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ON THE COVER

Photo by Eileen Valencia (June 2024)

Uxmal is a large ancient Maya city in the Yucatán Peninsula, renowned for its impressive Puuc-style architecture, including the Pyramid of the Magician and the Governor's Palace. Photograph taken during an archaeological field season in Yucatán, Mexico, led by Dr. Ken Seligson,

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Homosexuality in Humans: An Evolutionary Perspective

Isabella Kaya

she/her

Isabella graduated from CSUDH in May 2025 with a major in Anthropology and a minor in Asian Pacific Studies. Her academic interests include Eastern Asian cultures, biological anthropology, human variation and mental health. She hopes her research can foster greater understanding and acceptance of human sexualities and gender identities.

Homosexuality in Humans: An Evolutionary Perspective

This paper explores the evolutionary perspective of homosexual behavior, and how same-sex mate selection may or may not benefit long-term relationships in a modern context. Like bonobos, our closest living evolutionary relatives, it is possible that sexual preference fluidity in humans, in both females and males, may have arisen to reduce aggression and conflict towards fellow group members, as well as conflict and tension within partnerships (Kanazawa 2017). Another perspective states that homosexual behavior, regardless of an individual's actual sexual orientation, evolved because it indirectly increases both survival rates and reproductive success within a group (Muscarella 2000). The presence of homosexuality is common in most human cultures. However, there is evidence of homosexuality being completely absent in some societies, for example, among the Ngandu in Central Africa (Barthes 2015; Hewlett 2010). Given that there are many theoretical models of the origin and function of homosexual behavior, the goal of this paper is to synthesize these models and articulate a holistic hypothesis of its origins, functions, and possible benefits in a modern context.

Possible Origins

Homosexuality from a genetic perspective does not make a lot of evolutionary sense, therefore coming to even a broad conclusion as to its origins seems unlikely at first glance. Charles Darwin's theory of evolution states that organisms evolve to become better suited to their environments, which makes them more likely to survive and reproduce. Therefore, when considering Darwinism and natural selection, homosexuality appears to be a paradox. With homosexual individuals producing 80% fewer offspring than their heterosexual counterparts, homosexuality existing in humans over thousands of years doesn't make evolutionary sense and should be absent from the gene pool (O'Keefe et al. 2018). However, homosexuality persists in modern-day contexts, defeating the Darwinian odds against it.

One model addressing the seeming genetic paradox of homosexuality involves epigenetic modification to an individual's genes. When a fetus is gestating, certain hormonal 'signals' can be sent from the mother to her child that could activate genes that would otherwise go unchanged. In this model, genes affecting sexual orientation are activated and modified by signals being sent by the mother, which suggests that homosexuality is present from gestation. It's also possible that the mother is predisposed to producing homosexual offspring, as homosexuality has been linked to high maternal fertility rates (O'Keefe et al. 2018). When there is high stress within the mother, it's possible that epigenetics induce homosexuality in males due to homosexual males having "emotional qualities that help support emotional bonding and group cohesiveness" (O'Keefe et al. 2018).

Another common model suggests that homosexuality and same-sex sexual behaviors may stem from reciprocal altruism, making it an advantageous social adaptation (Kirkpatrick 2000). Reciprocal altruism entails individuals providing aid with the expectation of repayment in the future. In bonobos, homosexual behavior is shown to greatly reduce negative group tensions and create a more balanced, peaceful society. This phenomenon has been observed in humans as well. Comparably, chimpanzees are closely related to bonobos and humans and do not exhibit homosexual behaviors, which may correlate to highly aggressive and violent behaviors towards each other.

This model suggests that homosexuality is a byproduct of evolution that has managed to persist despite its paradoxical qualities. It adds to the gene pool by persisting; creating even more human variation. Therefore, an individual who carries homosexual genes within a pool of heterosexual genes is likely to have increased adaptability due to their genetic variation (McKnight 2003).

Evolutionary Advantages to Homosexuality

A study done in Indonesia by Nila et al. (2018) examined the kin selection hypothesis, which states that an individual will engage in self-sacrificial behavior to benefit the overall fitness of their kin group. Applying this to homosexuality, the homosexual individual has zero direct reproductive fitness. However, their effort in raising the children of their relatives can improve their indirect fitness via alloparenting, or caring for offspring that are not their own. Within a group in Indonesia, homosexual males had an increased willingness to give resources to their nieces and nephews. Participants' direct fitness

was reduced by 20%, but their generosity towards kin remained, increasing their indirect fitness (Nila et al. 2018).

In Samoa, *fa'afafine* is a term used to describe people assigned male at birth who identify as being a third gender or nonbinary. They adopt more fluid gender roles and express more femininity in their gender presentation (Schmidt 2003). Among the *fa'afafine*, avuncular, or uncle-like, tendencies and behaviors are more common than gynephilic men, or heterosexual cisgender males. While the general reliability between homosexual and heterosexual men is relatively the same, the reliability of *fa'afafine* remained higher (Vasey et al. 2007). Research suggests that some homosexual males don't perform avuncular roles and can be more estranged (Nila et al. 2018), which may be due to ostracizing homosexual males from their families for being openly gay, which could be interfering with their altruistic tendencies (O'Keefe et al. 2018).

In support of theoretical models discussed above, homosexual males, as compared to heterosexual males, show far less physical aggression and hostility and are known to have greater capacities for more cooperative behavior, sensitivity, and kindness. They make better use of empathy, which can be linked to reciprocal altruism (O'Keefe et al. 2018). This could suggest that the presence of homosexual individuals in human ancestral contexts would have benefited groups by reducing conflict and increasing empathy between individuals, as observed in bonobos. This is an evolutionary advantage to having homosexual members of a kinship group.

Benefits of Homosexuality in Modern Contexts and Relationships

Homosexuality does appear to have a benefit in modern contexts, specifically among homosexual women. Studies done by Herzog et al. (1990) suggest that homosexual women could have better body image despite being heavier on average than their heterosexual counterparts and report less body dysmorphia than heterosexual women. McLaren et al. (2008) surveyed 1026 women in their mid-fifties and found that nearly 80% had reported dissatisfaction with their weight, though 50% were within the 'normal weight' category of BMI < 25.

Among the women surveyed by Herzog et al. (1990), most if not all homosexual women were heavier than their heterosexual counterparts, being 14.3% above and 3.6% below the average weight for their heights, respectively. Despite this, only 36% of homosexual women reported that they were concerned about their weight at least once per day compared to 55% of heterosexual women. Homosexual women were also less concerned with their general daily appearances, with only 44% reporting their concern versus 81% of heterosexual women (Herzog et al. 1990). These studies indicate that surveyed homosexual women reported that they are more satisfied with their appearance, are not as interested in losing weight via dieting, and have lower rates of eating disorders.

Concerning homosexual relationships, studies have been conducted specifically on married couples (Harris and Turner 1986). In this study, twenty-three gay and lesbian parents were surveyed, as well as sixteen single heterosexual parents. Homosexual male parents reported

greater satisfaction than their heterosexual counterparts with their first child. Disagreements between couples over child discipline were less common as well (Harris et al. 2010). The findings of this study imply that homosexuality and homosexual relationships are compatible with effective parenting styles and do not pose elevated risk to the quality of a parent's relationship with their child or children.

Same-sex marriage may also benefit children through improved durability and stability of parental relationships (Meezan et al. 2005). According to Meezan et al., same-sex parents who are married while cohabitating have a higher incentive to work out conflicts in their relationship, further deepening their connection. Concerning how this relationship affects their child, a homosexual married mother is more likely to have greater quality of interactions with their nonbiological child, compared to a heterosexual father within a traditional marriage (Brewaeys et al. 1997). After same-sex marriage was federally legalized in the United States in 2015, it was seen that same-sex marriage was strengthening children's access to healthcare, with approximately 220,000 children being raised by same-sex parents gaining access to quality healthcare once their parents' union was legally recognized. For the couples themselves, data from California and Massachusetts indicate that legally recognized same-sex marriages led to fewer mental health-related medical visits for gay men and reduced psychological distress among gay, lesbian, and bisexual people (Gonzales 2014).

Conclusion

Evidence suggests that homosexuality's genetic persistence indicates positive evolutionary adaptation that continues to present benefits to family groups in modern contexts, especially for caregivers and children. With nearly 11% of the United States population reporting same-sex attraction, homosexuality and bisexuality remain persistent aspects of human variation, challenging Darwinian models that may frame them as evolutionary paradoxes (Gates 2011) Modern benefits of homosexuality have been supported through the legalization of same-sex marriage in the United States and continues to provide evolutionary benefits that are theorized to have existed in ancestral contexts.

When using Darwinian models for genetic and reproductive fitness, homosexuality appears to be an anomaly at first glance. However, hypotheses like the kin selection theory indicate that it is much more than an anomaly, and likely has evolutionary explanations. With epigenetics and kin selection theory being leading hypotheses, more research and data may suggest a clearer origin and understanding of homosexuality and more benefits of it in both ancestral and modern contexts.

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On the Presence of Parenting Education: Literature Review and Comparison to the Mother Nurture Network

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they/them

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Nurture Network

Bringing a child into the world is one of the most life-altering decisions an adult can make, and yet is socially expected of people by loved ones and strangers alike. This decision is something many adults are poorly prepared for, leading to higher need for the Department of Child and Family Services (DCFS) intervention, as well as elevated risk of childhood and parental trauma. Caregivers and children need to receive care and education from the public sector to improve family outcomes.

Childcare education, at this point, is far from standardized: resources are unevenly distributed between communities. In some cases, efforts to support families have been accused of being punishment for parents rather than a sincere source of safety and education (Shaefer 2010). This project works to locate the holes present in current parenting education, allowing for future research to find ways to remedy these gaps. By discussing the founding and operations of the Mother Nurture Network in a semi-structured interview with its founder, this project describes the importance of the work done by family services educators on soothing the infant, 'trusting their gut,' and on paternal mental health regulation.

Background

The United States federal government, state governments, and the private sector spend millions on parenting programs annually (Cucchiara 2021). Most federal resources tend to be applied nearly exclusively to parents who have lost custody or are at risk of losing custody of their children. This is especially true for parents of color —offenses that commonly are overlooked for a white mother more frequently leads to incarceration or separation of families among people of color in the US (Mason 2022). In addition, court-mandated classes garnered towards the newly divorced are seen as a punishment for not following normative gender and marital standards prioritized in the United States (Charania and Simonds 2018). The uneven distribution and quality of resources causes harm to both parents and children. By speaking with experts in family policy and education, we can see what these educators have found to work when working directly with mothers in support groups. This project explores the goals and methods behind the Mother Nurture Network, an independent parenting education program, and will discuss how its philosophy can be applied to existing court-mandated programs.

Maternal Thought and Expectation

The stereotype of a mother is seen as endlessly patient, empathetic, and loving; deviations from this standard are heavily scrutinized. However, mothers having 'unthinkable thoughts' is far more prevalent than many would expect. Not acknowledging this reality can lead to isolation of mothers, causing self-doubt and fear for their ability to raise their newborns and institutional interference (Mason 2022).

First, common complications like divorce, or other deviations from normative standards, are framed as moral failings that will inherently harm a child (Moon and Simonds 2018). The combination of societal shame and maternal undercutting can worsen the often fragile mental health of a new mother. Second, poor maternal mental health risks deeper social vilification when they are women of color. It is far more likely for intrusive thoughts and violent flashes to be seen as a risk against infant safety in most emergency rooms when the parent in question is a person of color (Mason 2022), making it much more dangerous to seek out help when they are struggling with ideation that is often a symptom of post-partum depression. Intrusive thinking is rarely talked about pre-motherhood, making those thoughts that much more stigmatized for a mother to have. Finally, court-mandated parenting courses are more likely to be assigned to divorced parents and parents of color. In addition, these classes are often used more as legal surveillance and carry an increased risk of vilifying parenting styles and parental mental health (Schaefer 2010).

Programs Currently in Place

Programs meant to address maternal state of mind and parenting strategy are in place exist for the incarcerated parent, such as the programs studied by Brittnie Aiello and Ashley Scudder. The children of incarcerated women face elevated risk of hardship associated with family disruption and precarious childcare situations. Lack of stable support in childhood can lead to heightened risk of children developing behavioral issues in adolescence and early adulthood (Scudder 2014). Incarcerated parents are given opportunities to take group classes on parenting in hopes that

they will reduce likelihood of recidivism. That being said, classes are not regulated by a standard authority and are cultivated in-house, leading to them ranging from being out of date to purely at the instructor's whim (Aiello 2016). They also rarely involve parent-child interaction, and those that do often will weaponize the ability to visit with children as a form of policing the incarcerated mother (Scudder et. al 2014). In addition, courses geared toward the 'free' co-parent can be seen to be part of the elaborate surveillance designed to discipline parents deviating from the white, heteronormative, nuclear family paradigm that has been pushed as the only moral standard (Moon and Simonds 2018).

