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Introduction to the "Out of Eurasia" Program: Theoretical Perspectives of Mesoamerican Landscape, Monument, and (Sacrificial) Ritual Studies

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This introduction to the "Out of Eurasia" program sponsored by the Japan Society for the Promotion and Science is to reconsider the theories and strategies to better-understand the bio-cultural evolutionary processes in Mesoamerica. By applying a shared interpretative "niche construction" model, we examine social evolutionary processes of hunter-gatherer communities who migrated into the New World and gradually developed subsistence strategies, new ideological realms, art works, technologies, and finally created complicated stratified societies independently without having direct interactions with Old-World societies. Some of the bio-cultural features newly created in the New World are similar to those observed in the Old-World; we therefore explore the underlying reasons why these similarities emerged and also discuss the implications of the distinctiveness of the New World civilizations.

Homo sapiens arrived in the New World for the first time around 13,000 years BCE or earlier crossing Beringia or through the Bering coasts. Restricted ethnic entities with rather homogeneous DNA haplo-groups, similar physical features, and bacteria repertory set out in the cold environments creating the first bottle-neck in Beringia. These early populations were dispersed throughout the New World for millennia, gradually organizing socio-cultural complexes, and finally achieved their own urban forms without contact with Afro-Eurasian entities. In order to explain the origin of a pristine or autochthonous social formation processes in Mesoamerica, instead of focusing on regional cultural traits reflecting local geography (outside factors), our transdisciplinary studies contrastingly explore agents who created cultures to elucidate the underlying mechanisms fueled by people's unusual intellectual faculties that mediate outside factors and consequently created artificial niches, subsistence strategies, efficient technologies, arts, religious realms, and complicated social organizations.

Here, I focus on city formation, particularly monumental constructions, to explore people's unique features (powerful capacity of imagination, memory, collaboration and altruistic action to build solid social structures). Connecting the social transformation process during 3,000 years (BCE 1500 - CE 1500) in the Mexican central plateau (mainly at Teotihuacan, Cholula, and Monte-Albán) I discuss the monumentality in terms of ① symbolism, ② functions as temple platform and (sacrificial) ritual place, and ③ materializations of rulership, in comparative contexts.

① Most of monuments in Mesoamerica, originally connoted "the sacred mountain," functioning as the spatial axis, a device symbolizing worldviews. The position, the shape, the dimensions, the directionality

with the neighboring topography of the monuments apparently incorporated the symbolism of the heavenly bodies and a complicated calendar system including sacred numbers. We plan to create precise 3D maps with LiDAR at Teotihuacan, Monte Albán, and Cholula to explore the interrelations among the monuments, the natural geography, and the heavenly bodies. Comparative analytical studies will contribute to elucidate ancient cognitive systems and knowledge about astronomy, nature, monumental constructions, and how the cityscape developed through time.

② The monuments in Mesoamerica were foundations for temples and (sacrificial) ritual performance at the same time. The recent investigations at the major pyramids in Teotihuacan indicate that sacrificial rituals were carried out at the bottom, inside, and the summit of the monuments. Other monumental constructions in the Mexican highlands may have similarly functioned and would have left ritual remains still to be explored. The sacrificial rituals persisted more than 3,000 years being related to the formation and transformation process of social complexity in Mesoamerica.

③ Monumental architecture and rituals performed were apparently the social symbols that reflected a hierarchical polity. Interdisciplinary studies of rituals conducted at the monuments incorporating archaeology, iconography, ethnography, evolutionary psychology, and brain sciences will contribute to understanding ancient minds and behaviors, and social actions that constituted sacred rulership. Possible royal graves discovered under the monuments at Teotihuacan demonstrate ancient people's concern with dead bodies, state affairs (sovereignty), and the monuments themselves. The reconstruction of ancient landscape, cityscape, in relation to the heavenly phenomena in Mesoamerican cities, using advanced technologies, will deepen our understanding of the dynamic interactions between humans' cognitive systems and natural/social environments, fundamental factors that triggered unique bio-cultural evolution of the Homo sapiens.

Esta introducción al programa, "Afuera de Eurasia" patrocinada por La Sociedad Japonésa para la Promoción de la Ciencia reconsidera las teorías y estrategias para crear un mejor entendimiento de los procesos de evolución bio-cultural en Mesoamérica. Al aplicar un modelo interpretativo de "construcción de nichos", examinaremos los procesos de evolución social de comunidades de cazadores-recolectores, nuevas ideologías, obras de arte, tecnologías, y que finalmente crearon sociedades complejas estratificadas de forma independiente sin haber tenido interacciones con sociedades del Viejo Mundo. Unos de los aspectos bio-culturales creados en el Nuevo Mundo son similares a los observados en el Viejo Mundo; nosotros, por lo tanto, exploraremos las razones subyacentes por las cuales estas similitudes emergieron y discutiremos las implicaciones y distinciones de las civilizaciones del Nuevo Mundo.

Homo sapiens llego al Nuevo Mundo por primera vez por los 13,000 ANE o antes, cruzando Beringia o por las costas Bering. Entidades étnicas restringidas y con grupos haplo de ADN bastante homogéneos, con similitudes físicas, y un reportorio de bacteria salieron de los ambientes fríos creando el primer

embotellamiento en Beringia. Estas poblaciones tempranas se dispersaron por el Nuevo Mundo por milenios, gradualmente organizando complejos socio-culturales, y finalmente logrando sus propias formas urbanas sin algún contacto con entidades Afro-Euroasiáticas. Para poder explicar el origen de procesos de la formación social prístina o autóctona en Mesoamérica, en vez de enfocarnos en rasgos culturales regionales que reflejan la geografía local (rasgos externos), nuestros estudios transdisciplinarios contrastan en explorar agentes que crearon culturas para elucidar los mecanismos subyacentes alimentados por las facultades intelectuales inusuales de las personas que median factores externos y en consecuencia crearon nichos artificiales, estrategias de subsistencia, tecnologías eficientes, artes, religión, y organización social compleja.

