western building is a radial pyramid with stairways on the four sides. E-Groups began to be constructed in the early Middle Preclassic period and are widespread in the Maya area (Freidel et al., 2017) and beyond. The earliest radiocarbon-dated complex in Petén is at Seibal, built around 1,000 cal BC (Inomata et al., 2013), but others are relatively dated by pottery fragments to a similar age, including Nixtun-Ch'ich' Sector Y (Rice et al., 2019) and Tikal's Mundo Perdido (Laporte and Fialko, 1995).

The specific and general functions of E-Groups have been much debated. Specific functions have long been thought to be related to horizon-based, solar observational astronomy: viewing solstice or equinox sunrises (or other celestial bodies and dates). A connection with time's passage is suggested by early stelae celebrating the endings of 20-year *k'atuns* in front of the eastern building at some sites, such as Uaxactun.

Absent better information on functions, E-Groups are generally seen as having multiple uses: places for various rituals or performances (perhaps time/calendar/astronomically related) and gatherings (Fialko, 1988; Laporte and Fialko, 1995). These gatherings could have included periodic, local or regional, market-like fairs featuring exchanges of certain goods alongside ceremonial or commemorative activities. Such activities, along with the construction of monuments, established E-Groups as central collective places (Doyle, 2017, p. 37–38). They coordinated populations spatially and, if they had some calendrical functions, they coordinated temporally.

Ponds/Fosas

Seven ephemeral ponds, which we call fosas, were incorporated into sectors of the city's urban core: Fosas B, C, I, Q, U, V, and Y. Some are natural, others are artificial; several appear to represent natural depressions that were modified—enlarged or sealed—by the ancient Maya. Some are fed from underground by the aquifer; others from rainwater. They are ephemeral because they vanish

during the dry season and re-emerge during the rainy season. Fosas C, Y, and I stood in a nearly straight line, evidencing the artifice. Each was several meters west of Avenue F, suggesting a role in processions. This line, almost perfectly perpendicular to a line formed by Fosas V and Y, highlights the relationship of Avenue F to the axis urbis.

E-Groups are often associated with pools of water (Reese-Taylor, 2017, p. 485), as at the Sector Y E-Group. Fosa Y, a deep reservoir, lies immediately east of the eastern platform, Structure Y1/1. A Late Preclassic stairway in the middle of the eastern side of the structure leads down to Fosa Y, signifying a strong relationship between the two. The Sector A E-Group, at the westernmost portion of the site, has no pool immediately next to it, but Fosa V stands 320 m to its east—the two separated by a large empty space. Farther eastward, the Sector AA E-Group has no known pool to its east unless one lies underneath the Late Preclassic period triadic group (BB1). Specific use-related ties between ponds and E-Groups are unknown, however.

Creation of artificial pools required management of groundwater by the planners and builders of Nixtun-Ch'ich'. The five fosas in the core are places where water was allowed to penetrate the surface in a controlled manner. The engineering that allowed the yearly cycle of renewal of those that filled remains unknown. Keeping groundwater in check prevented flooding during the rainy season, thereby increasing the quality of life in the city. Controlling floodwaters to maintain dry land reflects Maya Creation mythology and the orderly universe (Taube, 1988, p. 310; García, 2006). References to flooding may be present on the Late Preclassic murals of San Bartolo (Taube, 2012, p. 12). The annual formation of the ponds mimicked the natural cycles of birth, death, and rebirth, and likely projected beauty, an orderly city, and time.

Caches in the ponds indicate ritual activation: pools of water often represented entrances to the Underworld and are associated with ancestors, *k'u'x*, wind, and rain (Fischer, 1999, p. 482–483; Brady and Prufer, 2005; Saturno et al., 2005, p. 7–8). The ponds represent order and control, as Underworld water is held in balance and reemerges according to annual rhythms. The art and architecture of more-cooperative societies tend to emphasize myths of fertility, creation, and renewal (Feinman and Carballo, 2018, p. 10).