Parent-Instructor Conflict

While there is a lack of publicly available options, there are many private programs in place that are entirely voluntary for parents. Maia Cucchiara (2021) spent time observing Sutton Social Services' Positive Parenting program provided to a poorer neighborhood and mainly mothers of color. This example showcases why advocates worry that federal, state, and private policies in overemphasize 'fixing' and altering the behavior of poor parents, especially parents of color. This ideology reflects in educators who desire to alter behaviors without forming connections with parents or trying to understand cultural context, which causes serious friction between the two parties. For example, one of the main disagreements common between parent and instructor is on the use of corporal punishment. People enculturated into corporal punishment may use it, which goes against belief systems in the United States, especially among the middle class, that consider it unacceptable. Maia Cucchiara points out that this disconnect stems from instructors approaching parenting differences from an ethnocentric stance, refusing to 'meet women in the middle' and thus inhibiting shared understanding (Cucchiara 2021). Moreover, parents forced into classes that vilify their childcare strategies often report changes of parenting style; yet there is rarely evidence that indicates actual parental behavior changes or the effects of changes on children (Schaefer 2010).

Comparing the Mother Nurture Network

I was lucky enough to interview a co-founder of The Mother Nurture Network (MNN), Susanna Lutton, along with one of their instructors, Sara Schauer. For over twenty years, Lutton has been working with new and expecting parents after completing her Master's program in public health. Since MNN opened, the network has employed instructors and counselors, including Schauer. These instructors employ strategies that empower new mothers while taking into account their individual backgrounds and challenges. During our interview, Lutton made it clear that the jobs of both her and her instructors are to be there as a form of support system for the mothers looking for care. Rather than giving a 'one size fits all' approach to parenting, the goal at MNN is to listen to Mom in order to help her find the best way to keep herself and Baby happy. Trying to understand the daily list Lutton and her instructors have is difficult, as each day seems to be unique due to who they're seeing and what they need. The network provides lessons on breastfeeding, pre- and post-natal counseling, infant CPR, Mommy and Me, and parental support groups.

While they focus on mothers in the South Bay region of L.A. County, the MNN tackles issues seen by mothers across the United States. Lutton stresses that the network's emphasis is mother-centric care. Each new parent has a specific set of needs, and with small class sizes the network is able to accommodate parental need with tailor-made instruction. This is something far more difficult to accomplish in state-mandated courses that tend to be stretched for resources and far larger in class size. During a Mommy and Me support group I witnessed, Schauer began the class by taking in the early conversation of the group of mothers. She does this before starting educational content, as she feels that discussion on parenting is helpful only when it is centered around what Mom is currently dealing with in her stage of motherhood. Many of the parents in the MNN courses arrive proud of the fact that this is their first outing with Baby. Schauer sees this as a parenting victory and makes a point of ensuring that each new lesson is applicable to what Mom is already doing. Before starting class, Schauer takes their comments of how their past week was spent and adapts lesson planning on the hardships they are currently experiencing. Schauer does this because directing new parent attention to potential future challenges can cause unnecessary panic among already stressed Moms struggling to live in the moment.

MNN acknowledges that new mothers are often grappling with the stress of constant judgment, both internal, from themselves, and external, from family, friends, and society. Parents will see 'super moms' online and read every book they can find, hoping that they can find the 'right' way to look after their newborn. MNN tries to guide new and expecting moms away from that judgment. Lutton emphasizes that Moms finding their own right way to parent is the important goal. The only perfect family is the one a mother makes. Something that was shared by both Lutton and Schauer was the unofficial motto used by many of the Moms in group sessions: 'Good enough genuinely is good enough.' This is important, not only because it preaches reality, but also because there should not be efforts to 'fix' any family. While this group serves a more affluent demographic, applying this mentality to courses that serve lower income mothers that often face intense legal and social consequences on first offense would support efforts by DCFS to keep families together. Education without judgment is the key to having parents feel safe enough to seek out support and resources that could prevent or reduce need for DCFS involvement.

My final question to Lutton was asking how her own parenting has changed since working with mothers. We spoke on how lucky she felt to be educated on what the early mom needs in her toolkit. This is often something Mom often must learn on the job, she said, taking advice from everyone in her life, whether or not requested. Lutton stated that she doesn't feel that her parenting strategies would have changed too much had she had something like MNN at her disposal, in part because she was 'lucky enough to have that public health and maternal education' prior to having her own children. Lutton did however express that the main thing that she gained in this education is that the more she learned, the more her confidence grew. That is something that the network is trying to instill in its clients. Given the positive outcomes MNN sees, it makes sense that poor parents should also have access to similar resources.

That seems like an important takeaway: education nurtures confidence, and confidence improves parental outlook, which benefits children. Mother Nurture Network focuses on Mom trusting herself to know that she is doing what she can to provide for Baby, and giving her the tools needed to accomplish that herself. Reimagining family policy in the United States, and supporting resources like MNN for parents across diverse socioeconomic and cultural demographics, can help families be healthier and stay together.

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Huánuco Pampa, a Provincial Center in the Central Highlands of Peru

Francisca Nuñez

Introduction

The Inka Empire, or *Tawantinsuyu*, was an expansionist state that developed a highly complex socio-political machinery within a vast territory comprising six modern countries in South America. Inka society's political and administrative organization made possible the empire's territorial expansion and conquest of new near and distant local ethnic groups. New additions to the Inka imperial apparatus demanded diverse strategies led by the political elite in Cuzco, which reflects the government's complexity and role in contributing to their imperial plans. Thus, the Inka Empire cannot be understood without understanding the organization of the different aspects of their culture, particularly within the political, economic, and religious spheres. These cultural spheres worked together to promote the incorporation of new territories within the *Tawantinsuyu* through conquest and subjugation of smaller local kingdoms. Further, the empire's administrative apparatus made it easier to control conquered populations by effectively exploiting and administering their resources, which ensured the continuity of the Inka expansion northward.

The Inka state-built Huánuco Pampa in the central highlands of Peru, located on a plateau in La Unión district, in the province Dos de Mayo of the Huánuco Region. Huánuco Pampa is one of the major regional administrative centers in the Andean region whose architecture is marked by the imprint of its political organization and statecraft.

The research questions formulated to direct the development of this paper are: How does Huánuco Pampa architecture reflect statecraft within the Inka Empire's expansionist politics? In addition, how could acoustic effects in the plaza have contributed to administrative commerce, or interactions among the politically active citizens? These questions investigate the design and function of the following five architectural categories, which structure this discussion: Qhapaq Ñan, plaza, *ushnu*, *aqllawasi* and *qholqas*. Based on preliminary research, I hypothesize that some architectural features suggest that the Inka administration in Huánuco Pampa placed more emphasis on ideological control than on economic extraction.

Methodology

The methodology used for this study includes a comparative formal analysis of the architecture in the five categories mentioned above, as well as the site planning and intra-site spatial organization. Discussion of each category will include the following: 1) a comparative description of the communication system in Huánuco Pampa, 2) analysis of the Qhapac Ñan and the plaza with an emphasis on acoustic potentials around the *ushnu,* including possible types of interaction and their socio-political implications, 3) a description of the architectural features associated with astronomical observation and 4) their imperial functions. I will close discussion with an inter-site comparison of the *qholqas* storage capacity, to understand the differences in their storing priorities.

Inka socio-political organization

Given that the Inka Empire was an expansionist state that aimed to incorporate surrounding territories into the *Tawantinsuyu*, there is evidence that the empire integrated local kingdoms into its political system while simultaneously establishing a settlement hierarchy. In this hierarchy, Huánuco Pampa was a second-level regional administrative center.

Huánuco Pampa

Huánuco Pampa was built by Sapa Inka Pachacuti, the mytho-historical Inka emperor, as part of his plans to extend the imperial territory northwards. It was built as an administrative base from where new campaigns would be started. Possibly, his son Tupac Inka Yupanqui was co-ruling with his father when this project started sometime before 1471, the year Tupac Inka Yupanqui was crowned as the new Inka (Espinoza Soriano 1997:96)

Huánuco Pampa was built on virgin soil (Morris and Thompson 1985:56) at 3,800 MASL (Meters Above Sea Level) (Levine 1992:114) and covers about two square kilometers, where it has more than 4,000 buildings (Morris and Thompson 1985: 56). As with other administrative sites, this center followed specifications from Inka architects in Cuzco (Hyslop 1990:27. When the Spanish arrived in the Andes, Huánuco Pampa had not yet been completed, which is indicated by the presence of a small temple (Gasparini and Margolies 1980:105). Labor for building Huánuco Pampa was done by local populations like the Chupaychu and the Yacha, who did so to complete their *mit'a*, or mandatory labor tribute to the Inka state (Morris and Thompson 1985:62).

Inka Economic System

For the Inkas to achieve their imperial goals and to support their vast and varied administrative needs, they developed a complex political structure for the administration of their economy, military, communication system and the storing of surplus goods. These factors may have simultaneously constituted the cause and the effect of their political and territorial growth, since they needed prestige commodities to support their economy, which was centered around reciprocity and redistribution. This economic strategy required more lands and luxury goods to be distributed among the new *panacas (*Inka royal families), Cuzco administrative personnel, and regional ethnic leaders who were assimilated into the Inka ruling class (Espinoza Soriano 1997). Thus, for the Inkas to survive as a socio-political system, they might have needed to keep their expansionist politics to acquire more wealth to support the needs of their organization.

Background to the Problem

Huánuco Pampa has drawn interest of few scholars who started performing archaeological research in the decade 1960s. Murra and Morris focused their research on architecture and space distribution in relation to their role as Inka administrative centers. Craig Morris was one of these first researchers who contributed to the study of the architectural characteristics of Huánuco Pampa, which he relates to specific administrative and social functions within the settlement. He also applied Zuidema's concept of ceques to Huánuco Pampa. In the 1970s, Ramiro Matos studied two settlements in the Huánuco Pampa region that are associated with two ethnic groups: the Wamalli, who settled west of Huánuco Pampa in the Quero territory, and the Yacha, who settled in the south, where they built on the Wakan site.

In the 1980s, Morris and Thompson described the differences of the material culture of three local ethnic groups in the immediate area of influence of Huánuco Pampa: the Chupaychu, the Yacha, and the Wamali (Morris and Thompson 1985:163). Morris and Thompson described the Chupaychu villages as settlements on top of the mountains that were built with field stones and placed together with mortar (Morris and Thompson 1985:139). They concluded that there are differences between the structures of distinct ethnic groups. For example, they could be circular, as in the case of the Aukimarka (Morris and Thompson 1985:144), rectangular, in Ichu (Morris and Thompson 1985:141-142); and square with curved corners, in Quero (Morris and Thompson 1985:119).

In Huánuco Pampa, structures indicate that diverse ethnic groups may have participated in the construction of buildings on the site. Huánuco Pampa structures mostly follow the Cuzco style, but they also display other ethnic architectural traditions in the different shapes of building materials, techniques, and aesthetics. For instance, rock blocks are smaller in Huánuco Pampa than in Cuzco, and they are joined to rectangular forms rather than to curved ones (Morris and Thompson 1985:58). Construction differences may indicate Chupaychu, Yacha, and other ethnic groups contributed to construction in the area as mit'a taxpayers (Morris and Thompson 1985:62). For example, there are circular residential structures, which are uncommon in Cuzco and other Inka settlements.

Other scholars argued that the architecture of Huánuco Pampa was part of political projects that imposed the spread of Inka architecture techniques when expanding their territories along the *Tawantinsuyu*. Among them, Gasparini and Margolies, who produced one of the most important books on Inka architectures, and John Hylop, describes the criteria for Inka settlement planning, the building of the Qhapac Ñan, and the relevance of this communication network for the Inka Empire. Hylop argues that it ensured that the administrative centers and the main central area in Cuzco could keep connected in a growing empire. More recent research by José Luis Pino on Huánuco Pampa concludes that this structure and the *Inkawasi* are associated to astronomical alignments. Also, he found out some elements in the *ushnu*, such as funerary contexts and offering structures that make him conclude that this major

element, in this administrative center, was the focus for ceremonies and rituals. Carlo José Ordoñez has also studied this center and focused his attention in the Inkawasi to relate its building to the contribution of local ethnic groups through *mit'a.* Ramiro Matos and José Barreiros edited *The Great Inka Road: Engineering an Empire* (2015), where they provide access to varied articles from different young researchers that enrich the understanding of Huánuco Pampa with some new viewpoints, such as Gary Urton, who finds some similarities between the Qhapaq Ñan and *khipu* (Inka writing and record keeping tool using a complex system of knotted string).

Analysis/Discussion

As the type of infrastructure developed by the Inka society was designed to fulfill specific functions in support their socio-political organization, a group of architectural structures from the regional center Huánuco Pampa will be subject of a brief description and analysis in an effort to understand their role within this center and within the complex Inka system. The selected architectural units to be presented in this segment are: the communication network, the plaza, the *ushnu*, the *aqllawasi,* and the *qholqa*.