Aquí me enfoco en formación de ciudades, particularmente construcciones monumentales, para explorar los aspectos únicos de las personas (la poderosa capacidad de imaginación, memoria, colaboración y acción altruista para construir estructuras sociales solidas). Conectando los procesos transformación social durante 3000 años (1500 ANE-1500 NE) en la meseta central de México (principalmente en Teotihuacán, Cholula y Monte Albán), tratare la monumentalidad en términos de su ① simbolismo ② funciones como plataforma y lugar de sacrificio y rito y ③ materialización de gobernación en textos comparativos.

① Muchos de los monumentos en Mesoamérica, originalmente connotan "la montaña ", funcionando como eje espacial, y dispositivo que simboliza cosmovisiones. La posición, la forma, dimensiones, orientación en relación con la topografía circunvecina de monumentos aparentemente incorpora el simbolismo de los astros y el sistema complejo calendárico incluyendo numerología . Planeamos crear mapas tridimensionales usando LiDAR en Teotihuacán, Monte Albán, y Cholula para explorar las interrelaciones entre los monumentos, la geografía natural, y los astros. Estudios analíticos comparativos contribuirán a la elucidación de sistemas cognitivos antiguos, conocimiento de la astronomía, la naturaleza, construcciones monumentales, y como el paisaje urbano fue desarrollado durante el tiempo.

② Los monumentos en Mesoaméric funcionaron como templos para actuaciones (de sacrificio y rito al mismo tiempo. Las investigaciones recientes en las pirámides mayores de Teotihuacán indican que ritos de sacrificio se tomaron acabo en la base, adentro, y en la cumbre de los monumentos. Otras construcciones monumentales en el altiplano de México también funcionaron de la misma manera y hubieran dejado rasgos todavía por explorar. Los ritos sacrificiales persistieron mas de 3000 años y se relacionaron a los procesos de formación y transformación de la complejidad social en Mesoamérica.

③ Arquitectura monumental y rituales realizados aparentemente fueron los símbolos sociales que reflejaron la jerarquía política. Estudios interdisciplinarios de los rituales realizados en los monumentos incorporan arqueología, iconografía, etnografía, psicología evolucionaria, y ciencias del cerebro y contribuirán a nuestro conocimiento de las mentes, comportamientos, y acciones sociales que constituyeron la gobernación . Posibles tumbas reales descubiertas bajo los monumentos de Teotihuacán demuestran la preocupación de los antiguos con los cuerpos fallecidos, asuntos de estado (soberanía), y los monumentos

mismos. La reconstrucción del paisaje antiguo, paisaje urbano en relación de los fenómenos celestiales en las ciudades Mesoamericanas, usando tecnología avanzada, profundizaran nuestro conocimiento de las interacciones dinámicas entre sistemas cognitivos humanos y ambientes naturales/sociales, y factores fundamentales que desencadenaron la evolución bio-cultural única del Homo sapiens.

Theories and Strategies for Bio-Cultural Studies in Mesoamerica

Following the theoretical framework and strategies set by the "Out of Eurasia" program (Matsumoto in this volume), I present an introductory discussion about people's unique "niche construction" strategies, particularly ancient landscaping and monumental construction in relation to ritual activities and changing social complexity in Mesoamerica (Figure 2.1). I focus on monumentality as an index of a long-term bio-cultural evolutionary trajectory. Monuments directly reflect shifting relationship between the surrounding natural environment (resources) and the people (brain-mind-body), and are intimately entangled with both symbolic behavior and social stratification at pertinent temporal span (Hodder 2012). Instead of applying historical particularism that focuses on regional geography and cultural diversity, the "Out of Eurasia" program explores the mechanism of agents, which created growing and resilient complex societies from cross-culturally comparative perspectives. Our goal is to take a step further toward constructing bio-cultural evolutionary models searching for an underlying unique nature of Homo sapiens that may be commonly detectable in different ancient entities (Brown 1991). In order to build hypothetical premises, we may better first review roughly the early stages of Homo sapiens to propose what the first Americans would already have had in their minds and bodies before they wandered out of Eurasia.

Intelligent Hunter-Gatherers

Recent paleo-anthropological studies indicate that Homo sapiens migrated out of Africa by 70,000 years ago while becoming powerful and efficient in imaginative capacities, communicative skills facilitated by the advent of language, religious thoughts, artistic/technological productions, and social organizations at different stages of human evolution, all which made people flexible, resilient, and successful enough to inhabit in almost all regions of Afro-Eurasia. Hunter-gatherer communities reached the East Asian coasts, inner highlands of Eurasia, or severe cold front in Siberia. Around its north-eastern edge, a small number of communities traveled out of Eurasia to get into the New Worlds through Beringia or along the coasts by 1,000 BP or earlier (e.g., Potter et al. 2017; the dates are still contested). We still do not have precise archaeological data to demonstrate how they survived and successfully achieved such trans-continental journeys. However, new discoveries in other parts of the Old World suggest that the Homo sapiens were continuously evolving for millennia becoming more skillful and intelligent developing ideological schemes, materializing them in rock-paintings, or finally building shelters or houses. Thus, humans gradually shifted surrounding environmental conditions that may be termed as a beginning of "artificial niche construction" that we discuss later. The excavations at Gobekli Tepe in Turkey (Haklay and Gopher 2020) for example, among other Pleistocene sites, clearly demonstrate