Fosa Y

Fosa Y, east of the Sector Y E-Group, stands at the intersection of the axis urbis and Avenue F, the crossroads of the city. We believe that it is partially natural and helped establish the site layout, making it the most central place of the city (Rice et al., 2019). It measures 46 m north–south by 31 m east–west, and is 2.5 m deep measured from the unmodified edges. The deepest soils excavated in the depression were wet, dark clay and we assume they were deposited in a seasonal pond bed, but despite excavating 6 m, we did not encounter bedrock, sterile soil, or water. This led us to believe that the fosa likely began as a natural sinkhole, intentionally or unintentionally sealed in antiquity. A Middle Preclassic pottery vessel was cached 5 m below ground surface.

Above the dark soil, a series of terraces form an amphitheater-like ring around the interior of Fosa Y. On its eastern side, these steps or seats extend 10 m into the fosa, down to a plaster floor; the tiers also exist on the west. The terraces were covered with Middle Preclassic pottery sherds, many from reconstructible vessels, which appear to have been terminated by smashing. The vessels include decorative wares and exhibit very little erosion, so they were likely covered with fill after their deposition. One spouted vessel was modeled as a cacao pod (**Figure 4**). Some exotic objects, such as a fragment of a jade Olmec mask, were recovered.

FIGURE 4 | Golondrina modeled black slipped vessel, Fosa Y, Nixtun-Ch'ich'.

Significant amounts of faunal material with the Middle Preclassic ceramics imply food-sharing and feasting (Rice and Pugh, 2017; Rice et al., 2019). A preliminary study of faunal remains from Fosa Y counted 674 animal bones, of which 351 could be identified by species (**Table 1**). The sample included low frequencies of armadillo, agouti/paca, galliforms, and ray-finned fishes, but the most prevalent identified species were domestic dogs, followed by white-tailed deer, and turtle. Turtle remains included few limb bones and mainly carapace/plastron scute fragments.

Most parts of both deer and dog were utilized and discarded in Fosa Y. However, no deer skull elements, including dentition, were recovered and they may have been reserved for offerings (Pohl, 1983; Brown and Emery, 2008, p. 326). Canid/carnivore cranial and facial elements (dentition included) were usually fragmentary and/or numerous, such as teeth, increasing counts. Dog forelimbs and deer hind limbs and front limbs occurred in higher frequencies than expected relative to other anatomical regions; dog hind limbs may have been too fragmented to identify. The bias toward meaty limbs suggests that most were butchered elsewhere. Sacrifice does not explain the majority of deer and dog remains in Fosa Y.

Overall, 34% of the collection incurred some level of burning. The majority of turtle specimens were burned—a strong indication that they were probably roasted in their shells (Hamblin, 1980). Only 4% of the entire assemblage and 8% of identified dog bones showed signs of cut marks, but many

TABLE 1 | Fauna of Fosa Y, Nixtun-Ch'ich'.

Taxon	Common name	NISP	MNI	MNE*	% Burned	% Cut marks
Testudines	Turtles	154	10	4		
Dermatemys mawii	Central American River turtle	14	1			
Kinosternon spp.	Mud turtles	8	1		70.3%	
Trachemys scripta	Meso-American slider	3	2			
Dasypodidae	Armadillos	3	1			
Cuniculus paca	Lowland paca	1	1	1		
Galliformes?	Ground-feeding birds	1	1	1		
Actinopterygii	Ray-finned fishes	3	1	3		
Canis lupus familiaris	Domestic dog	111	13	90	28%	8%
Canid/carnivore		14	3	6		
Odocoileus virginianus	White-tailed deer	39	8	17	56.4%	
Mammal (small)		6	2	4		16.6%
Mammal (small/medium)		28		7		
Mammal (medium)		55		18		1.8%
Mammal (medium/large)		41		6		
Mammal (large)		23	2	4		
Vertebrate		170		16		
	Total	674	48	175		

**Only long bones, not including scutes.*

bones also suffered abrasion and root damage that may obscure cut marks.