Qhapaq Ñan

The Qhapaq Ñan, a Quechua expression meaning 'Road of Power' (Barreiro 2015), constituted a complex network of roads organized in two axes running south-north, one along the coast and the other along the highlands. Both were interconnected by transversal roads connecting coast and highlands, allowing for easier movement of people, transportation of materials, and diffusion of information throughout the *Tawantinsuyu* (Urton 2015). Mapping of the Inka road was influenced by the environment and the state's political needs, which emphasized a straight road whenever possible for faster and more effective movement. As a result, some roads avoided high population zones, instead falling along routes with the least obstacles where administrative centers such as Huánuco Pampa and Pumpu were built (Hyslop 1990:276). Taparaku and Tunsucancha were *tampus,* roadside inns, located in the north and south of Huánuco Pampa, respectively (Levine 1985). Murra and Thompson surveyed the area between Huánuco Pampa and Taparaku and found that technology changed according to the surface morphology and ecological conditions. As a result, the road displays a range of characteristics. For example, in flat areas, the road measures twelve meters wide, downslopes, have retaining walls and three-meter wide stairs, and swampy areas have roads paved with stone. There are several areas with bridges to cross waterways (Levine 1985). The Qhapac Ñan enters Huánuco Pampa's central plaza (Levine 1985) and diagonally runs across from the southeast corner heading northwest (Gasparini and Margolies 1980:103).

To the south of this administrative center, passing Tunsucancha, the royal road climbs to 4400 meters elevation (Levine 1985). Besides the main royal road, there seems to be an additional highway running north and out of Huánuco Pampa (Levine 1985) following the Río Marañón, whose functions might have included the transportation of goods from the low tropical lands and the gold mined at Chuquibamba (Levine 1985). Other intra-regional routes may not have been part of the Qhapaq Ñan, but might have facilitated traveling within this administrative region. One road goes east connecting the Marañón and the Huallaga valleys and the lowlands. Another road runs in opposite direction following the Río Huallaga towards the administrative center Pumpu, possibly to transport materials to its storehouses. It was testified by the Chupachu in 1549 and 1562 that, "they were instructed by the state" to transport goods along this route (Levine 1985). The variety of roads satisfied different needs within this area, and its use was under close supervision of the state. Espinoza Soriano explains that the Inka state restricted the traffic of people to keep people where they were born unless it was decided to send them as *mitimaes*, or laborers forced to relocate to live and work; thus, the purpose of the roads was neither the national unification nor the development of ethnic groups' local exchange (Espinoza Soriano 1997:391-392). This historian concludes that all roads were property of the Inka and their use was only to serve the state by 1) allowing the easy and fast mobilization of warriors headed to more conquering campaigns or to suppress rebellious attempts among the subjugated population, 2) to carry messages to the Inka, 3) to transport goods to the storehouses, and 4) for the travel of the Inka Sapa and his functionaries. (Espinoza Soriano 1997:391). However, one of the main functions to be attributed to the Qhapaq Ñan is to have allowed the regional centers to remain in communication with Cuzco, as it was consolidating and centralizing the hierarchical organization of its political system, which was extended to include the new secondary level, or satellite, administrative centers that were built on different areas of the growing empire's territories.

The Central Plaza

The central plaza, one of the most relevant architectural areas in Huánuco Pampa, was 'leveled by earth fill' (Hyslop 1990). Huánuco Pampa's plaza has an orthogonal shape, which measures 547 meters long by 370 meters wide (Moore 1996). This huge plaza covers about 10% of the administrative center's area, where it occupies its central part (Morris, Covey, and Stein 1992). It is a four-sided rectangular open place, which has, on each side, one or more barrios (Gasparini and Margolies 1980:103); however, it has open entryways, as there are 'principal roads leading from the corners of the square' (Moore 1996). Streets and walls radiate out from the borders of the plaza, streets and walls radiate out subdividing the city into a series of sectors on each side of the plaza (Hyslop 1990), which form a total of twelve sectors (Levine 1985). Morris points out at the difficulty to find direct evidence for the use of Huánuco Pampa's central plaza, since it is an open space which might have been regularly cleaned; however, it can be inferred from an objective observation of this space to stress it as a key location for the performance of imperial *tinku* (Quechua; lit., 'meeting-encounter') and many other public events, such as the collection of

labor tribute, the distribution of prestige goods, public trials and punishments, and even the selection of victims to be sacrificed in empire-wide ceremonies (Morris, Covey, and Stein 1992).

On the other hand, as Moore notes, the Huánuco Pampa plaza offers no ambiguity when assessing its function. Its huge dimension relates to its pivotal role as an open stage for many activities that "involved ritual feasting and public ceremony" (Moore 1996), whose key function was to forge and strengthen relationships between the state and local ethnic leaders (Moore 1996). In addition, as a highly class structured society, the Inka ranked ceremonies by discriminating between public and private ones. Moore points to public ceremonies taking place outdoors while private ones took place inside shrines and temples, which were reserved for the "royalty, priests, and objects of worship" (Moore 1996). The extraordinary size of the central plaza at Huánuco Pampa indicates the intentionality of the Inka to confer it as symbolic of the imperial power that conquered these territories (Gasparini and Margolies 1980:103). Its dimensions are relevant to its role as a place to stage gatherings that strengthened the political dominance of the Inka over the local leaders.

Ushnu

Ushnu are special architectural structures that are found in conquered territories, not in the Cuzco region (Hyslop 1990:70). The impact Huánuco Pampa's impressive plaza may have on visitors is enhanced by the enormous size of the *ushnu,* a structure placed at the center of the main plaza of this regional center.

It is important to note that the *ushnu* in this regional center is the largest known platform in the *Tawantinsuyu* (Hyslop 1990:87). The *ushnu*, which measures fifty-by-thirty meters, sits four meters high with the platform serving as its base. It displays fine stonework resembling the Cuzco style (Gasparini and Margolies 1980:277) while, in contrast, the majority of Inka *ushnu* in the empire are built with *pirca* (walls) (Gasparini and Margolies 1980:280). The *ushnu* sits on two lower platforms and connects to the plaza through six stairways (Hyslop 1990: 87). On top of the *ushnu*, there is an enclosed surface which is surrounded by a one-meter-high edge wall. (Gasparini and Margolies 1980:278). Within this encircled upper-level area, there are many seats where the Inka or his representative might sit in order to officiate in state ceremonies or to make astronomical observations (Morris & Thompson 1985:58-59).

According to Pino Matos, astronomical alignments are associated to two structures in Huánuco Pampa: the *ushnu* and the *Inkawasi,* where he measured and verified the sun's positional alignment during the 'equinox, zenith, antizenith, and solstices; moon alignments; as well as star positions of the Alpha and Beta Centaurus and the Southern Cross' (Pino 2004). Pino addresses Zuidema's chroniclers' references to a couple of felines accompanying the sun, as well as Guaman Poma de Ayala's mentioning two felines on each side of a Coricancha window through which the sun's image and its sunlight was projected (Pino 2004). These observations led Pino to the conclusion that the feline sculptures on the doorways in Huánuco Pampa are also representing the sun, since during the equinox "the first and last sun rays simultaneously cross all the doorways" (Pino 2004).

The physical characteristics of this *ushnu* evidence that it had been a multifunctional structure that fulfilled a great variety of functions, which may have included roles as an 'altar, place of prayer, place of sacrifice, seat, throne, and place from which justice was imparted' (Gasparini and Margolies 1980:271). Since the plaza and the *ushnu* played a relevant role in Huánuco Pampa, as in other regional centers, acoustical research was done in this center by measuring sound waves at different points on top of the *ushnu* and the plaza. The purpose was to determine the dynamic of the Inka and/or his representatives' interactions with the population gathered in the plaza. This research concludes that the Cuzco elite knew about the acoustic potentials to effectively transmit messages to the visitors at the plaza, and that they used audio and visuals strategies for this purpose (Kolar, Covey, and Cruzado Coronel 2018). In conquered territories, *ushnu* may have the purpose to symbolically bring together the image of the ruling Inka nobility, associated to this platform itself, and the huge plaza, which may have represented the local population who gathered there (Hyslop 1990:71). Furthermore, stressing their political alliances, sacrifices might have taken place in the *ushnu*'s area, which had important political implications that could be expressed as a hierarchical model for strengthening the political ties between the central power in Cuzco to the provincial centers which, in turn, were strengthening relationships with the local ethnic groups (Hyslop 1990:72). Hyslop, citing Zuidema, describes institutionalized sacrifices such as the child sacrifice, which was performed next to or in the *ushnu* (Hyslop 1990: 72).

Aqllawasi

The area of the *aqllawasi,* which is located in the north of the plaza, comprises an enclosed arrangement of many rooms of similar size where a group of chosen women lived and produced cloth and *chicha*, or maize beer, under close supervision, as part of their obligatory *mit'a* work (Gasparini and Margolies, 1980:108). Within these Inka structures, the *aqllas* served imperial interests by performing specialized roles serving the official cult. The *aqllas'* major functions consisted in preparing important food and beverages, such as *chicha*, and weaving elaborate ceremonial textiles (Morris and Thompson 1985:28). These prestige goods were needed to fuel the *mit'a* labor system, the state rituals, and the 'reciprocal exchange relationships' (Hyslop 1990:297).

Qholqa

The *qholqa* area is on a hill located on the south of the plaza, where there are 497 units with a storing capacity of 38,000 cubic meters (Gasparini and Margolies 1980:101). Of these units, 62% are rectangular and 38% are circular, and they are organized along eleven rows. Of these rows, only the first two rows are a mix of rectangular and circular styles (Levine 1992:114).

The size and complexity of *qholqa* vary in addition to shape. Circular storehouses range in diameter from 1.9 to 6.3 meters. Rectangular style size depends on complexity: if they are single room structures, their length varies between eight and twelve meters while the multiple room units are longer (Levine 1985). Morris suggests that deposits' shape may be related to the accounting and organization by crop (Levine 1992:139).

Morris relates the shape of the *qholqa* to the products to be stored. He states that rectangular deposits were used to store root crops while the circular ones were for maize and other commodities. Based on the high ratio of rectangular deposits in relation to the circular ones, Morris attributes more importance to root crops, whose storage volume had been between 50% and 80% out of the total storage volume for Huánuco Pampa (Levine 1985). Its relevance is evidenced by the strict care of the stored goods, as it can be seen in the organization of the storing lower area, where there are rectangular structures of different sizes for different functions associated with food storage. These storehouses had two clear functions. The primary one was supplying for the administrative center's needs, and the second one was related to the redistribution of goods (Gasparini and Margolies 1980:101), which stresses the importance that storing had for the state, since it allowed the imperial system to keep functioning, maintaining its bureaucratic organization, and supporting the expansion of its territories. Providing for the economies of conquered regions was not a priority for the Inka state (Hyslop 1990:298) unless these regions participated in Inka reciprocity and redistribution economic strategies. There are differences between the central area (Cuzco) and the regional administrative centers in regard to the amounts of *qholqa* and population. There is an inverse relationship between them. In the central region, where there are stable and permanent populations, the number of *qholqas* is small, since there is an equilibrium between the production and consumption activities. Permanent populations have direct access to their production fields to sustain their subsistence needs. On the contrary, in the regional centers there were not permanent populations, and these had to focus on their specialized functions, not being able to participate on subsistence productive activities

Central Region	Administrative Centers
• Few qhollqa • Settlements well established with permanent and stable population • There was equilibrium between production and consumption	• More qhollqa • Settlement are temporary with "floating and transient population" (Gasparini & Margolies 1980) • Centers depended on storehouses for survival

Comparing the storage volume of Huánuco Pampa and Hatun Xauxa, both regional administrative centers in the Central Andes, one can observe that the storing capacity of Huánuco Pampa is more excessive than that of Hatun Xauxa, considering the size of their respective populations. It could be that the Huánuco Pampa administrative elite was more concerned with performing rituals and ceremonies, which could have demanded the usage of stored items to support a greater number of people attending the ceremonies. In addition, the storage capacity may be related to Inka use of reciprocity strengthen political ties with local ethnic groups and to keep them in peace and supporting the Inka administration.

Region	Estimated Total Regional Population	Regional Storage Volume	Storage Volume per 1,000 Population.
Huanuco Pampa	55,000	38,748m³	705m³
Pump	60,000	36,286m³	605m³
Hatun Xauxa	217,000	169,249m³	780m³

Comparative chart from Levine 1992: 139

Conclusion

The discussed architecture structures are examples of how infrastructure reflected the imperial political system, which depended mostly on regional administrative centers to acquire the resources that would maintain its functioning. Each of these structures were pivotal for the expanding Inka state, for they provided vital resources to the different areas of its administrative organization. The Qhapaq Ñan served varied purposes for the Inka Empire. For instance, it facilitated the transportation of warriors, administrative bureaucrats, commodities and information to the areas where they were needed, as well as the maintenance of the communication among the hierarchically connected settlements. A growing imperial state without an effective infrastructure would not have succeeded. The plaza and the *ushnu* were essential to the state functions, for they were the stage where the interaction between the ruling elite and the governed subjects took place, where political alliances were promoted, and relationships were strengthened though ceremonies and rituals. These structures hold symbolic meaning as they represented the greatness of the power conquering these territories. The *aqllawasi* and the *qholqas* are tightly related to the Inka's economic organization, since they provided for the well-established reciprocity and redistributive economic strategies, which were considered a 'staple finance,' since it involves the state's acquired obligation to distribute necessary goods among the population, such as food and clothing. The regional administrative center Huánuco Pampa played an important role in the different areas the Inka state needed for continued political growth by providing necessary infrastructure for a stable political system.