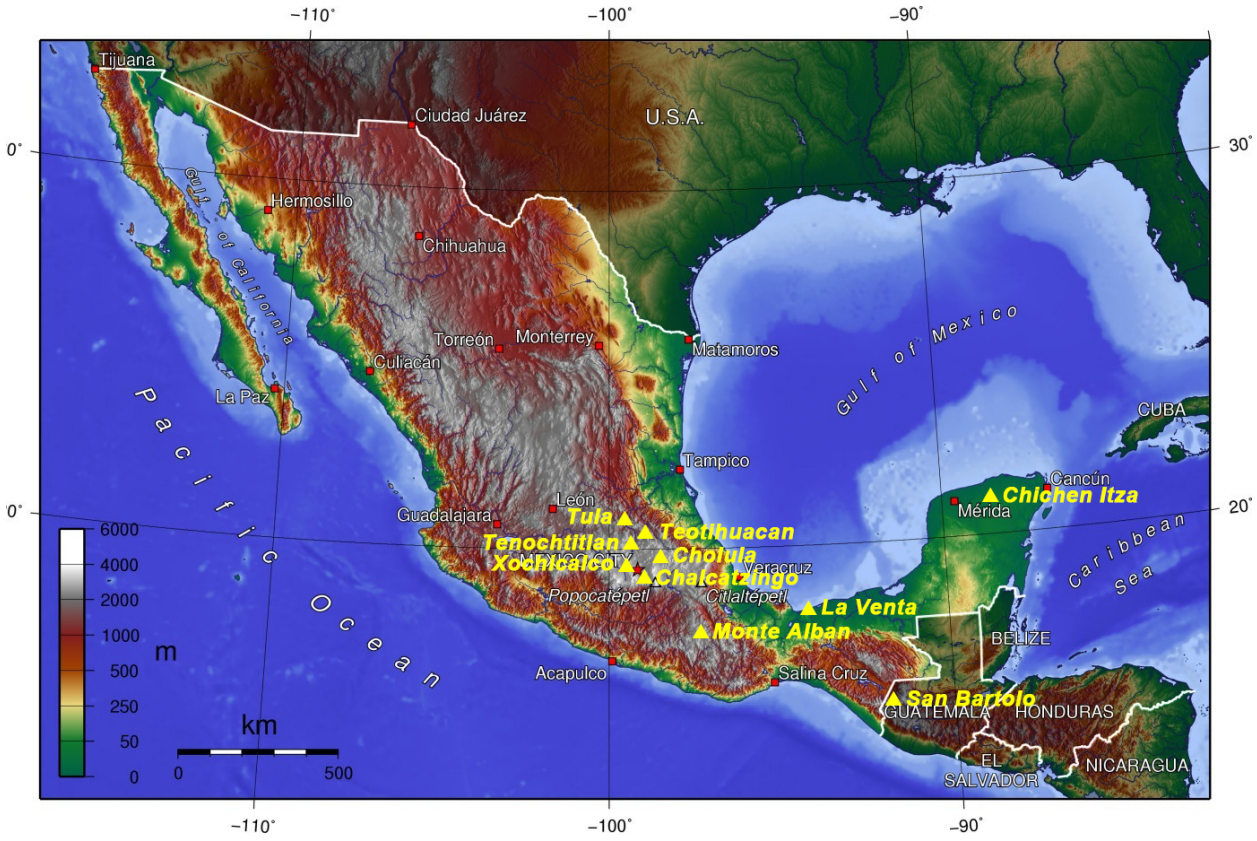
that advanced hunter-gatherers had the capacity to build large symbolic monuments, handling complicated social organization, sharing architectural, sculptural, and probably astronomical knowledge by 12,000 BP before evidence of domestication. That was the time when the initial peopling into the New World had already begun, presumably with same intelligent and imaginative capacities as anatomically modern humans.

Cooperative First Americans

There is increasing evidence for elaborated large-scale collaborative organizations for big-game hunting, systematic food gathering, landscaping, navigating/fishing to exploit new kinds of marine resources, or building shelters or residences with perishable materials in the Americas (e.g., Des Lauriers in this volume; Meltzer 2009). These features can be described as products of people's distinctive cognitive system, or Triadic Niche construction (Iriki and Taoka 2012), in which the mind mediates matter through the body's cognitive system to create new artificial niches, which bio-culturally affected the following generations successively. This is a basic model that we explore and want to develop further in this program, specifically focusing on the critical period of the rising social complexity during the last 10,000 years in the Americas. As a consequence of the advent of agriculture, the rise of cities, industrial technologies during the last five centuries, and long-distance massive demographic

Figure 2.1.

General plan of Mexico and Central America with locations of sites mentioned in the text.



movements including modern aerial transportation system, Homo sapiens rapidly became the most dominant, populous, and dangerous species in the planet. Advanced hunter-gatherer communities, before sedentarism was established in the New World, continuously developed efficient collaborative organizations, hunting technologies, more artificial niche construction strategies by themselves. Among their feats included, the conceptualization and structuralization of the materials, lives, and natural phenomena, the gradually increased degree of control or domestication of plants and animals, and quantification of materials, and core ideological factors like time and space, arts, religious practices, astronomy and myth (Hodder 2010; Mithen 1999; Renfrew 2008; Prufer et al. 2019). These ideological factors began to shape "high culture" materials in Mesoamerican complex societies.

For the objectives of our program, it may be constructive to recognize that the first Americans in the New World experienced two population bottle-necks, once in the Isthmus of Beringia and another in the Isthmus of Panama, that incidentally provide an ideal experimental condition to explore, in comparative contexts, the two irreversible histories that happened in Mesoamerica and the Andes. Restricted ethnic entities with rather homogeneous DNA haplo-groups, similar physical features, and bacteria repertory set in the cold environments at the first bottle-neck in Beringia, were dispersed in the New World for millennia, gradually organizing socio-cultural complexes, and finally achieved their own urban forms without contact with Afro-Eurasian entities. Namely, social formation and transformation processes in the New World may be considered as genuine or pristine not unlike those of the Old World ancient complex societies among which interactions, trade, communications, or tribal hybrids apparently occurred and should be considered as critical for mutual development.

We also consider that the Andean and Mesoamerican societies independently developed their socio-political, ideological, technological, and economic factors by their own creative capacities, although small scale interactions between Andean and Mesoamerican communities seem to have intermittently occurred (Beekman and Colin 2019). Particularly, Mesoamerica can be well defined almost as an isolated territory limited by the Gulf of Mexico, Caribbean ocean, the Pacific Ocean, Isthmus of Panama with buffer zone, and Sonoran dessert and wide northern barren zones near the US-Mexico border; the last extensive vacant areas were where few movements of materials and people seem to have occurred sporadically (Nelson 2008). It can be proposed that the natives formulated their proper worldviews for millennia within geographically well-defined territory of Mesoamerica, and finally materialized them during the Formative period (1800 BCE-250 CE). They gradually upgraded ideological contents qualitatively and quantitatively through the Classic (250-900 CE) and Postclassic (900-1521 CE) periods until the sudden encounters with the Spaniards in the early 16th century. We here try to underline this long independent social formation processes in Mesoamerica to recover data about indigenous cognitive systems in archaeological, ethnohistorical, or ethnographic records and to compare them.