Although Fosa Y has seen substantial excavation, the locus is far from completely understood. The encircling, stadium-style seating suggests that Fosa Y hosted some sort of performances in its center, but we do not know the nature of the performance. The seating would have accommodated a larger crowd and allowed better visibility than standing in a plaza. Feasts may have been sponsored to foment the social reactor of urban life for the greater good, in times of nascent social complexity, and perhaps between occupants of the city and outsiders. Middle Preclassic-period Fosa Y, the epicenter of Nixtun-Ch'ich', was an overtly public space.

Fosa I

Fosa I stands west of the site's largest ballcourt, Ballcourt 1, in Sector I. Ballcourt 1 is an enormous, 137 m-long (north–south) and 85 m-wide, I-shaped court, its two parallel mounds standing 7 m tall. Mesoamerican ballcourts were public goods, serving as theaters for contests that were part sacred ritual and part recreational sport. Test excavations revealed that the majority of construction dated to the Late Preclassic period. Middle Preclassic-period construction was encountered deep under the eastern building, but, as with Ballcourt 2 (Rice, 2018b), we do not know if this earlier building formed part of a court. The deposits in nearby Fosa I suggest that the area had witnessed substantial Middle Preclassic ceremonial activities.

Fosa I filled with rainy season water during fieldwork until around 2013, and likely did so in the Late Preclassic period, when Ballcourt 1 was in use. Nevertheless, evidence of construction and ceremonialism in the pond bed dated from the Middle Preclassic and earlier periods, not from the Late Preclassic (Pugh et al., 2021).

The base of Fosa I was a dense (extremely fine), sterile, white clay, also found below some other archaeological deposits at the site. It held substantial water, as it began to loudly crack after a day's drying and shrinkage through exposure. White clay, lacking coloring contaminants, is a distinctive and uncommon, hence valued, resource, likely used to create certain figurines (Rice, 2019).

A fill layer with both Mamom and Pre-Mamom pottery fragments separated this sterile clay base from a plaster floor, which, like the three above, sloped downward and eastward to the center of the fosa. These were not typical fine plaster floors; instead, they were composed with greater amounts of sand, perhaps to facilitate penetration by the aquifer. The fill separating the first and second floors included large amounts of Middle Preclassic sherds and several offerings, including a cached Desvario Chamfered ceramic vessel, marine shell pendants, and a deer antler. The third floor rested immediately upon the second. The third and fourth floors were separated by fill with large amounts of Middle Preclassic sherds, faunal remains, a ceramic roller stamp depicting a reptile (**Figure 5**), ceramic figurines (**Figure 6**), and jade artifacts including beads and a tiny animal head. A similar fill lay upon the fourth floor, above which was collapse from adjacent buildings including Terminal Classic-period diagnostics.

The caches of Fosa I indicate ritual activation. Complete deer antlers are rare in the archaeological record in the Petén lakes region, as they are commonly modified to produce tools. Deer antlers and skeletal material, among other faunal remains, were found in Late Classic-period reservoirs at Cancuen and may have been the result of deer sacrifice during fertility and water rituals

FIGURE 5 | Roller stamp depicting reptile with artist's reconstruction of the stamp, Fosa I, Nixtun-Ch'ich'. Mandible area is missing (drawing by Kelly McLafferty).

FIGURE 6 | Examples of Figurines, Fosa I, Nixtun-Ch'ich'.

(Thornton and Demarest, 2019). Antlers also may be tied to rain. They occur seasonally, with male white-tailed deer tending to be antlerless between January and April—the dry season (Klein, 1982). In the Guatemalan highlands, deer skulls were placed in caves as offerings to the guardian of deer, but the antlers were removed (Brown and Emery, 2008). This point evokes another aspect of pools of water—they often represented entrances to the Underworld and are associated with ancestors, *k'u'x*, wind, and rain (Fischer, 1999, p. 482–483; Brady and Prufer, 2005; Saturno et al., 2005, p. 7–8).