Architectural structures reflected key political strategies and sustained the expansionist program through transportation, finance, and the alliances with local populations. Huánuco Pampa's plan shows that the Inka stressed making political alliances, which required them to perform more ceremonies and rituals to strengthen political ties with local leaders. Thus, it would prove the hypothesis presented that the Inka placed more emphasis on ideological control that on economic extraction.

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Screening for Cervical and Breast Cancer among Latina Women

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In medical institutions, the health science of cervical and breast cancer screening aims for early detection, prevention, and effective management of breast and cervical cancer. Among both foreign-born and U.S.-born Latinas, cervical and breast cancer are of major concern due to multiple barriers which leads to minimal usage of screening and Pap Smear Services. Latinas face an array of disparities which influence their choice on getting tested for cervical and breast cancer. Research has shown that sociodemographic, cultural, psychosocial, and interpersonal factors play a key role on Latinas cancer screening intentions and behaviors (Torres et al. 2013). Studies have found that Latina women might not get screened for cervical and breast cancer because of fear towards the examination process, family influence, economic barriers, and immigration status. Latinas in the U.S., experience elevated risk for cervical cancer because of late detection, which leads to higher mortality rate because of the stage of the cancer. The Theory of Planned Behavior (TPB) can help explain and address health inequalities by examining the psychological factors which influence health-related behaviors among foreign- and U.S.-born Latinas.

In this paper, I will address some causes of low screening rates among Latinas in the United States. To do so, I have conducted a semi-formal interview with a patient of cervical and breast cancer screening that identifies as an immigrant Latina of low income. Latinx are the fastest growing minority in the United States, and tending to their health has been of principal concern for doctors. Latinas report some of the lowest rates of screening for cancer and follow-up appointments. Studies have found that belief systems influence behaviors that reduce the rate at which Latinas get screened for cancer. In addition, health inequalities often lead to disparities in accessing regular screening for breast and cervical cancer.

The woman who I interviewed prefers to identify herself only with her first name, Rosa. Rosa is a forty-three-year-old Latina immigrant from El Salvador. Like many other Latinas in the Los Angeles area, Rosa comes from a low-income background and is a patient at the Los Angeles Medical Center (LAMC), where she regularly attends appointments for cervical and breast cancer screening. When she was forty-one years old, she was referred to LAMC for cervical screening because of cervical pain. She was found to have precancer at various stages of the disease. Rosa was scared because, given her socioeconomic conditions, she did not believe that she would be able to afford treatment. Psychologically, she could not believe this was happening to her and feared going through examination and treatment because she was told that the experience was painful and traumatizing. Individuals like Rosa from socioeconomically disadvantaged backgrounds are faced with the reality of limited health care due to their income, legal status, and lack of awareness.

Studies find that about 88% of Latinas in the U.S. have never been screened for cancer (Mann et al. 2014). Fear and lack of awareness are among known causes of low screening rates. For example, low-income Latinas might not be educated on the importance of preventative cancer screening at an early age because of social influences and beliefs (Shelton et al. 2016). Rosa is among this group of women who report that they were not informed on the necessity of cancer screening. For her and for many other Latinas who come to the United States, going to the doctor seems to be almost impossible for both monetary reasons and a fear of discovering they have dangerous health issues. Studies indicate that poor education in their home country, lack of health care access in both their home country and the United States, and legal status lead to low rates of preventative healthcare.

When a socioeconomically disadvantaged group does not have health insurance, their health is the last thing they think about because they know that it might be impossible to pay for treatment (Shelton et al. 2016). Rosa is one of the lucky women that qualified for Medi-Cal, which means that she does not have to pay for her tests and treatment. But, if she did not have access to Medi-Cal, Rosa believes that she would not have been able to afford her screenings and treatments because of the high cost of medical care without insurance. She used to believe strongly that her own health was not important because she had other people to take care, such as her daughters and mother in El Salvador who rely on her income to meet their basic living needs. Because of this, Rosa did not go to a doctor for preventative care until she was forty-one.

Another factor is lack of social support, which heavily influences screening rates among Latinas. Intimate partner support is important during challenging health journeys. However, if the male partner does not like the idea of his female partner going through a cervical or breast cancer screening, she might not do it because of the patriarchal system that Latinx communities have established. Studies have found evidence that, among Hispanic populations, male attitudes may influence women's decision to refuse screenings (Read et al. 2020). The opposite is reported for women not in heterosexual partnerships, such as single mothers who reported that factors their decision to pursue cancer screening is heavily influenced by affordability—if they do not have health insurance and are of low income, there is a higher chance of not getting screened.

The California Department of Public Health (CDPH) pushes for preventative healthcare, such as cancer screenings that lead to early detection. The LA Medical Center where Rosa receives care provides translators for people who do not speak English or who are more comfortable speaking to doctors and nurses in Spanish. Doctors understand the importance of communicating with care and nuance when a patient's results are abnormal, and using a home language can make a difficult conversation less traumatizing. Research has found that patients feel appreciated and validated when doctors and nurses facilitate translators (Simon et al. 2013). Hispanic women feel more at ease and more likely to attend follow-up appointments if Spanish is used to explain to them the process that they are undergoing. Finally, Hispanic women feel more at ease if female doctors and nurses perform the examinations because of potential shame resulting from being exposed to a male doctor.Feelings of shame are related to cultural beliefs about gender and dignity (Mann et al. 2015).

Overall, health inequalities among Latina women are linked to low education and awareness of preventative healthcare and economic barriers to access. Therefore, it is important to bring awareness of cancer screening and early detections to Hispanic and other communities of color. Education is important, but in order for education to be effective it is necessary for low-income individuals to have access to effective and welcoming clinics and hospitals. Not everyone is able to afford to pay for medical services and not everyone has health insurance. Governmental and medical institutions should provide free access to cancer screening to everyone regardless of insurance, income, or legal status, because healthcare is a basic human right that everyone should have access to.

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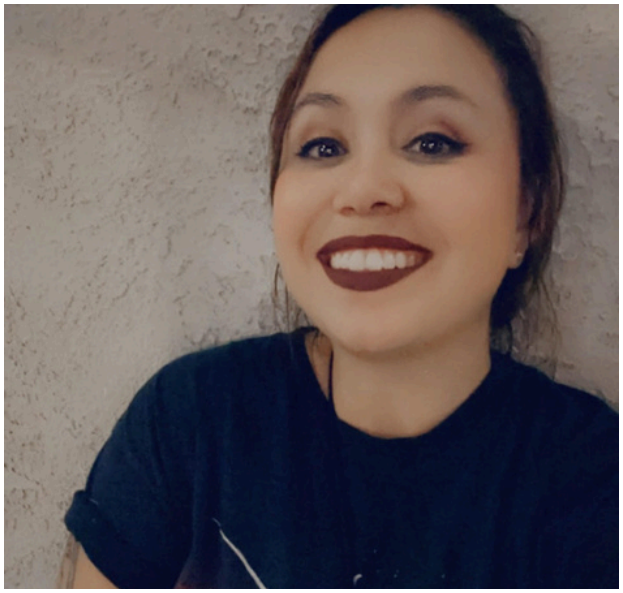
The Importance of Cacao in Ancient Maya Society, Funerary Rituals, and Its Relationship to the Underworld

Lauren Heib



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Introduction

Thousands of years ago, deep in the jungle of the Yucatan, in what is now Mexico, Belize, and Guatemala, the ancient Maya civilization began cultivating a rich drink derived from the fruit of the cacao tree. While there is some dispute regarding its origins, there is evidence that cacao (Theobroma cacao L.) was heavily incorporated into Maya culture from the earliest settlements of life in Mesoamerica. Cacao was therefore essential in all forms of celebration, including sacred rituals and funerary practices. Cacao was considered a sacred substance; everything from its cultivation to its consumption, animal engagement, and the image of the cacao pod itself were treated with reverence (Terry et al. 2022).

In this essay, I will present the impact of biomarker testing on ritual pottery and in soil and explain how this provides evidence regarding the widespread use and importance of cacao among the ancient Maya. Furthermore, I will examine the abundance of cacao iconography, its role in depicting sacred Maya rituals, and the importance of cacao in the Maya cosmovision. Through this evidence, I will demonstrate how cacao played an integral role in ancient Maya society with special focus on sacred ritual practices that represent cacao's close relation to the Maya underworld.

Vessels of Chocolate

Cameron E. McNeil (2006) argues that the importance of cacao is most evident through the abundance of iconography created on vessels, large stone stelae, and building façades during the Late Classic Period when images of cacao reached their peak. Similarly, bimolecular archaeologist Patrick E. McGovern (2009) observes that the Maya had a fascination with cacao's place in the universe, leading to the Maya artfully incorporating images of the plant on ceramic vessels. For instance, one vessel depicts the head of the maize god amid the pods of cacao trees. This iconography represents cacao as a sacred tree important to the underworld, rulership, blood, and the maize god (McNeil 2006).

Although some vessels depicted images of gods, culinary historian Maricel E. Presilla (2009) explains that the primary use of Maya glyphs on the exterior of these vessels was used to identify not only cacao flavor varieties, but also the previously intended contents. Some identified variations of prepared cacao include "bitter cacao," "tree-fresh cacao," "foamy cacao," or, as marked on a polychrome vase discovered at Río Azul, *k'ab kakawa*, which translates to "honey cacao." Furthermore, Dorie Reents-Budet explains that vessels with the aforementioned inscriptions were considered to be elite food service wares. For example, at the site of Copan, vessels with cacao glyphs were not found within the tombs of rulers but had been found in elite burials. It is likely that the presence of these vessels signifies the owner's participation in sacred events or serve as a form of trophy (McNeil 2006).

While ceramic "chocolate pots" are visually important for the glyphs on their exteriors, vessels are also important for what is invisible, such as the capability to contain biomarkers that can be used for testing for their former content (Terry et al. 2022). Specifically, biomarker testing is the scientific method of measuring organic compounds left behind by formerly living organisms (Seligson, lecture, September 6, 2024). Therefore, scientists can confirm the time frame and vessel variety, as well as the number of vessels used for cacao's consumption. For example, the specific biomarkers of chocolate include methylxanthine, theobromine, theophylline, and caffeine, all of which have been found in ancient ceramic pots collected from Preclassic, Classic, and Late Classic Period Maya sites (Terry et al. 2022). Additionally, in a study conducted on a series of Middle and Late Preclassic vessels from the site of Colha, Belize, Terry G. Powis (2002) discovered that four out of eleven vessels tested positive for theobromine, a compound exclusive to cacao plants in Mesoamerica. However, these vessels were not solely used for holding cacao. In a similar study at the University of Kansas, Steve Bozarth also identified biomarkers of fruit and vegetal matter in the cacao vessels (McGovern 2009).

Chocolate Groves and Passages to the Underworld

While biomarker testing on the inside of ceramic vessels can determine the potential use history of a specific pot or cup, biomarkers found in soil can be used to determine the location of previous cacao groves. For example, in a study that sampled the soil of eleven sinkhole sites in the Mexican states of Yucatan and Quintana Roo,

nine tested positive for theobromine and caffeine (Terry et al. 2022). Testing for these biomarkers was done through a new method of soil extraction that, in simplest terms, requires drying soil samples from within the sinkhole, filtering them, passing them through extraction disks, and then analyzing those extractions (Hollingshead 2022). When compared with soil with biomarkers indicating no previous history of exposure to cacao, this evidence concludes that even if a location no longer has cacao trees it previously did.

The presence of cacao groves in sinkholes is significant. Sinkholes, also referred to as cenotes, dzadzob, or rejolladas, vary in shape and size and incredibly important to the ancient Maya (Terry et al. 2022). In the Maya cosmovision, these partially submerged caves represented passages into the underworld and were revered as sacred spaces (Seligson, lecture, September 6, 2024). In order for cacao trees to grow within a cenote they would have to be planted intentionally, as cacao trees do not naturally grow in cenotes. Such sites are examples of deliberately created sacred spaces. For example, two sinkholes discovered in Coba contained stone ramps, which would have allowed for a pilgrimage or procession to descend into the sinkhole (Terry et al. 2022). Additionally, archaeologists this site discovered evidence of ceremonial artifacts, such as offerings of jade—considered one of the most sacred offerings—various ceramic vessels, and small ceramic cacao pods (Hollingshead, 2022). There still exists such rich symbolism in the descent into the underworld that, even today, Maya use the ramps to access the cenotes (Terry et al. 2022).

Johanna Kufer and Micheal Heinrich theorize that cacao's relationship to the underworld lies in relation to its ideal growing environment: darkness. Additionally, cacao may have been intended as the visual representation for the opposite of corn, which is grown in bright open fields. As such, Kufer and Heinrich identify maize and cacao as "paired opposites," one growing in the sun, the other in the dark (McNeal, 2006). While the correlation between the maize and cacao may not appear to be interrelated, the ancient Maya believed that they were similarly related in importance. Richard E. Terry (2022) observes that there are important visual similarities between the maize plant and cacao, such as their development of pods on the trunk of the tree as opposed to branches.