In order to precisely define and evaluate the origin of a pristine or self-developed social formation process in Mesoamerica, archaeologists tend to stress regional cultural traits reflecting characteristic local geographies, like particular mountains, lakes, rivers, volcanic activities, climate variables, land fertilities, rocks, minerals, animals, plants, or other locally available materials/phenomena as advantageous factors which might have led toward the civilization (Nichols and Pool 2012). Here in our trans-disciplinary project, we contrastingly focus on agents, to explore the underlying mechanisms fueled by humans'

unusual intellectual faculties that mediated outside factors and consequently created particular artificial niches, subsistence strategies, architecture, efficient tools, art objects, religious beliefs, or complicated social organizations that we may call high culture complexes (Smith 2019; Yoffee 2015). Mesoamerica seems to be methodologically an attractive cultural unit to re-analyze intricate creation process of cooperative and collective behaviors and stratified social organizations, and to test explanatory models of bio-cultural evolution (Carballo 2016).

Rejecting the Wild vs Domestication Dichotomy

Many theories and practices for bio-cultural evolution were, in fact, hypothetically proposed largely based on data from Old World civilizations. Classic historical perspectives and epistemological foundations of the Westerners' sense of civilizations to evaluate ancient worldview, religion, philosophy, science, art, music, and other characteristics unique to humanity have long been created considering cases of Afro-Eurasian cultures, without taking into account the New World contextual data that had not been available until impacting collusion and social/cultural conquest by Spaniards in the 16th century. While the strong impulse of colonization by the Europeans in the New World caused substantial changes, fusions, or extinctions of indigenous bio-cultural elements, the Western values only gradually assimilated American indigenous traditions and cultural varieties in a minor scale. We may still need to explore countless bio-cultural factors from New World complex societies to evaluate or modify some of explanatory models about humans' historical trajectories constructed in the Old World. For example, the impact of domestication might merit re-evaluation from the perspectives of Homo sapiens' unique cognitive systems since the humans faced for the first time many unknown species in the New World and explored alternative strategies to exploit them creating distinct technological and ideological foundations. First, we may need to evaluate upgrading power of hunter-gatherers' and fishers' communities with long-distance navigation skills and exploring technologies for seafood subsistence, in addition to cognitive potentials to conceive nature and astronomy (Des Lauriers, in this volume).

Domestication is considered a fundamental human intervention on nature based on Old World models. Domestication studies in the Eurasian contexts have evaluated this process as a revolutionary from a hunting and gathering life style into a sedentary one that triggered food storage systems, large-scale collaborative works, social stratification, and consequentially urbanism (Childe 1950). This model seems to still structure our mind to meaningfully conceive social evolution. However, in the Americas indigenous communities sustained long and intricate symbiotic processes with an immense variety of new species of plants and animals, some of which remained wild or semi-wild despite long period of systematic exploitation by controlling, feeding, or teaming, and carefully consumed by people (Figure 2.2). There would not have been simple dichotomy or clear border lines between domesticated and wild plants/animals that demonstrate a big step-up on variety, complexity, and interactivity of the changing relationship between human and plants/animals in worldwide contexts. Apparently, the New World people alternatively created distinct landscapes, food chains, or complicated social organizations to obtain food resources efficiently that would not necessarily follow evolutionary models created on the Old World civilizations (Sugiyama, et al. in press). The issue should be revisited reanalyzing materials and contextual data from trans-disciplinary approaches in the "Out of Eurasia" program, particularly now that extremely selected species of domesticated animals and plants are monopolistically providing primary

Figure 2.2.

Zoo-plant reservation at Ixtapalapa in the Valley of Mexico, where the domestication of the whole symbiotic landscape can be observed (Florentine Codex).

resources for a large portion of entire population in the world causing serious global problems of bio-diversity, environmental degradation, and climate changes, in addition to the central questions of social stratification and inequality (McClung de Tapia and Sugiyama 2012).

2. Evolutionary Perspectives of Mesoamerican Monuments

To re-evaluate how exceptional human abilities (e.g. brain's imaginative power, memories, and creativity to organize social complexity) developed, we take a bio-cultural evolutionary approach to better understand social changes over time. We focus on monuments to discuss what triggered indigenous' minds to modify landscape, and to finally create cityscapes in the New World. Particularly, relatively well explored archaeological sites in Central Mexico and Maya zones provide an unusual opportunity for long-term comparative studies of the 3,000-year urbanization processes, from Olmec ceremonial centers (1500 BCE~) through Maya cities, Monte-Albán (Figure 2.3), Teotihuacan, Cholula, and others, up to densely populated Aztec capital of Tenochtitlan (~1500 CE). While we observe great diversity in environmental condition, landscaping, monument morphology, or city-layout, in addition to ethnic and linguistic variation in this area, we explore many commonly shared socio-cultural, especially ideological factors. In order to evaluate salient human cognitive idiosyncrasies connected to imaginative power, emotions, memories, and socialization, we here concentrate in the commonly observable factors in chronological framework. Three aspects of monumentality can be examined in Mesoamerica; ① cosmic symbolism of monuments, ② functions of monuments as theoretical stages for (sacrificial) rituals, and ③ changing socio-political implications or rulership proclaimed at monuments in Mesoamerica.

As other contributors to the volume discuss varied case studies, I briefly review these three aspects of monumentality during the Late Formative (400 BCE to 250 CE) and the Early Classic (250 CE to 600 CE) periods in the Mexican highlands, particularly at Teotihuacan. This symbolic city rather suddenly emerged by the first century CE and became one of the largest Pre-Columbian urban centers in the Americas in terms of the metropolitan area it covered (about 25 km2), its estimated population (85,000-125,000; Cowgill 2015), and the degree of multi-ethnic interactions with other distant cities (Hirth et al. 2020). The period from the Late Formative to the Early Classic in Mesoamerica particularly seems to have been characterized as a new phase of urban formation, when innovative astronomical knowledge, the long count and 260-day ritual calendar systems, invention of writing system, grand monumental buildings, and new creature deities, among others, emerged spontaneously at different parts in Mesoamerica. I hope that discussions of cosmic symbolism, theatrical functions, and polity, interrelated at the three major monuments in Teotihuacan shed light on

bio-cultural evolutionary perspectives we search with the Out of Eurasia program.