An extremely high number of ceramic sherds was found in Fosa I, but they differed from Fosa Y as they were smaller and did not form as many reconstructible vessels. However, the unusually high frequency of faunal remains suggest feasting. The ceramic figurines included several heads, which are rare elsewhere at the site and may have been offerings. The roller stamp may represent elite participation as several stamps were found in an elite burial at Cuello (Hammond et al., 1992, p. 957). Similar stamps have been found elsewhere at Nixtun-Ch'ich', including with Middle Preclassic feasting refuse in Structure ZZ1 (Rice, 2009, p. 407).

Other Fosas

Fosas Y, I, and C all border Avenue F and stand roughly in a straight line, reiterating the centrality of Fosa Y. Fosa Y and Fosa V form part of the axis urbis of Nixtun-Ch'ich'. Excavations into a platform (Structure W1), midway between Fosa V and Fosa Y, struck the aquifer during the rainy season of 2016 (**Figure 7**). The aquifer had been sealed by a 25 cm-thick layer of heavy, gray clay, its base at the same elevation as the water level in Fosa V. Similar clay was used elsewhere at Nixtun-Ch'ich' and other Maya sites as architectural mortar, footing, and coating (Rice et al., 2018; Pugh, 2021). In the base of Structure W1, the material appears to have been used as a sealant to contain groundwater. Fosa V has not been excavated, but it completely desiccates during the dry season and fills with a few feet of water during the rainy season.

Fosa C stands adjacent to the northern end of Avenue F—the northernmost of the avenues and likely one of several site entrances. It is possible that Fosa C and Fosa V marked boundaries of the urban core of the city. Fosa C is roughly centered on the northern edge of the urban core and Fosa V is similarly positioned on the western edge. Lake Petén Itzá formed the southern boundary. Excavations along the southern shore of the city revealed a number of cached Middle Preclassic ceramic vessels. The Sector A E-Group stands 320 m west of Fosa V, outside the urban core, and no eastern fosa, like that of the Sector Y E-Group, was discerned.

Fosa Q stands between Fosa Y and Fosa I, but offset slightly to the west. Like Fosa I, it is visible without excavation, as the grass planted for cattle grazing does not thrive above it—presumably the soil retains too much water. A ring of stones protruding above the ground surface also defines its edges (Pugh et al., 2021). Excavations tested the interior of Fosa Q and found that its edges were composed of large stones and its base was lined with smaller stones. The feature was devoid of de facto artifacts, but the soil that filled it contained Late Preclassic-period diagnostic ceramics. Middle Preclassic-period deposits, including a number of marine shells and figurine fragments, were found in a refuse deposit to the south of Fosa Q.

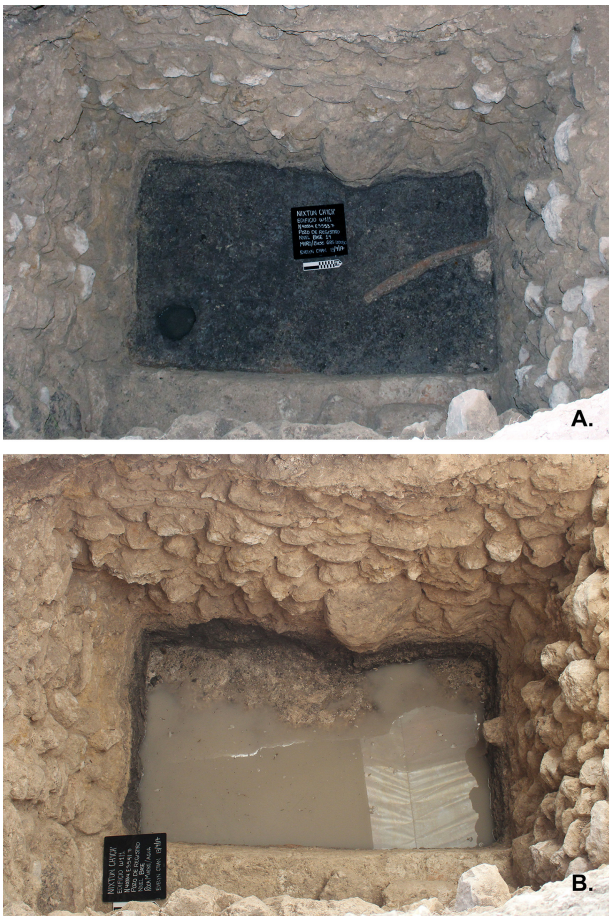


FIGURE 7 | The removal of the clay sealant, structure W1, Nixtun-Ch'ich' (**A** Before sealant removal. **B** After sealant removal).