According to Presilla (2009), however, the relationship between corn and chocolate lies within their shared mythical associations regarding cosmic life cycles. For instance, McNeil (2022) notes cacao's portrayal as a cosmic or sacred tree, sometimes even standing in place of the axis mundi, or the center of the world (Seligson, lecture, September 7, 2024). To expand on cacao's relationship with the cosmos, death, and the underworld, Chichen Itza's iconography represents cacao as one of the most important fruits produced from the body of Hun Hunahpu after his death in the epic of the Hero Twins (Terry et al. 2022). McGovern (2009) observes that "the Maya equated cacao with blood," and therefore with death. Thus, cacao's connection to the underworld makes it a critical component in funerary rituals. For living participants of funeral rituals, the consumption of cacao by family members can help ensure passage to the underworld (Prufer 2007).

The Maya believed that departed souls need to be properly provisioned for their journey into the underworld. Environmental archeologist Keith Prufer (2007) explains that cacao plays two distinct roles within funerary rituals: 1) as a substance consumed by the living in preparation for internment, and 2) as one of the substances that travels with the deceased into the afterlife. These two roles were vital, as a person who was not properly provided with goods could return to haunt the living (Prufer 2007).

Conclusion

The evidence discovered regarding the abundance and incorporation of cacao in diverse aspects of ancient Maya civilization demonstrates its widespread importance. Furthermore, soil biomarkers indicating the former presence of cacao groves providesevidence of deliberate cultivation, while the use of vessels reveal frequent use in ritual and consumption. Finally, the use of cacao in Maya iconography represents its importance within Maya cosmovision. While this research only scratches the surface, the examination of the role of cacao in the life of the Maya provides valuable insight into what they held as sacred.

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Sustainable Food Production: Education, Gender, & Food Availability

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Introduction

In this paper I explore how teaching children about sustainability follows them home and has a positive impact on their lives and families. If children are taught about the effect humans are having on the environment, we will have a future that includes people who are passionate about sustainability and the environment. I look at a specific example: Sustainable Farming classes at Costa Rica's Earth University (EU), where students have the opportunity to work on a way to make the world more sustainable. I look at what this program has done for the environmental cause through hands-on banana farming classes.

At EU, students have an 'upside down' curriculum—they start working in the field rather than in a lecture. Unlike industrialized banana groves, the teaching grove allows wildlife to live in the banana plants. Earth University is also researching how to reduce chemicals in large-scale cultivation (Nicole 2013). Prescott et al. discuss how farm-to-school food production increases student knowledge about nutrition and sustainable food sourcing. They conclude that there were positive outcomes in nutrition knowledge and healthy food selections among students who participated in sustainable farming classes. More students were willing to try more fruits and vegetable and

nutritional self-efficiency increased among student participants in their study (Prescott 2020).

Background

In high school I took an Environmental Science class, and on the first day the teacher asked, "How do you save the environment?" She gave three answers, two of which are long forgotten. However, the third has stuck with me all these years: "Elevate the status of women." She explained that inequalities between men and women are a consequence of environmental issues (Nightingale 2006). Once gender is conceptualized as a social and cultural process, the relationship between gender, environment, and other aspects of social and cultural life can be focused on for change.

The need for political ecologists to look at gender beyond the household and community and the need to reevaluate the relationship between gender and environment emerges. For example, community forestry in Nepal is a case study that shows the importance of interrogating role of gender in the discussion about environmental change (Nightingale 2006). Mallory (2013) acknowledges three key items in her article, "Locating Ecofeminism in Encounters with Food and Place." First, we must examine the socioeconomic factors associated with cooperative grocers, or "co-ops," and their customers, or "members." Frequently, members and the shareholders of co-ops are predominately white and have a high socioeconomic status. This underscores inequitable access to all people and is not as sustainable as one would think.

The second point Mallory discusses is Ecofeminism, which she defines as "eco, meaning the end of anthropogenic destruction of natural places, and Feminism, meaning the end of oppression of women and other social groups based on equality for all." The third and final point is the philosophy of place, meaning the physical environment seen through different worldviews. One example is in the United States, where there is power structure based on Eurocentric worldviews rather than Indigenous worldviews. As participants in our society, we tend to encounter food in the the same ways as we encounter place (Mallory 2013).

Production of sustainable food using sustainable farming techniques is the goal for the future of food production, but today we have to deal with immense food waste and loss. Galanakis defines both food waste and food loss in his book, *Sustainable Food Systems from Agriculture to Industry: Improving Production and Processing* (2018). He describes food loss as a loss of nutritional and caloric value and food waste as food that is intended to be thrown away. Even with food waste recovery research and techniques for increasing the shelf-life of products, food waste is still very high due to food waste exploitation. Current food manufacturing procedures focus on cutting costs and not environmental repercussions.

Zocca talks about the history of farming and argues that it was harmful to the environment even before the industrial revolution where most things started to go wrong. During the industrial revolution in the nineteenth century, production in Great Britain increased by 340% due to the industrialization of farming tools and crops alike.

Education

Marginalizing Access to the Sustainable Food System (Mata 2013) is about low-income communities, like the minority district in Oakland that she studied, and their inequitable access to sustainable food sources. Mata's research includes how to measure food security, the current status of food security in Oakland's minority districts, and how these communities as better access sustainable foods. Measuring food security involves looking at minority inclusion and community outreach, which requires both social and environmental activism. Mata defines low-income people as unemployed, single adults with children, the elderly, and undocumented. She outlines ways to access sustainable food in low-income communities, including community supported agriculture (CSA) programs, farmers markets, and urban gardens, which are difficult to maintain legally in low-income communities. Outreach involves educating communities on governmental policies impacting agriculture and food access.

A lack of education about the environment and sustainability is the reason for many problems we face today, not only in this country but all over the world. Starting as early as Kindergarten, children need to be taught more about the environment in their primary and secondary education, including how humans impact the environment, what we are doing to try to reverse climate change, and what we still need to be doing. We can reverse the damage we have done in the past 260 years since the start of the industrial revolution, where everything went downhill for the environment.

Starting with education about the long-term effects of the Industrial Revolution can teach future leaders there is more to living than making money through exploitation and can encourage people to think about the global and long-term consequences of actions that ignore sustainability. Earth University prepares students for the emergent practice of sustainable farming by allowing them to work directly with plants and cultivation while learning about the future of sustainability. The university designs student projects that provide opportunities to start a sustainable agriculture business or their own original projects related to sustainable business models, which EU believes can, "Prepare leaders to contribute to the sustainable development of the tropics" (Nicole 2013). I believe all schools should have a program like this school, where students can learn about sustainability and the environment firsthand.

The programs typically seen in American public schools related to sustainable food education focus on nutrition and the impact of food growing conditions on people rather than the impact people have on the environment. Although Nicole found some data to be inconclusive, many overlapping components of the study show that the impact of farm to table programs on students is difficult to quantify. Nicole concludes that future studies will benefit from clear metrics for assessing impact on students. That said, Prescott et al. concluded that there are clear positive impacts in teaching about food and nutrition, especially when school activities taught about healthy food selection.

Gender

The effect gender has in agriculture is best explained by Andrea Nightingale (2006), "Not only are inequalities between men and women a consequence of environmental issues; gender is a cause of environmental change." The relationship of gender to sustainability has been explored since ancient times, as seen in cultures who worshipped agriculture and fertility deities. In contrast, companies such as Kraft, Nestle, General Mills control over the consumer markets and farms that produce their products—rather than sustainability, the focus is on increasing profit. In the patriarchal social structure that dominated in the United States, environmental resources are controlled and exploited by companies who care more about their profit than the long term consequences of their actions. Looking at the works from Mallory and Nightingale, we can see how gender disparities is linked with capitalist exploitation of the environment, which supports the idea that 'elevating the status of women' can help to fix the environment we are destroying.

The impact of gender and culture on sustainable food production can be seen in how food is marketed and to whom. Cooperative grocers (co-ops) in Philadelphia, for example, serve predominantly white customers despite being in a very ethnically diverse community (Nicole 2013). Farmer's that supply co-ops are also predominantly white, although there is a range of socioeconomic statuses.

One way to think about the relationship between gender, inequality, and the environment is Ecofeminism – a term first used in the 1970s to describe the merger of feminism and environmental concerns.

Ecofeminism is the idea that the environment is suffering in part because of patriarchal power structures and beliefs about the use of natural resources. Mallory defines Ecofeminism as follows: 'Eco-' represents environmentalism, or end of anthropogenic destruction of natural places. 'Feminism' is the end of oppression of women and other social groups by deconstructing the harms of patriarchy. Ecofeminism argues that the world can come back from the harmful effects of climate change by ending the destruction of the environment, which in turn can end the dispossession and oppression of all people. The Western world has a patriarchal, extractive view of the environment as 'place,' and treat nature background for human activities and anthropocentric purposes, as something to exploit for gain and profit. This view is harming the environment and shows a disconnect between a people and the land they are on. Philosophy of place asks us to think about the physical environment's relationship with the cultural, ecological, social, and historical aspect of a location. Being respectful of the land we live on doesn't mean food production goes down or stops, because "...cultures are maintained and reproduced through food and foodways" (Mallory 2013). By continuing to produce foods sustainably we can cultivate a growing culture along with fresh ecologically grown food.

Production and Consumption

Chris Galanakis' book *Sustainable Food Systems from Agriculture to Industry: Improving Production and Processing* (2018) introduces sustainable techniques for farming, which are evolving and making the craft easier, often times by adapting ancient and pre-industrialization techniques. When the Industrial Revolution took hold in nineteenth-century Western Europe, established agricultural techniques were abandoned for new technologies that increased yield substantially—in Great Britain there was a 340% increase in production (Zocca 2018). Increased food production meant more food availability. However, as industrial agriculture developed, consumers became more alienated from their food and producers began using more and newer chemicals to extend shelf life. Even with extended shelf life, there is immense food waste because fresh produce is rejected for sale due to aesthetics related to "perfect food" people have been unconsciously trained to expect—there is low awareness of what fresh produce typically looks like. There are a few companies, such as Imperfect Foods, that sell the less-than-perfect fruits and vegetables being sold to stores but preemptively thrown away rather than provided to customers because they do not look like the idea of "perfect" customers have, therefore the imperfect foods will not sell.

In addition, corporations often undermine sustainability by disenfranchising local farmers who can provide better and more affordable food to communities in need of accessible groceries, such as Oakland. Food access is measured by minority inclusion through social and environmental activism. Social activism brings to the surface why lack of food access is a common problem in minority communities. Environmental activism brings to light the sustainable and organic farms and products. Community outreach is also involved in the measurement, through government policies, agricultural policies, and government participation. Food security, which is a small aspect of food access, involves having and keeping a steady access to food. California is the number one producer in the agriculture industry in the United States, and is also first in number of organic-certified farm operations. Food access should not be a problem in California cities, let alone the rest of the country.

Low-income people, as Mata (2013) explains, are defined as unemployed single adults with children, the elderly, undocumented, and other similar groups (Mata 2013). In Oakland, Mata identifies three ways to get sustainable foods: 1) through Community Supported Agriculure (CSA) programs, 2) at farmers markets, and 3) in urban gardens.

There are eight CSAs in Oakland, but, like co-ops in Philadelphia, they are used predominately by rich white customers, to whom the CSAs deliver groceries. Farmers markets are more present in minority communities, but racial inequity is seen in other ways. Farmers markets provide fresh produce for the minorities in cities such as Oakland, but the focus by city councils have been to "revitalize" downtown areas, not provide affordable, sustainable food to communities in need. Urban gardens are not as helpful as the other two because they are typically not established in low-income areas.

One of the reasons for this is the permit application process: permits for urban garden land use are required but difficult to get and often rejected. One solution is guerilla gardening, or establishing gardens without legal permission from the city. People who are involved with guerilla gardening are mostly concerned with address the food security issues in marginalized communities. Both guerilla and permitted food security programs, such as those seen in Oakland, are seen as foundational for community economies and help improve access to nutritious and organic foods to low-income people.

Conclusion

In conclusion, sustainable food access in low-income areas is being affected by all the concepts I mentioned and many more concepts I did not mention. The main problem will always be money in America, how to get it, how to keep it, but never how to use it to help others. Social activism is telling the world about these problems in food access and environmental activism. Since high school when I learned that increasing the status of women or ending the oppression of social groups would significantly help end environmental issues, I have learned that low-income areas aren't getting access to sustainable foods because of corporate concern for profit. Industrial farming with no concern for sustainability is degrading the environment and the quality of agricultural produce, and making it harder for low-income communities to access food.

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Cranial Deformation and Brain Development in Ancient Mesoamerica

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Diana is a 2025 graduate of CSUDH Anthropology with a focus in Mesoamerican archaeology. Her research explores spatial orientation and architectural use at Xanab Chak, a small-scale prehispanic Maya site in the Puuc region. She is interested in how Maya conceptions of the five directions influenced their built environment. Diana has been awarded the Mellon Mays Undergraduate Fellowship, McNair Scholars Program, and Sally Casanova Scholarship. She is learning to use ArcGIS to enhance her spatial analysis. Diana is currently a doctoral student of Archaeology at the University of Texas, San Antonio.