Monuments Symbolizing Sacred Mountain and Cosmology

As López convincingly explains in this volume, Mesoamerican monuments fundamentally represented the "Sacred Mountain", a portal connecting the upperworld and underworld. This fundamental concept can be traced back to 1500 BCE or much earlier and lasted more than 3,000 years in Mesoamerica in spite of changing morphology of monuments. For instance, Complex C at La Venta built around 1000 BCE apparently symbolized a sacred mountain by shape, and provides a good example of an original artificial niche materialized collectively by physical human labor.

Monuments were, however, multi-symbolic and multi-functional. Some Classic and Post-Classic monuments visually represented a cosmogram that meaningfully structured the time and space of the present world, visualizing time-recognition systems and/or calendar cycles connected to astronomical movements (Aveni 1980). We may recall that the Early Post-Classic El Castillo pyramid at Chichen Itza apparently has represented cosmic order materializing 365-day solar calendar by the numbers of steps, platforms, or with the orientation of the building. I here summarize how the major monuments at Teotihuacan encoded complicated and precise time and space cognition system (Sugiyama 2017). Ceremonial centers in later periods could have had similar symbolism and functions as memories of Teotihuacan's monumental symbolism (Garcia-Des Lauriers this volume, Travis et al. in this volume).

I have mentioned that the Teotihuacan city layout conspicuously materialized indigenous concepts of time and space, an innovative version of the Mesoamerican

Figure 2.3.

Central Plaza of Monte Albán, viewed from the North Pla tform toward the south (photo by author).

cosmogram by the time of the city's massive foundationaround 200 CE (Sugiyama 2011). The harmoniously proportioned architectural plan of public buildings and residential structures strongly suggest that the city did not develop through an aggregation of independent buildings, but with a single master plan imposed by leading entities who orchestrated the massive construction program of a meaningful cityscape. Archaeological data accumulated to date support this idea (e.g., Sugiyama et al. 2013; Sugiyama 2017). Analogous instances of centralized cosmic city planning exist around the world, like at the Inca capital of Cuzco or in ancient Chinese cities like Xian or Luoyang (Zuidema 1983; Wheatley 1971). Mesoamerican monuments and important administrative structures or palaces were spatially arranged accordingly to reflect the cosmic order that authorized governing elite to stand at the axis mundi, the center of the universe. I suspect that at Teotihuacan, in order to begin this kind of large-scale construction program, social organization with powerful leadership to organize people must have been already established before 200 CE. However, we still know little about the origin of the Teotihuacan ritual center as barely fragmented data are available concerning the movements of this critical period, the 1st to 2nd century CE.

In contrast, various archaeo-astronomical studies

(e.g. Aveni 1980; Dow 1967; Malmstrom 1978) and a measurement unit study of Teotihuacan architecture (Sugiyama 2010, 2017) indicate that the currently seen city layout was established in accordance with the movement of celestial bodies, local topography, and the calendar systems (Figure 2.4). A three-dimensional systematic recording of the architectural assemblage in AutoCAD demonstrates that Teotihuacan architects applied 83.0 cm as the basic measuring unit (called TMU, Teotihuacan Measurement Unit) to design the city layout. The dimensions of major monuments and distances between them corresponds to multiples of this unit, often reflecting calendric or cosmologically significant values including 9, 13, 18, 20, 52, 73, 178, 260, 360 (365), 486, and 520 (Figure 2.5).

One of the most intriguing characteristics is that the Mesoamerican people integrated astronomical and human cycles harmoniously in this cosmic perspective of time and space. The 260-day ritual calendar, which approximates the human gestation period, is a distinctive calendar conceptually combined with the solar calendar to create a larger cycle of 52 solar years (365 x 52 = 260 x 73) that had long been celebrated in the most Mesoamerican centers for more than 2,000 years. This important Mesoamerican large cycle or "century" may have represented a persons average life expectancy or menopause, like the 60 solar year cycle calculated as human's life cycle integrated in solar calendar systems in ancient East Asian civilizations that seems to represent, rather than merely coincidence, most probably a product of commonly shared human's imaginative capacities.

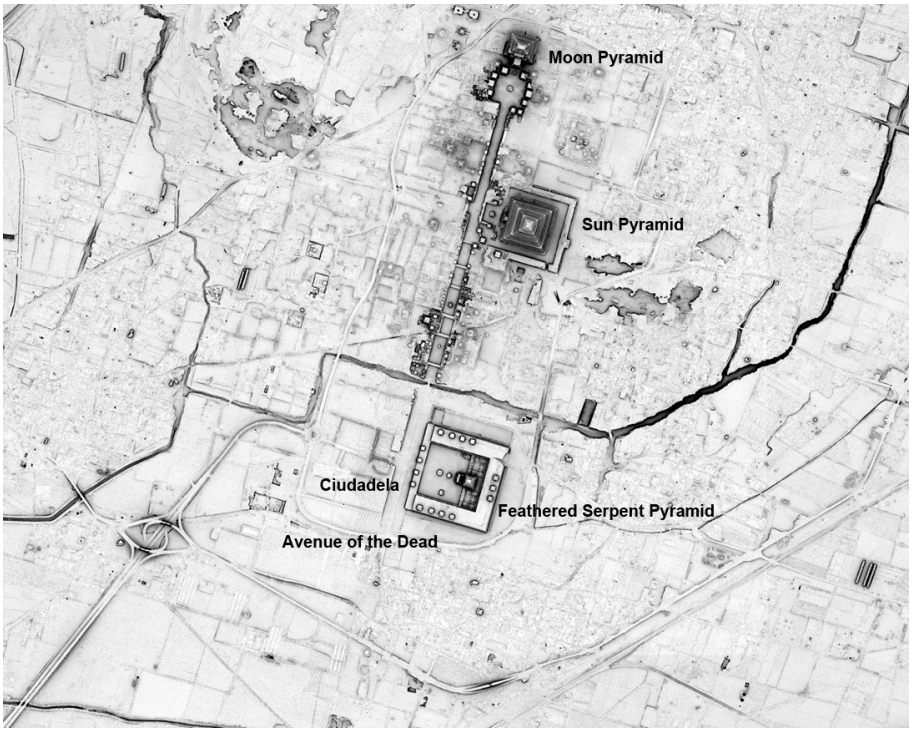
Thus, the city's proportional spatial distribution with symbolic monuments can be argued to have symbolized a combined cosmic vision of the solar/natural cycle and a ritualized human life cycle, for which leading groups meticulously and precisely calculated complicated movements of celestial phenomena, like the cycles of the Sun, the Moon, the Venus star, the Pleiades, or solstices, equinoxes, and eclipses, and cycles of human body and

Figure 2.4.