Figurines

Fragments of anthropomorphic and zoomorphic hand-modeled, fired-clay figurines and musical instruments (whistles, ocarinas) were recovered in varied contexts throughout Nixtun-Ch'ich' (Rice, 2019), including 65 in the fosas. The paste color of 29.9% (74 of 247) percent of them was white-to-cream and it was proposed that they were produced at Nixtun-Ch'ich', a prescient observation preceding the recent discovery of light gray and white clay deposits at the site. Those of other colors, varying from gray to tan to brown to red, along with the NAA findings of varied chemical compositions, raise the possibility that persons from throughout the lakes region or even outside it attended rituals or other festivities at this regional capital.

Middle Preclassic/Formative figurines throughout Mesoamerica are generally unclothed but rarely were modeled to depict anatomical sexual traits. At Nixtun-Ch'ich', fewer than 10 torsos were judged to be female on the basis of delineation of breasts, vulvas, or pregnancy, and only one—from Fosa I—depicts male genitalia (**Figure 6**, left). Social differentiation was indicated by headgear: a fan-like headdress, braided headbands, or bands of large beads or shells. One head from Mound ZZ1 was modeled with the "tied headband" of authority, hinting that some figures may be modeled on actual leaders. Perhaps, as in the Pre-Pottery Neolithic B in the Levant, the general lack of conspicuous markers of individuality signaled an emphasis on "collective, community identity" (Kujit and Chesson, 2005, p. 176–178).

How might figurines be construed as symbolic public goods? Although these objects are often considered items of domestic culture, perhaps representing family ancestors, their recovery in fragments in public or civic-ceremonial contexts at Nixtun-Ch'ich' suggests a broader role. Perhaps they were the proto-human clay people of Creation stories, used in ritual re-enactments. The Maya viewed the human body as partible, with vital essences (perhaps *k'u'x*-like) contained in the legs, arms, and especially the head and torso. Given this, it is not surprising that figurine heads and torsos were more commonly recovered in excavations in the city's monumental core, compared to other locations (Rice, 2019, Table 14.4). The most powerful essences of these figures were thus embedded in ritual spaces, infusing them with sacred/cosmological power and authenticity. This was a common good.

DISCUSSION: COMPARISONS

Nixtun-Ch'ich' did not stand alone in the Middle Preclassic Maya lowlands in its lack of aggrandizing leaders, so that criterion by itself does not define its status as a more-cooperatively organized early city. Certainly not all Middle Preclassic (or Middle Formative) communities in Mesoamerica, or even in the Maya area, were organized in this way. But Nixtun-Ch'ich' appears to be an exception to many generalities about the characteristics and processes of early cities and emergent states, and it is the presence of varied public goods, including symbolic public goods, that support our contention. That is, we believe that the investments in public goods/works or services, such as the grid of roads, civic-ceremonial architecture (E-Groups, ballcourts), and water management systems, testify to joint production, and good government. We conclude by comparing Nixtun-Ch'ich' to two better known early centers of societal complexity, the Gulf Coast Olmecs and highland Teotihuacan. Scoring of 26 pre-Columbian Mesoamerican urban centers on a scale of more- or less-collective organization placed the Olmecs, with a score of 0, at the less collective end and Teotihuacan, with a maximum score of 3, at the more-collective end (Feinman and Carballo, 2018, p. 9–12, Table 3). In general, more-collective centers were earlier and larger than less-collective ones (Feinman and Carballo, 2018, p. 13).