Throughout the Americas, we can observe intentional cranial deformation practices among various indigenous cultures. Cranial modification is accomplished by applying pressure to the frontal and occipital bones of the skull, which later results in a flat or elongated head shape. This practice was widespread among several Indigenous American cultures, including the Maya, Inca, Chinook, and many others across North and South America. This ancient tradition was regarded as a mark of beauty, status, and a cultural identifier.

Forensic anthropology provides a critical lens through which to examine these practices. Distinctive skull shapes, such as elongation or flattering, serve as physical signs of intentional manipulation. By examining the patterns of bone growth and deformity, forensic anthropologists can infer the techniques used in cranial deformation by identifying features of cranial binding and head-shaping devices based on evidence left on the bones. The effects of cranial deformation extend beyond aesthetics, crossing into biological implications. Potential health risks include alteration in brain development, impacts on sight and hearing, and becoming more prone to developing diseases. Additionally, cranial modification influences the positioning of the cranial sutures, which can alter brain morphology.

Cranial modification was achieved through the binding of an infant's head with tight wrappings or using wooden boards that were crafted especially to help the skull grow into the desired form. These practices are done during infancy when the skull is most malleable and allows for manipulation. In this paper, I explore the biological effects of cranial manipulation. An interdisciplinary approach, including methods of forensic anthropology, I hope to gain a deeper understanding of the cultural significance, societal practices, and biological consequences of intentional cranial deformation among ancient Mesoamerican civilizations. This holistic perspective enhances our knowledge of past societies and their complex interactions with the human body.

The human body keeps a score of all life activities an individual has experienced, even processes and experiences of which we are not fully conscious. The human body is like clay. Our bodies are molded through the process of evolution and life course history, just like a lump of clay being able to be molded and hardened in the correct conditions. Through evolution and human intention, societies have been able to change their physical being to differentiate themselves or build unity, social status, and concepts of beauty within communities. Within the widespread methods of body modification, indigenous societies have showcased a variety of techniques—such as body painting, piercings, tattooing, scarification, ear or septum stretching, dental modifications, and lip plates—to create visual emphasis on certain parts of the body. However, perhaps the most interesting of these is cranial modification because bones tell a story. It is important to note that cranial modification is not exclusive to the Americas; rather, it has been observed globally, including sites associated with ancient civilizations in Egypt and Nubia, Europe, and Asia. The practice of cranial deformation, also known as skull modification, is an ancient practice that is at least 30,000 years old (Palomo et al. 2017). Cranial modification traditions hold significance not only as cultural marks of belonging, but also as a subject of inquiry for forensic anthropology as it sheds light on the intricate relationship between societal practices and biological consequences.

In ancient Maya contexts, modification of the skull was used to indicate an elevation in social status, which was typically determined by birth and manifested through various cultural practices, including cranial modification, which specifically signified nobility and high social rank. The social hierarchy of the Maya was distinctly stratified, with each class playing a critical role in the functioning of their civilization. At the top of the hierarchy was the Ahau, or king, who was considered divine and served as the primary ruler of a city-state, embodying both political and spiritual authority. Below the Ahau was the nobility, a class that included priests, scribes, and elite warriors. These individuals wielded significant power and influence in the community, often participating in governance, religious activities, and intellectual pursuits. Among the nobility, cranial modification was a common practice, serving as a marker of their high status. The middle class consisted of artisans and merchants, skilled workers, and traders who enjoyed a higher standard of living compared to commoners and played a crucial role in the economy.

The largest class was commoners, comprised of farmers, laborers, and low-level craftsmen. They provided the essential labor force for agriculture and construction but faced limited social mobility. Lowest in the hierarchy were slaves, who were often prisoners of war or individuals in debt to the empire. Slaves performed the most labor-intensive tasks and lacked personal freedoms, occupying the lowest tier in the social structure. This stratified system not only defined the roles and responsibilities of individuals within Maya society but also reinforced the social order and cultural practices that underpinned their civilization (Romero-Vargas, Samuel, et al. 2010). Cranial modification in Maya society served as a physical manifestation of social stratification and class. Given that ancient Maya society was highly stratified, with clear distinctions between different social classes, such modifications reinforced social stratification and intensified 'us vs. them' distinctions that differentiated individuals from others. In addition, skull modification reinforced group identity and cohesion, critical aspects of ethnogenesis.

Elite Maya individuals often had their heads bound to achieve a flattened or elongated shape, making their status immediately recognizable. The practice distinguished the elite from the commoners, reinforcing the hierarchical structure and maintaining the social order. The elongated or flattened skulls of the nobility were a symbol of beauty, power, and divine favor, visually communicating their superior status to others within the society. This practice was an integral part of the visual language of social differentiation, reflecting and reinforcing the complex hierarchical structure of their civilization. Through cranial modification, the Maya could visibly assert and maintain their social distinctions, ensuring the continuity of their social and political systems. Recognizing kin and non-kin, understanding social hierarchies, and interpreting emotional cues have direct implications for survival and reproductive success. As human societies grew more complex, the need for nuanced social communication increased, further refining our facial recognition capabilities. Artistic depictions of faces in early human history, like temple paintings and sculptures, reflect this evolutionary trait.

Spiritual beliefs contribute to the practice of cranial modification among ancient Maya. The Maya viewed the human body as a microcosm of the universe: the head, being the highest part of the body, was symbolically associated with the sky and the heavens. An elongated skull might have been understood to bring an individual closer to gods in the celestial realms. By altering the head's shape, the Maya could have believed they were facilitating a physical and spiritual connection to the divine cosmos. In this context, we can better understand the ancient Maya belief that infants were particularly vulnerable to harmful or evil spiritual forces, such as mal Viento (Spanish, trans. 'bad winds') (Duncan and Hofling 2011), which were thought to cause illness or misfortune. Early intervention through skull modification could have been understood as a ritualistic act that protects the infant from evil celestial forces and ensure their spiritual well-being throughout life. This transformation was a way to align a person's physical form with the gods' ideal forms, thus enhancing one's spiritual presence and influence.

By modifying the shape of an infant's skull, the Maya aimed to protect them from spiritual

threats. The act of binding and reshaping the skull may have been accompanied by prayers, ceremonies, and offerings to invoke divine protection and blessings. Given that ancient Maya placed great importance on ancestor worship and veneration, modified skulls may have been a way to honor and emulate revered ancestors, who are themselves often depicted with elongated heads in Maya art and iconography. By reshaping the skull, individuals might have believed they were paying homage to their forebears and maintaining a strong spiritual connection with their lineage.

Also significant is the ancient Maya belief that human blood contains life force (*k'uh*) and was essential to sustaining the gods and the universe. Bloodletting rituals, often performed by nobles, were a means of offering this vital substance to the deities. These rituals were conducted on specific body parts, such as the tongue, ears, and genitals, symbolizing different connections to the cosmos and deities. The torso represented the terrestrial world, the central plane of human existence where everyday life and agricultural activities took place. The arms and legs were linked to the underworld, the realm of the dead, and the ancestors, who played a significant role in Maya religion and cosmology (Tiesler, Vera, and Lozada 2018). The heart was considered the seat of life and consciousness. It was the central point connecting the physical body to the spiritual realm. During ceremonies where Human sacrifice was needed, heart extraction was seen as the ultimate offering to the gods, providing the life force needed to maintain cosmic balance.

The head, associated with the sky or heavens, featured in rituals honoring the gods through practices like cranial modification, which not only marked social status but also symbolically connected individuals to the celestial realms.onsidering that the head or brain controls the body, it makes sense to place a significant emphasis on the shape of the head, especially since humans have evolved to recognize similarities and differences within each other.

Humans have developed precognitive abilities to recognize and remember other individuals, create and maintain social bonds, identify allies and rivals, and facilitate social cohesion. The fusiform gyrus, part of the temporal lobe in the brain, is critically involved in face perception. This area, known as the fusiform face area (FFA), is specialized for processing facial features and configurations (Ross and Ubelaker 2009). Developmentally, infants show a preference for faces shortly after birth, indicating an innate predisposition for facial recognition. This ability rapidly develops in early childhood, highlighting its evolutionary importance for social bonding and communication. Physically, childbirth and infancy are the prime periods for cranial modification since the skull is most malleable at this stage due to the sutures (joints between the bones of the skull) not being fully fused. This malleability allows for the intentional shaping of the head using various techniques. The practice of cranial modification usually continues into early childhood, until the bones begin to harden and the sutures start to close, typically around two to three years of age. This period is crucial for effective cranial modification as it coincides with significant brain growth and development.

The ability to mold the skull during this time not only reflects cultural and aesthetic values but also plays a role in integrating individuals into their social and spiritual communities. The changes in skull shape are more than physical alterations; they are a manifestation of cultural identity and social belonging, reinforced during a time when the brain's capacity for adaptation and growth is at its peak.

Although there are diverse approaches to analyzing skull modification, here I focus on how forensic anthropologists employ a particularly multifaceted approach to deciphering the intricacies of cranial deformation. By analyzing distinctive skull shapes and patterns of bone growth, they can infer the specific techniques utilized in the shaping process. Cranial binding and other head-shaping devices leaves discernible marks on the modified bones, providing valuable insights into ancient cultural practices. Different techniques of cranial modification produce distinctive shapes, such as elongated (dolichocephalic), flattened (plagiocephalic), or rounded (brachycephalic) skulls. Through morphological examination, forensic anthropologists examine the overall shape and symmetry of the skull. Another thing forensic anthropologists employ is measurement of cranial length, width, and height used to calculate cranial indices. These indices help classify the type and extent of modification and can indicate the specific binding methods involved.

The examination of cranial sutures and fontanelles, or “soft spots,” on a baby's skull provides insights into the age at which modification began and how it affected skull growth. Delayed fusion resulting from disrupted growth of cranial sutures might indicate prolonged binding or shaping. The presence of specific bone remodeling patterns, such as thickening or additional bone deposits, can indicate areas of pressure and the duration of modification. Forensic anthropologists look for physical evidence of pressure points, indentations, or depressions on the skull that can indicate where boards, bands, or other devices applied pressure to shape the skull. Specific surface marks, such as grooves or wear patterns, can reveal the materials used for binding and the techniques employed; for example, tight bandages may leave distinct linear impressions. In a contemporary example, surface marks from extended pressure is observed among some video gamers, some of whom are exhibiting cranial depressions due to the constant use of headphones.

In ancient Maya sites, artifacts associated with skull modification, such as binding materials (cloth, leather bands) or shaping devices (cradleboards), serve as evidence of cranial modification behaviors and, when found in burial contexts, offer clues about methods used across time and place. Forensic anthropologists often consult ethnohistorical records, such as writings, illustrations, and photographs from the time, to understand the cultural context of cranial modification practices. They also employ tools like 3D scanning and imaging, which allow for precise measurement and visualization of modified crania (Kuzminsky, Tung, Hubbe, and Villaseñor-Marchal 2016).

These research tools help reconstruct the original shape of a skull and the modification process. By creating virtual reconstructions of the skull, forensic anthropologists can simulate the modification process and analyze the effects of and changes in skull modification techniques across cultures.

Beyond its cultural significance, cranial deformation carries profound biological implications. For example, the manipulation of skull morphology may influence the positioning of cranial sutures and alter brain morphology, raising questions about its long-term effects on individuals subjected to such practices. Some research suggests that potential health risks associated with altering the brain's physical development include impacts on vision, hearing, and susceptibility to diseases. However, there has been a rise in the practice of cranial modifications in infants today, often driven by aesthetic purposes, which can be attributed to the increased time babies spend in the lying-down position. This positional factor naturally leads to a flattening of certain parts of the skull, which cultures might then deliberately enhance or counteract through binding techniques or helmets to achieve desired shapes. Understanding skull modification practices in their historical context, in addition to changing motivations behind the practices, can significantly benefit modern and future anthropological research. By recognizing the influence of infant care practices on skull morphology, anthropologists can better interpret skeletal remains and differentiate between intentional cultural modifications and natural positional effects. This knowledge aids in accurately reconstructing past lifestyles, health, and social structures.

It also provides insights into the cultural significance of body modification and its role in identity formation, allowing for nuanced understandings of how human societies have shaped and been shaped by their physical practices. Research indicates that cranial modification, when done correctly, does not typically result in major health issues or impair brain function due to the human skull's remarkable biological resilience and adaptability.

Given that cranial modification can be used to date and analyze cultural context in ancient societies, does it affect the sexing of a skeleton? Sexing a skeleton—determining whether it belonged to a male or female—relies on various anatomical features, primarily of the pelvis and the skull. Skull morphology is used in sex determination through presentation of brow ridges, mastoid processes, and nuchal crests, which are typically more pronounced in males. While cranial modification can obscure some of these features and complicate assessment, it does not fundamentally alter key characteristics used for sex determination. Experienced forensic anthropologists account for these modifications to make accurate determinations about morphology and specific sexually dimorphic cranial traits that can often still be discerned despite deformation. Anthropologists and archaeologists studying populations with a history of cranial modification develop expertise in recognizing and compensating for these alterations. For example, the pelvis is generally considered the most reliable skeletal region for sex determination. Features such as the shape of the pelvic inlet, the subpubic angle, and the overall robustness of the pelvic bones provide indicators of probable sex that are not affected by cranial modification.