View of the Moon Pyramid from the central axis of the Avenue of the Dead toward the north at Teotihuacan. Notice that the top of the Moon Pyramid exactly coincides with the top of the highest mountain of the Teotihuacan Valley, Cerro Gordo, which is often covered with cloud especially during the rainy season, as if the mountain is seen as a water resource connected to the north.

Figure 2.5.

LiDAR map of the central section of the ancient city of Teotihuacan, Mexico. We believe that systematic analysis of topographic features detected by the map will reveal an indigenous perception of time and space.



integrated produced numerals symbolically into monumental layout. This grand construction program must have absorbed many elites, specialists, workers, and material resources that should have had strong impacts on its hinterland communities, distant states, and surrounding natural environment. We can imagine how this grand enterprise with new foundational ideas was attractive for many Mesoamerican people intellectually and emotionally. Recent discoveries at Teotihuacan also suggest that dignitaries or astronomers from diverse Mesoamerican states including Maya and Zapotec cities seem to have participated in the cosmic urban construction program by the 3rd century CE (Gómez 2017). Consequently, the symbolic monuments became a religious, intellectual, political, and socio-economic attraction during its heyday, and such monumental sites conspicuously remained in the social memories for centuries after the collapse of the city during the 6th century CE.

Many other ancient Mesoamerican centers have not been explored extensively to reconstruct monumental cityscape with precision to run this kind of city-layout analysis searching for encoded numerological symbols. Teotihuacan has been extensively excavated and consolidated since the late 19th century, allowing for this type of analysis. We expect that new studies proposed by the "Out of Eurasia" program with LiDAR mapping, and re-interpretations of previous excavation data may further provide opportunities to explore numerological symbols and indigenous perceptions of the nature and humans; we may consequentially be able to retrieve ancient people's

mind that mediated outer worlds (the environments) and inner worlds (body and mind), and invented systems to quantitatively measure time and space (Morley and Renfrew 2010).

Monuments as Theater for (Sacrificial) Rituals

Major monumental buildings integrated evidence of public ritual performance, physical remains into their foundation, particularly those of human (and animal) sacrifices at Teotihuacan (Figure 2.6). These characteristic rituals lasted more than 3,000 years crossing over different regions, ethnic groups, dynasties, or states in Mesoamerica. We know from abundant archaeological and ethnohistorical records that this peculiar symbolic, emotional, and collective behaviors must have constituted a central politico-religious and moral discipline for the Mesoamerican societies. Monuments, plazas, and surrounding facilities had long been functioning for theatrical performance carried out on special days with specific purposes like celebrating the passage of time, dedication rites to deities or significant individuals, and other commemorative events (Fash and López 2009; Inomata and Tsukamoto 2014; Tsukamoto this volume). Sacrificial rituals often constituted climatic scenes in these events among other integrative components like processions, chanting, dancing, playing music or games, and feasting activities (Inomata and Coben 2006; López and Olivier 2010). Theatrical function of monuments for (sacrificial) rituals can be detected from early Formative centers in Mesoamerica and continued until the time of the conquest by Spaniards who witnessed human sacrifices taking place at the top of the pyramids of Tenochtitlan (Boone 1984). In Teotihuacan, recent and abundant excavation data indicate that monumental constructions like the Sun, the Moon, and the Feathered Serpent Pyramids, as well as complementing large plazas and other functional monumental buildings served as theatrical stages to carry out such bloody sacrificial rituals.

People and sacred animals, such as pumas, jaguars, wolves, eagles, and rattle snakes, among others, were ultimately embedded within, above, and under major structures in Teotihuacan (N. Sugiyama 2014; N. Sugiyama, et al. 2014, Sugiyama and López 2007; Sugiyama 2005). Particularly at the Feathered Serpent Pyramid, we uncovered more than 200 warriors/elites were sacrificed and systematically buried while being constructed the pyramid around 200-250 CE that I once interpreted as dedication burials to the erection of the new monument (see below for further discussion) (Cabrera et al. 1993).

New discoveries at the Moon Pyramid evidenced a fundamental function of the pyramid. Our tunnel excavations along the upper floor of Building 5 confirmed the lack of a masonry temple atop the pyramid, suggesting that the pyramidal monuments fundamentally served as a stage for public ritual display, not as a platform to sustain temple(s) on its summit in Teotihuacan. As illustrated in later period codices about Mexica's sacrificial rituals scenes, archaeological data indicate the Teotihuacanos probably executed sacrifices on the top of the monuments or inside the nucleus while being constructed (Sugiyama and López 2007). Conspicuous bloody rituals atop the hill-top-like summit of the monuments must have had tremendous and lasting emotional impacts in mind and bodies of thousands of public audiences watching from the wide-open plazas. A trans-disciplinary unit study group of sacrificial rituals in the "Out of Eurasia" program will explore the logics of practitioners and biological/cultural mechanisms analytically. A modeling methodology including examination of ancient cooperation or altruism in relation to brain mechanisms, may be explored to explain how and why this kind of rituals persisted widely in space and time among Mesoamerican stratified societies. Sacrificial performances in fact have been recorded in many