The Olmec culture, beginning as early as the late Early Formative period (ca. 1,500–900 BC) with San Lorenzo (Veracruz), was characterized by centralized political authority, evidenced by monumental sculptural art depicting humans, especially rulers and their power (Pool, 2007, p. 100–120). These objects include colossal heads, thrones with low relief, and smaller busts, masks, and figurines, all made of imported stone (e.g., basalt and jade), probably by specialists with elites or rulers as patrons. The landscape was modified by terraces and

causeways, some for flood control, but it is not known if these works were commanded by coercive elites or built independently by commoners. San Lorenzo was succeeded by Middle Formative (ca. 1,000–400 BC) La Venta (Tabasco), continuing many of the same principles of "ideological and economic sources of political power, manipulating similar concepts, materials, and goals as their predecessors" (Pool, 2007, p. 176). But displays were more ostentatious, especially seen in the circulation of prestige goods such as jade, and civic-ceremonial architecture including E-Groups. The refuse of festival and feasting activities at San Andrés included large serving vessels, faunal remains, greenstone plaque fragments, and a roller stamp decorated with possibly the earliest written text in Mesoamerica. The seal may have been a symbol and tool of leadership (Pohl et al., 2002). The Olmec utilized aqueducts and incorporated pools of water as central ritual spaces, but these facilities were strongly connected to rulership (Cyphers, 1999).

The enormous Classic-period primate city of Teotihuacan, a tollan, is visually similar to Nixtun-Ch'ich' in having an ordered, gridded layout. Beginning with small farming villages in the well-watered valley of the Río San Juan in the northeastern Basin of Mexico, the area experienced explosive growth in both population (in-migration) and construction beginning about 100 BC. The city's two major structures were built: first, the Pyramid of the Moon then, a century or so later, the Sun (Cowgill, 2015, p. 55). Both anchored the Street of the Dead, which runs northeast–southwest at 15.5° azimuth. The swelling population resulted from a pull factor: creation of grid blocks of apartment compounds of uniform size, covering 4.5 square miles (Millon, 1964). These structures were built using a standard measurement unit of 83 cm, multiples of which corresponded to calendrical cycles and intervals based on cosmology (Sugiyama, 1993, 2004). The façade of the Feathered Serpent pyramid, built ca. AD 200–250 (Nichols, 2016, p. 22), is decorated with the head of a primordial Creation crocodilian, which is also Cipactli, the first day of the central Mexican calendar. We once thought Teotihuacan's urban grid was the inspiration for that of Nixtun-Ch'ích', but because it was probably established around AD 150–250 (Sugiyama, 2004), it is obviously much later. The grid and the standardized measurements, together with repetitious, geomantic assertions of the supremacy of the calendar, strongly suggest centralized and authoritarian planning.

As at Nixtun-Ch'ích', the nature of leadership at Teotihuacan is opaque, as there is no portraiture or other depiction of rulers at the city, nor are there royal tombs. Elites, and maybe rulers, might have lived in the apartment compounds of the Ciudadela or elsewhere along the Avenue of the Dead (see Cowgill, 1997, p. 151). New interpretations of the city's political organization are favoring more cooperative, corporate action and collective rule. This might have been initiated with the termination of the Feathered Serpent Pyramid in the Ciudadela, as a "rejection of a rulership cult and change to more depersonalized, corporate bureaucrats" (Nichols, 2016, p. 19). A "mundane civic consciousness, a sense of the virtue of 'good citizenship,'" rather than elite exploitation, might have been a factor in the city's stability and florescence (Cowgill, 1997, p. 152–155; see also Graeber and Wengrow, 2021, p. 328–336).

Teotihuacan's public goods and services would have included water management (e.g., diverting the San Juan River through center city), ease of movement along the grid corridors, the equitable housing of the apartment compounds, the large open gathering areas of major plazas along the Street of the Dead and the Street itself, and interceding with the gods and cosmos by materializing the calendar. As at Nixtun-Ch'ích', Teotihuacan's layout, emphasizing straightness and social and cosmic order and morality, was a symbolic public good. But in the AD 600s Teotihuacan witnessed fiery destruction, perhaps indicating the elites were becoming increasingly exclusionary, no longer practicing good government, and could no longer guarantee the well-being of the city's residents.