In conclusion, although cranial modification alters the shape of the skull there is evidence it does not typically impair brain function or cognitive development due to the brain's adaptability, especially in early childhood. While it can complicate sex determination from skeletal remains, experienced anthropologists can still accurately determine sex by focusing on other skeletal features, particularly the pelvis, and using their knowledge of how cranial modification affects skull morphology. The study of intentional cranial deformation provides a profound insight into the cultural practices of ancient civilizations and their understanding of identity, status, and beauty. Indigenous cultures across the Americas, such as the Maya, Aztecs, and Inca, utilized cranial modification as a means of distinguishing social classes and reinforcing cultural cohesion. Through the binding and shaping of infants' skulls, these societies were able to create visible markers of social stratification and cultural identity.

Forensic anthropology plays a crucial role in deciphering these ancient practices, using detailed examinations of bone growth patterns and skull morphology to reveal the techniques and cultural significance behind cranial deformation. This interdisciplinary approach not only sheds light on the past but also enhances our understanding of the complex interplay between culture and biology.

Knowledge gained from studying ancient practices such as cranial modification can inform modern anthropological research, particularly in distinguishing between cultural modifications and natural positional effects in skeletal remains. As cranial modification practices re-emerge in contemporary settings, driven by aesthetic preferences, recognizing the historical context becomes increasingly relevant. Understanding the cultural motivations and biological implications of cranial deformation allows anthropologists to better reconstruct past lifestyles, social structures, and health conditions. By appreciating the cultural significance of body modification, we gain a deeper understanding of how human societies have historically shaped and been shaped by their physical practices. This holistic perspective not only enriches our knowledge of human history but also provides valuable insights into the enduring impact of cultural traditions on biological systems.

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Evolutionary Function of Music & Music Making

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Eileen is a 2025 graduate of CSUDH with a major in Anthropology and a concentration in archaeology. Her research interests are in archaeology and the evolutionary functions of music and how it affects different groups around the world.

Introduction

This paper will discuss the evolutionary functions of music and music making and background information for understanding the origins of music. I will discuss whether music has a purpose for humans, as music is present in all human societies and frequently playing in almost every institution you walk into daily (Rentflow 2012). I will analyze the earliest evidence of music-making in the archaeological record, and why one artifact in particular is quite controversial. Also, I outline major theories on the evolutionary functions of music. Finally, I discuss the function of music in modern times and how it coincides with human emotions.

Earliest Instruments

The earliest evidence of music-making in the archaeological record is dated to 60,000 years ago and labeled Inventory no. 652, although it is better known as the Divje Babe Neanderthal Flute. The Divje Babe flute (artifact no. 652) was discovered in 1995 in Divje Babe Cave near the city of Cerkno, Slovenia, by the ZRC SAZU Institute of Archaeology of Ljubljana (Turk et al. 2020). Artifact no. 652 is made out of a bear cub's femur and includes two holes. It possibly included end that broke of, which would have extended the flute beyond its current length of 10 centimeters (Montagu 2017).

The flute's discovery generated controversy and debate among experts regarding how capable Neanderthals were of creating and making music. Archaeologist Ivan Turk initially proposed two hypotheses: 1) the artifact was the result of an animal gnawing on the bone or 2) a flute intentionally created by Neanderthals (Turk et al. 2020), who until recently have been assumed to lack culture. However, Turk describes new evidence that changes how Neanderthals are understood by experts (Turk et al. 2020). To understand how it functions, the Divje Babe flute was reconstructed and has been played numerous times. The resulting consensus is that the flute is made of a bone an animal gnawed at (Montagu 2017). Turk and his colleagues ran a series of experiments to argue against it being simply a gnawed bone. For example, they created bronze dentitions of predators such as wolves and hyenas biting down on a fresh bear femur. Turk et al.'s experiments concluded that the holes can only be created by drilling. Despite this, many argue that Neanderthals are incapable of music making and believe in the gnawing hypothesis (Turk et al. 2020).

A second set of flutes were discovered from 2006 to 2008 near Ulm, Germany, in the Geissenklosterle, Hohle Fels, and Vogenerd caves (Killin 2018). The flutes are dated as from the Aurignacian period, around 43,000 to 39,000 years ago, and made from the radius and ulna of vultures and swans (Killin 2018; Montagu, 2017). These flutes were made with intent in design: the bones were carved at one end in a V-shape, possibly for a more comfortable place to set one's mouth, and have multiple scratches and cut marks along the finger placements that suggest theholes were measured (Killin 2018). The depressions on the bone flute's finger holes give the impression that the flutes were used frequently over a long period of time (Montagu 2017).

Instrumental horns were created out of various materials during the upper-Paleolithic and are well represented in the archaeological records since they are made from durable materials. A common style of ancient horn is the Central African ivory horn, versions of which are still used today. Importantly, these horns preserve well in dry climates like Sub-Saharan Africa (Killin 2018). Horns are intricate instruments since they must be hollow but cannot be too fragile to produce sound (Montagu 2017). The first known horn is a conch shell found in the Marsoulas Cave in Haute-Garonne, France, and is dated to around 20,000 years ago (Montagu 2017). This conch horn is the only such example from the upper-Paleolithic era as many are from the Neolithic period (Montagu 2017). The Marsoulas shell horn is unique and gives wonderful insight into its special role, as the cave that it was found in is far from the nearest body of water (Montagu 2017).

Evolutionary Function

The evolutionary function of music and making music has been theorized but is underrepresented in the literature. The study of music in anthropology is difficult as musical behaviors will have different contexts, functions, and meanings which leads to music being understudied (Morley 2014). Music has been seen as having no evolutionary purpose (Huron 2001). Others have suggested otherwise, drawing from diverse theories on music's evolutionary function, with the most popular theory being its utility in sexual selection and community bonding purposes (Dunbar et al. 2012).

Theories for the evolutionary function of music include sexual selection, working and bonding with others, and gaining personal or social skills that will benefit everyone. Social cohesion and group effort necessary for coordinating community defense, solidarity, and working together for labor purposes (Huron 2001). Music and making music have allowed for certain skills to develop and exercise the brain. Listening to music can help strengthen the ability to hear a predator or other danger in the distance (Huron 2001). Musical activities are believed to have aided the development of vocalization from singing or humming, brain-to-body communication by learning how to make and play instruments, and endurance by playing instruments and dancing (Huron 2001). With the development of agriculture and a more settled lifestyle, the free time for music is a safe route and with a more community musicality allows for a more trusting and communicative environment to decrease the issues of tension or conflicts that may arise (Huron 2001).

Sexual selection is the top theory for the evolutionary function of music as it has building blocks of being everything many would want in a partner and for their offspring. Participation in musical activities, especially in ceremonial acts, shows that the potential mate is great at working with others and possibly having a better kinship (Dissanayake 2009). Most importantly, having musical talent shows someone's intelligence, which is desirable for offspring to inherit (Dissanayake 2009). Even in the animal kingdom, musicality is used to get more positive attention for mate selection. For example, some gibbons vocally duet to find companionship and bond, and cranes dance to attract mates (Dissanayake 2009). These animals practice sexual selection by choosing the best singer or dancer for their offspring to have the best chance to produce their offspring.

Emotions

Emotions and music together highly affect people in a personal or social setting. Music is omnipresent: we hear it on the radio, in stores, malls, and even elevators (Rentfrow 2012). Music genres are often used to signal self-identification and self-worth, and the music we prefer often changes during developmental phases (Rentfrow 2012). Music can stimulate a certain body language and emotional response; it can change someone's breathing, heart rate, and body temperature and cause goosebumps or tingles with or without awareness (Morley 2014). People often make a statement with music about who they are or how they want others to perceive them (Rentfrow 2012). There was a study where they had professional guitar players perform three pieces of music four different times to the emotions they were feeling; happiness, sadness, anger, and fear (Rentfrow 2012). The results from the experiment showed that each guitarist had changed the loudness, timbre, and tempo to convey the emotion they were experiencing (Rentfrow 2012). Music and music-making have a strong effect on human emotion and identity whether it is personal, societal, or even cultural. Music has often been claimed to be a "universal language" that can conquer cultural differences, barriers of ethnicity, age, social class, ability/disability, and guide for better psychological and physical well-being (Clarke et al. 2015).

Discussion

The purpose of music is and probably always will be a debated topic, but the huge influence that music has on human emotions and the bonding is undeniable. Music occurs in every culture on the planet and is one of the most universal human behaviors (Merker et al. 2015). Humans often can connect a specific song or album to an emotional experience they had good or bad (Rentfrow 2012). Music has a function in humans that is embedded in immense experience whether it is in a cultural, societal, or even personal context. The evolutionary function of music and making music has promoted community bonding, increased cooperation, and reduced tensions, music will always be the neutral medium that will bring people together (Dunbar et al., 2012). Music has always brought people together and it will continue to unite people. If our early ancestors were capable of creating music and intricate instruments, it clearly has a purpose and as music is being studied more, discussions can begin to take place.

Conclusion

Music is often a large part of many societies and can be a personal experience for many people. Music can be an intense, powerful, and life-altering experience people will ever go through (Clarke et al. 2015). Music and music making is one of the oldest forms of solidarity action and community bonding as people in unison sing, clap, and dance together to music played by someone who is putting all their effort, emotion, and energy into making an instrument make noise for others to enjoy.

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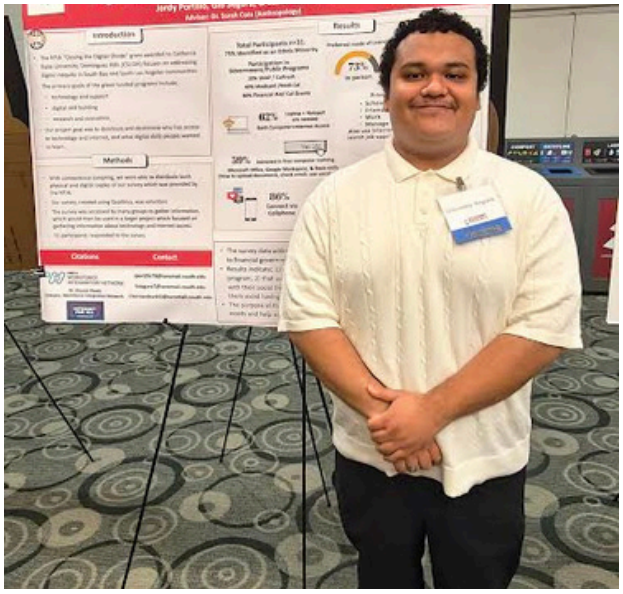
A Critical Analysis of the Mesoamerican Worldview

Giovanny Segura



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Introduction

The Mesoamerican civilizations cultivated exceptionally multifaceted and intricate worldviews, reflecting their beliefs in the cyclical nature of time, cosmology, and humanity's role. Their beliefs were simply not a cluster of complex myths; instead, they influenced the underpinnings of their way of living, religious practices, and social structures. The Mesoamerican people shared multiple aspects of material identity and ideologies. This cultural unity, underlying the diverse expressions of basic patterns across ethnic and political divisions, is foundational for the modern understanding of the distinct Mesoamerican culture. Among the achievements of these civilizations, including the Maya and Aztecs, are the complex beliefs of the universe and time as they comprehended them. In this paper, I will argue that the Mesoamerican worldview, deeply rooted in a cyclical understanding of time, interconnectedness with nature, and a balance between cosmic forces, profoundly shaped their daily practices, including agriculture, architecture, rituals, and governance. These practices, imbued with spiritual significance, continue to influence contemporary cultural traditions, agricultural methods, and community structures in the modern descendants of Mesoamerican civilizations.

Background

Mesoamerica consists of civilizations that share similar cultural characteristics in locations comprising modern-day Mexico, Honduras, Guatemala, El Salvador, Belize, and Nicaragua. Some of the well-known Meso-American cultures, the Maya, Olmec, Aztec, Zapotec, Toltec, and Teotihuacan, are known for their sophisticated calendars and cyclical concept of time, interconnectedness with nature, and a balance between cosmic forces. Generally, Mesoamerican cosmology is characterized by three main concepts: the sacred 260-day and the 365 solar calendars, a universe composed of layered realms, and the reciprocal relationship between humans and gods. Some of the most elaborate conceptualizations of the Mesoamerican worldview encompassed the existence of multiple realms and continued sequences of creation and destruction across expansive epochs of time.

Although each culture developed its distinct cosmology, all models of the nature of cosmology have standard features, marking them as distinctively Mesoamerican. For example, the sacred 260-day and the 365 solar calendars and the concept of dualism were commonly shared across all cultures in Mesoamerican civilization. Dualism and Cosmology

Cosmology and Cyclical Nature of Time

The creation myths of the Mesoamericans, notably the Mayans, are the most symbolic representations of their mythology, offering profound insights into their beliefs about the divine, cosmos, and humanity's role in the world. One of the most prominent sacred texts, the Popol Vuh of the K'iche' Maya, recounts the origins of humankind. It does not merely account for creation myths but also includes the Mayans' spiritual worldview, emphasizing the creation, destruction, and renewal cycles. Based on this narrative, the creation of humans was done through several attempts by divine powers in a series of trials and errors. At first, the gods attempted to create humans from mud, but these were fragile (Berg 2021:5-6). In a second trial, humans were made from wood, but they were sturdy and lacked the spirit and ability to worship the gods. In both accounts, the gods were displeased, and they destroyed them (Berg 2021:5-6).