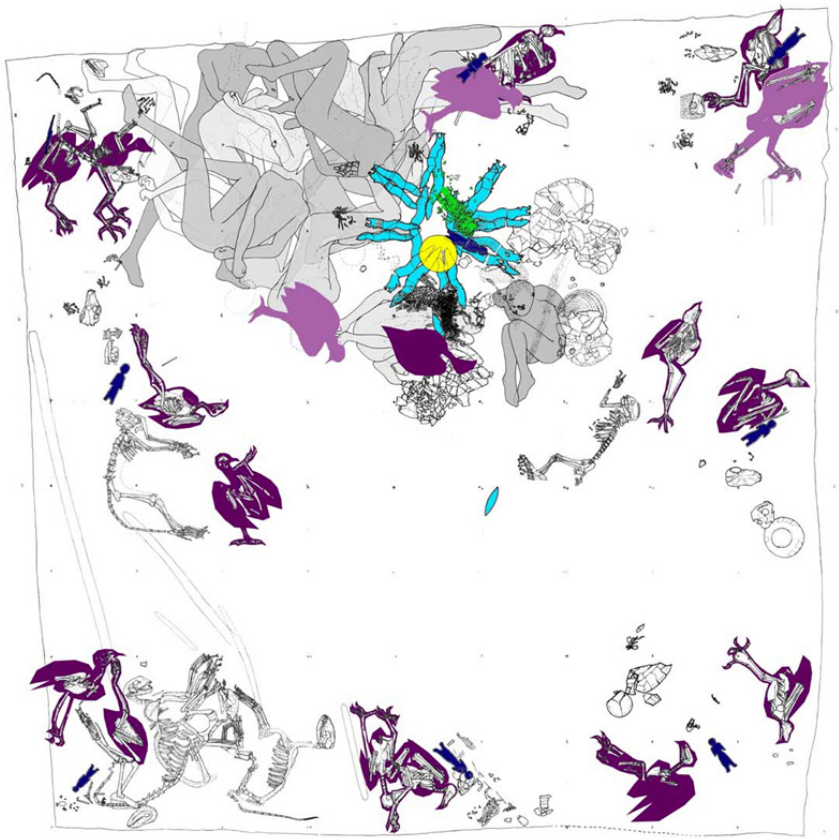
ancient complex societies world-wide. In order to discuss in comparative contexts of this peculiar ritual behaviors we have substantial data about monumental buildings as theatrical stage for ritual performance, a wide assemblage of tools for sacrifice, abundant osteological materials of sacrificial victims (both people and animals), related pictorial and written information (epigraphy and codices), in addition to ethnographic records and new investigations of modern indigenous communities which still perform sacrificial rituals with animals that we will coordinate to carry out in "Out of Eurasia" program.

Monuments as Reflection of Rulership and Social Memories

We explore another fundamental aspect of Mesoamerican monuments--social stratification and rulership. The monumental buildings in Mesoamerica often symbolized power relations metaphorically using hierarchical order of deities. For example, the twin temples on the Great Temple (Pyramid) in Tenochtitlan demonstrated the two most important deities; the northern temple dedicated to Tlaloc, rain deity fundamental for agriculture, and the southern temple devoted to Huitzilopochtli, the Mexica's patron deity symbolizing the Sun, eagle, and warfare, the most powerful authority in the

Figure 2.6.

Plan of Burial 6 found tri-dimensionally near the center of Building 4. Twelve individuals with canids, felines, eagles, and rattle-snakes, were found sacrificed and buried with rich offerings.

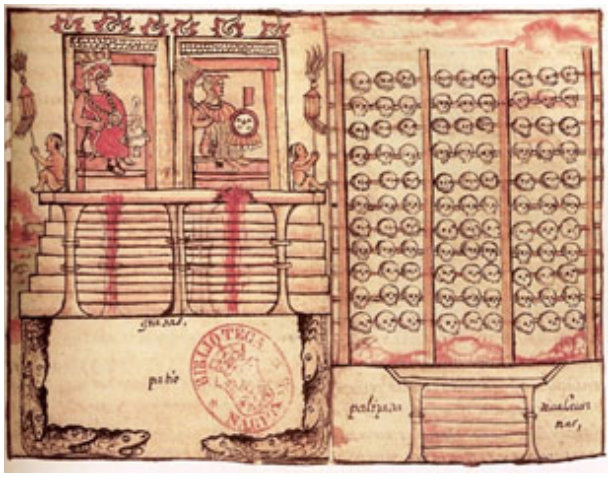


sky (Figure 2.7). This holy dichotomy which divided the sacred mountain into dual temples on the northern and the southern portion of the pyramid evidently corresponded to the movement of the Sun toward the north during the rainy season and toward the south during the dry season (Boone 1987). The Great Temple within its precinct materializing the Mexica's universe operated as theatrical stage to carry out countless sacrificial rituals (in many cases with war captives), thus proclaiming powerful military order and maximum rulership symbolized by the Sun through the dramatization of the universe.

At Teotihuacan we did not know what deity or divine attributes were designated to the Moon and the Sun Pyramids specifically. Recent discoveries and measurement unit study however suggest that the Moon Pyramid located at the northern end of the Avenue of the Dead was dedicated to the water goddess related to fertility, earth, femininity, rainy-season, and probably the Moon (Figure 2.4), and that the Sun Pyramid represented the Sun god with attribute to fire, heat, dry-season, 260 day ritual calendar, and possibly

Figure 2.7.

The Great Temple with twin temple and a platform with rack for decapitated heads (right side) in Tenochtitlan, the Aztec capital, is depicted in the 16th century codex (Duran 1995, II: lam. 5).