CONCLUSIONS

Were ancient rulers really the foundations of social complexity? Were they invariably self-serving? Such Rand-like heroes (Montmarquet, 2011) seem more a romantic reflection of modern capitalism than the ancient world. While seemingly scientific, this psychological egoism is an unverifiable armchair-assumption about human nature (Feinberg, 2013, p. 168–169). Instead, studies have shown that cooperation is a far more cogent arrangement, even from an egoistic perspective.

As mentioned, in the Middle Preclassic period, lowland Maya leaders were typically invisible and anonymous (Freidel, 2021), memorialized neither in portrait sculpture nor named in texts: hieroglyphic writing was not yet known. Such is the case at the early primate city of Nixtun-Ch'ich', where we have detected no monuments, tombs, palaces, or art hinting at personifications of governance. Instead, public places, goods, works, and services provide strong support for a collectively organized urban center. Of course, gridded cities can reflect symbolic action for elites rather than public goods meant for the collective (Blanton and Fargher, 2011, p. 515). Nevertheless, the axis urbis, gridded streets, and fosas made Nixtun-Ch'ich' an orderly city both horizontally and vertically, draining the city and enhancing social interaction. These works were planned, so they stand as secondary indicators of leaders, who instead of advertising their own existence, strove for the greater good. Roller stamps and jade artifacts suggest that leaders also likely coordinated festivals and feasts. Feasts such as those evident in Fosa I, Fosa Y, and Structure ZZ1 exemplify good government, as they would have helped to bond participants and tie them to the city.

Three E-Groups provided the politico-religio-administrative foundations of Nixtun-Ch'ich'. They were central places that coordinated the population both spatially and temporally, and reflect the city's sources of supernatural power. They may also reflect districts or neighborhoods within the city. However, they are all ordered by the axis urbis, centered on Fosa Y. Likewise, the fosas may have represented ceremonial places of factions, but their placement around Avenue F suggests processions and the involvement of the larger community. Like the dispersed open areas of Teotihuacan, the fosas and E-Groups were likely critical aspects of the social infrastructure

enhancing inclusion and a sense of community as well as resilience (Carballo et al., 2021, p. 572).

The *petate*-like roads of Nixtun-Ch'ich' interwove these features and the people and water that they carried, as well as the pools and platforms, into an orderly city. The *petate* was coordinated by the axis urbis, with the pools and artificial mountains, places of immense *k'ux'* reticulated into the structure of the city. The axis was, in turn, ordered by the east–west path of the sun. The city was overtly and redundantly *toj*: it was a tollan, imbued with sanctity, a spiritually safe place with respect to the poorly known and dangerous other worlds. It was a microcosm that reflected the orderly universe, the balance of earth and water, and the cycles of rain and fertility. These features were symbolic public goods that added to the quality of life of Nixtun-Ch'ich' and helped establish it as the Creation place—the world as created by the gods.

Early rulers at Nixtun-Ch'ich' sought to govern by emphasizing the greater good. Collective works helped build solidarity, bonding members together performatively though labor, fostering a sense of accomplishment and group history, and celebrating the origins of the community. These works—from the temples to the streets—were also monuments to cooperation. Like war monuments and the twentieth century space race, they celebrate the virtues and power of group efforts. The gridded layout of Nixtun-Ch'ich', established by the streets and avenues emplaced by 500 BC, has survived, largely intact, into the twenty-first century through Classic, Postclassic, and Colonial-period occupation. It stands as testimony to the powerful, enduring *k'ux'* of this collectively built sacred landscape.

AUTHOR CONTRIBUTIONS

TP wrote most of the manuscript. PR composed about 30%. EC wrote about 10% of the manuscript. JG about 5% of the manuscript. All authors contributed to the article and approved the submitted version.

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