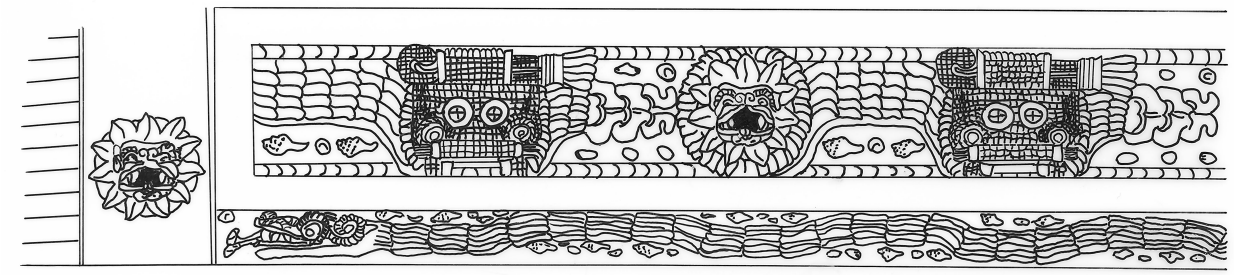


eagle (as a Sun symbol) (Sugiyama 2010, 2017). A large sculpture of the water goddess was found on the western slope of the Moon Pyramid, suggesting that it was perhaps standing on the top of the pyramid. I have mentioned that the pyramid did not have a masonry temple but very probably functioned as a ritual space with a huge image of water goddess emphasizing the importance of the water symbol complex. In contrast, an exceptionally large stone brazier in the form of the Fire God (and Old God) was found at the summit of the Sun Pyramid while many fragments of jaguar sculptures possibly symbolizing the Sun traveling in dark underworld, a fragment of large anthropomorphic figure, and a large skull sculpture resembling the Sun, were found among others in the Sun Plaza in front of the Sun Pyramid. These data suggest that the Sun and the Moon pyramids may have been conceived by the Teotihuacanos as symbols of dualistic worldview; the Sun vs the Moon, fire vs water, heat vs cold, sky vs earth, dry vs rainy seasons, and perhaps maleness vs femaleness. In contrast, the Feathered Serpent Pyramid unmistakably represented the Feathered Serpent deity that symbolizes Venus (Nicholson 2000) (Figure 2.8). This brilliant star was the most important planet in Mesoamerica and is often depicted in Late Classic period as symbol of warfare and rulership (Carlson 1991).

López, López, and Sugiyama (1991) discussed that the sculptural program on the facades of the Feathered Serpent Pyramid symbolized the beginning of new Era inaugurated by supreme deity, the Feathered Serpent. I further believe that the monument was the place where accession ceremonies originally took place proclaiming powerful rulership in Teotihuacan (Sugiyama 2005). The image of Feathered Serpent deity became a symbol of maximal sacred authority for the following centuries in other Mesoamerican ceremonial centers including Xochicalco, Tula, and Chichen Itza. Sacred serpents (not feathered), often depicted with elaborated headdress,

Figure 2.8.

The first platform of the façade of the Feathered Serpent Pyramid at Teotihuacan (drawing by the author).

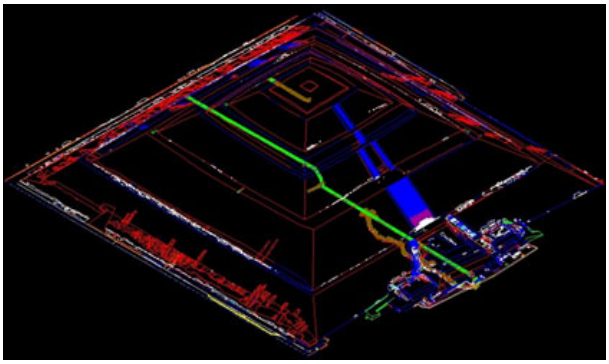


existed since earlier Formative periods like in Chalcatzingo or in Maya mural at San Bartolo (Chinchilla 2017). However, this new creature composed with the elements of serpent, crocodile, jaguar, and bird appeared at Teotihuacan in monumental scale for the first time in Mesoamerica. Curiously, this creature is morphologically and conceptually similar to the Asian Dragon, which also functioned as symbol of authority for millennia over distinct Chinese dynasties. This coincidence of two creatures symbolizing rulership on the both sides of the Pacific Ocean would not have been a result of the contact between two continents, obviously neither completely accidental, but may be worth reconsidering from a bio-cultural evolutionary perspectives as a product derived from similar symbol formation process by creative mind, the theme which may be further analyzed by transdisciplinary studies with psychological modeling.

The city-wide monumental construction program at Teotihuacan apparently demonstrate strong socio-political power relations of ruling groups which metaphorically proclaimed their divine authority in the Citadel. However, a royal grave has not been found or identified to date at Teotihuacan. An accidental discovery in 1971 revealed that a man-made tunnel existed 7 meters below the Sun Pyramid (Heyden 1975) (Figure 2.9). I suspected that this was a strong candidate for royal grave at Teotihuacan (Sugiyama 2010). Unfortunately, original contexts had been disturbed excessively in antiquity, therefore we could not confirm the royal grave. In 2004, Gómez (2017) found another ancient tunnel 15 meters under the Feathered Serpent Pyramid with striking similarities between two tunnels. Material studies from the latter tunnel are currently in the process, and clear evidence of royal grave has not been reported as several re-entering activities disturbed the original contexts (Gazzola and Gómez in this volume; Gómez 2017). However, these tunnels seem to have been most probable place for deposition of rulers' bodies because of direct association with the most significant monuments representing the Sun and divine creature symbolizing rulership, its central locations in the meaningful city layout (Sugiyama 2017), evidence of looting activities, and many associated offertory complexes that would have been dedicated to someone once deposited at the end of the sacred tunnels. In addition, more than 200 sacrificed warriors/elites found in and around the Feathered Serpent Pyramid at the ground level may have been dedicated to a possible ruler originally deposited 17 meters below them. This interpretation of sacrificial retainers and royal grave still needs to be confirmed with material analysis. However, extensive looting activities in the tunnels and the possibility of the cremation of high-status individuals or post-mortem

Figure 2.9.

AutoCAD drawing of the Sun Pyramid, Teotihuacan, with location of straight research tunnels and undulating ancient tunnel discovered under the Sun Pyramid.



activities including reuse of bones of royal members or ancestors by Teotihuacan descendants as social memories may make it difficult to precisely identify the original function of the ancient tunnels as a royal grave (Astor-Aguilera in this volume). As a preliminary conclusion we can confidently propose that the Citadel served as a public ceremonial enclosure as well as the cradle of the maximal political and military forces of the Teotihuacan government, symbolically and physically embedded in the Feathered Serpent Pyramid complex.

Previous brief discussions about the possible meanings, functions, and political implications of the major monuments in Teotihuacan may elucidate power of mind; gradually upgrading intellectual, technological, and informative advents and hierarchically growing social organizations at Teotihuacan, and humans' intolerable interest to explore imaginative spatial dimension (upperworld and underworld), and temporal dimension toward the past and the future. Our projects plan to create precise LiDAR maps of ancient cityscape with monuments and to integrate them in the landscape and astronomy programs that would contribute to conceive humans' evolving cultural/biological factors through time. Systematic trans-disciplinary studies of cosmologies, landscapes, cityscapes, monuments, and rituals would provide more sound interpretations about bio-culturally evolving human's unusual capacities that made us the most dominant and dangerous species in the planet.

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