Finally, humans were created from maize, a sacred crop representing life, sustenance, and spiritual nourishment. These humans were perfect beings capable of honoring their gods and upholding the balance of the cosmos. This reinforced the idea that humanity was deeply tied to the universe and cycles of agriculture, highlighting the sacred relationship between humans and the universe. Moreover, the idea of gods creating, destroying, and recreating reveals a dynamic process that recognizes the ephemeral nature of existence.

This cyclical interplay also manifests in the Aztec's understanding of the Five Worlds and their Suns, with each sun representing an era of a cycle of creation and destruction. This cyclical renewal is also linked to ritual human sacrifices as a means of sustenance. Human sacrifices nourished the gods, fostering balance in the cosmos and ensuring agricultural fertility. Celestial bodies like the sun and moon were tied to agricultural rituals and cycles. The cultural and natural cycles, such as the festival, human life, and agricultural cycles, were aligned with their solar and sacred calendars to create a cosmos that positions humans in a consecrated order that demands continuous sustenance (Carmack et al. 2016:528).

These societies developed complex cosmological beliefs, and a 260-day ritual calendar based on celestial events. Ceremonies and rituals were timed to align with specific astronomical occurrences, emphasizing the connection between terrestrial and cosmic realms and ritual human sacrifice was one of the most deeply rooted religious traditions in honor of the gods.

In the creation myths, there is also the aspect of the Hero twins and how they were intertwined with the creation. The Hero Twins embarked on a journey to the underworld, where they played a ball game and defeated the Lord of Death. This victory symbolized the triumph of life over death and the ongoing cycle of cosmic renewal (Carmack et al. 2016:510). They also had roles in the placement of bodies in the heavens and were associated with the sun, further illustrating their connection with cosmology. Within these spiritual narratives exist the values of awe, balance, and interconnectivity. Furthermore, the ball game shares an affinity with architecture, literature, and art in gesturing toward the notion that sport can reinforce a cultural narrative about the divine.

The Principle of Dualism

Further understanding the Mesoamerican worldview requires recognizing the fundamental role of the dualism principle. Dualism defined how Mesoamericans perceived their universe. It meant that they perceived everything in terms of pairs, referring to the complementary and interdependent reciprocal interaction in nature, such as life and death, day and night, and order and chaos (Hunbatz 2009:89). Pairs were not seen as opposing forces; instead, they were seen as complementary entities where balance and harmony governed their existence. For example, the mythic siblings represented by the Hero Twins embodied the contrasting counterparts of duality and completion. This idea described independent yet connected pairs and structured the Mesoamerican worldview. The balance hinged on the cyclical understanding of time, nature, and existence. The gods could also have a duality of aspect; they were considered both benevolent and malevolent, often symbolized by a death sign (Thompson 1970:199).

Governance and Gender Roles

The concept of duality also extended to aspects of social organization and governance. For example, in the Aztec culture, Ometeuctli and Omecihuatl were considered a dualistic male-female creator couple (Carmack et al. 2016:99). In the Mixtec communities, there was also a male deity for men and a female deity for women (Carmack et al. 2016:109). Female deities played critical roles in the creation narrative, symbolizing fertility (Carmack 2016:453).

The male-female pair of deities contributed to the complex societal structures, where the idea of balance in gender roles represented the cosmological theme of duality. In most Mesoamerican cultures, leaders were in pairs, emphasizing shared responsibility in decision-making and balanced authority. Dual leadership structures reflected the cosmic order, where harmony between rulers was critical to communal stability. Society was also organized in complementary roles, where men and women occupied distinct but interdependent responsibilities. For example, the Mayan and Mixtec art represented male and female pairs, reflecting the interdependence of both genders in the survival of the community (Carmack et al. 2016:442).

This shows that the Mesoamerican worldview of the cosmos significantly influenced gender roles and the need to achieve balance.

The gender systems were based on complementarity. For instance, in rulership, men and women could be leaders. In an instance where a husband and a wife jointly inherited official positions, they both ruled. Women and men could inherit property and pass it on to their children without being under a male authority in the Mixtec communities (Carmack et al. 2016:444). However, Spanish colonialism significantly resulted in gender hierarchy, with societies embracing male-dominated nuclear families and machismo. Although not entirely, this undermined dualism as more native women lost some autonomy, and societies shifted in favor of male dominance (Carmack et al. 2016:207).

The Sacred Geography, Architecture and Urbanism

Regarding architectural features, most urban centers are dedicated to their divine ancestors, and their layout replicates the cosmos (Carmack et al. 2016:510). For example, the city of Teotihuacan was strategically chosen and constructed as a sacred precinct that materialized the vision of the cosmos (Love and Guernsey 2022:195). The nature of the early urbanization of the Teotihuacan city was fundamentally symbolic of the human need to understand nature, astronomy, and the role of humans in time and space. The people designing urban centers integrated the sacred 260-day calendar, which harmonized the astronomical and human cycles (Love and Guernsey 2022:195). This shows that communities were dedicated to cosmic city planning, which materialized in architecture. Sacred ceremonial architectures (temples) dominating the urban centers were oriented to the movement of celestial bodies, such as the moon and sun (Love and Guernsey 2022:181). They were dedicated to the celestial deities, such as the sun deity (Carmack et al. 2016:510), demonstrating a tangible interconnection between humanity and the divine and the desire to align with cosmic forces. The Mesoamerican worldview of duality also plays out in architecture and sculptures associated with Templo Mayor of Tenochtitlan in Aztec culture. For example, the pyramid was split into twin temples dedicated to a dual pair of deities, exemplifying the duality principle.

Modern Influences of Mesoamerican Beliefs: The Legacies and Continuity

Many elements related to the Mesoamerican practices, such as deities, cosmological beliefs, and rituals, persisted throughout the later Mesoamerican societies, leaving a lasting legacy. In modern times, aspects of the Mesoamerican culture and religion continue to be practiced and celebrated by indigenous communities, demonstrating the lasting influences of ancient traditions and beliefs. The 260-day sacred calendar is still implemented in some Mesoamerican communities for religious purposes. The solar calendar, composed of 365 days, is widely used in many Mesoamerican cultures and is similar to today's calendar. Their calendrical systems reveal how their timekeeping innovations helped shape future societies' cultural and intellectual frameworks. The Mesoamerican architectural constructions and styles found in ancient civilizations are in present-day Mexico, El Salvador, Guatemala, and Honduras. For instance, the ancient spatial division and its relationship between agricultural cycles and human life are

present in modern native communities such as the Huichols in Mexico (Love and Guernsey 2022:196).

Concerning religion, the Spanish colonialists widely influenced the religious beliefs of Mesoamericans by purging their pagan ideas of religion. As a result, they set out to convert the natives and convert them to Roman Catholicism, often through mass baptisms (Carmack et al. 2016:150). However, native people interpreted Christianity in terms that were compatible with their cultures. Preachings were done in their languages, slightly altering Christian concepts, and this led to a Christianized hybrid religion. For many natives, the practices of Christianity resembled their Mesoamerican religious practices, such as sacred images, offerings, prayers, and processions. As such, the process was viewed as adding the Christian god to the native deities rather than a substitution (Carmack et al. 2016:194). The present Mesoamerican religious systems and practices combine aspects of animistic polytheism and Western Christianity. Most of the altars found in present-day Mexico reflect the primordial deities.

Contemporary indigenous practices inherent to the ancient worldviews are still evident today, such as festivals and rituals that honor the dualistic nature of existence. These aspects form part of the cultural heritage of Mesoamericans today, highlighting how the past worldviews have transcended time and evolved while maintaining critical elements that were unique to the identity of Mesoamericans. An ordinary festival in present-day Mexico cultural practice is the Dia de los Muertos (Day of the Dead). It is a complex fusion of pre-historic religious beliefs and influences of Roman Catholicism. It connects life and death and Mesoamerican's past and present, symbolizing the concept of dualism. For instance, the ancient spatial division and its relationship between agricultural cycles and human life are present in modern native communities such as the Huichols in Mexico (Love and Guernsey 2022:196). These aspects form part of the cultural heritage of Mesoamericans today, highlighting how the past worldviews have transcended time and evolved while maintaining critical elements that were unique to the identity of Mesoamericans. An ordinary festival in present-day Mexico cultural practice is the Dia de los Muertos (Day of the Dead). It is a complex fusion of pre-historic religious beliefs and influences of Roman Catholicism. It connects life and death and Mesoamerican's past and present, symbolizing the concept of dualism.

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Conclusion

The Mesoamerican worldview of the cyclical nature of time and the cosmos was fundamental to their identity, religious and cultural practices, and social organization. These practices encompassed wide-ranging beliefs, rituals, and ceremonies, all of which played a pivotal role in shaping the Mesoamerican societies and leaving a lasting impact on the cultural heritage of modern-day Mesoamerica. The ritual and mythic expressions were inextricably interwoven into Mesoamerican cultures' political, social, cultural, and religious facets.

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The Classic Maya Collapse: A Political and Environmental Crisis

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The term "collapse" has long been used to describe the period of decline experienced by the Classic Maya civilization, yet its applicability has been the subject of debate. The widespread abandonment of monumental centers, political fragmentation, and shifts in sociopolitical structures during this period have led many scholars to consider it a collapse. However, while certain regions, particularly the Maya highlands, suffered from significant societal breakdowns, other areas such as the Northern Lowlands continued to thrive. Given the complexity of this period, a reassessment of the term "collapse" is necessary to reflect the nuanced reality of the events that occurred.

One major factor of the Classic Maya collapse was the increasing unpredictability of the climate, particularly severe droughts that led to resource shortages (Sabloff 1995; Medina-Elizalde et al. 2012). While human-environmental interactions played a role in the decline of certain areas, such as deforestation leading to soil erosion and the drying of wetlands (Roman et al. 2018), the primary issue was the inability of rulers to maintain stability as they face of worsening environmental conditions. The legitimacy of the Ajaw (king) was deeply tied to their perceived ability to maintain favorable relationships with the gods, ensuring sufficient rainfall and agricultural productivity.

As droughts persisted and crop failures became widespread, public confidence in the ruling elite deteriorated, leading to political strife and, in some cases, the overthrow of rulers (Raun et al. 2023). Monument building, a key activity of the elite, ceased during this period, signaling the decline of centralized authority (Demarest et al. 2004). The cessation of monument construction was not simply a consequence of economic decline but rather an indication of the diminishing power of the ruling class (Coe et al. 2012). Without the resources to commission these grand projects or the public support to justify their rule, many Ajaws lost their authority. This loss of faith in the ruling elite further contributed to political instability and warfare, as competing factions vied for control over increasingly scarce resources.

Warfare during the Classic period had traditionally been centered on capturing elite prisoners and asserting dominance over rival city-states. However, during the collapse, conflict became far more destructive. Sites such as Dos Pilas and Cancuén experienced violent upheaval, with entire royal families being massacred, specifically Cancuén, events that were uncharacteristic of previous Maya warfare (Demarest et al. 2004). The breakdown of established political norms, combined with resource scarcity, led to an increase in large-scale raids and the destruction of entire sites rather than the mere subjugation of rival rulers (Roman et al, 2018). This shift in warfare tactics further destabilized the region and accelerated the decline of many city-states.

Despite the turmoil in the southern lowlands and highlands, not all Maya regions suffered equally. Chichen Itza, located in the northern Yucatán, continued to expand and exert influence while other sites were abandoned (Coe et al. 2012). This suggests that while environmental factors contributed to the decline in some regions, the severity of the crisis was not uniform across the Maya world. The northern lowlands, with their different political and economic structures, adapted more effectively to the changing conditions and did not experience the same degree of societal collapse as the southern cities (Demarest et al. 2004).

Given the disparities in how different Maya regions experienced this period, the term "collapse" is misleading. While it is true that many city-states in the highlands and southern lowlands suffered political and economic breakdowns, Maya civilization as a whole did not disappear. Instead, it transformed, with power shifting to new centers such as Chichen Itza and later Mayapan (Coe et al. 2012). A more accurate term for this period might be the "Highland Crisis," which acknowledges the severity of the upheaval in the southern regions while recognizing that other parts of the Maya world continued to flourish. Another key component in understanding the complexity of the Maya “collapse” is the evidence of widespread migration. As southern cities declined due to environmental and political pressures, there is strong evidence that populations moved northward in search of more stable conditions (Demarest et al. 2004). This migration likely contributed to the rise of centers like Chichen Itza, which benefited from an influx of labor, knowledge, and new political ideas. The relocation of elites and artisans may have helped shape the unique architectural and artistic styles seen in northern sites, distinguishing them from their Classic predecessors.

The sociopolitical disruptions of the Terminal Classic also brought significant changes to Maya religious practices and the role of ritual in public life. As centralized authority eroded, there is evidence of increased communal and household-based ritual activity, suggesting that religious expression became more localized (Demarest et al. 2004). This decentralization of spiritual authority may have helped communities cope with instability and reassert identity in a time of uncertainty. It also reflects how the collapse was not only a political and environmental crisis, but a deeply social one that reshaped the relationships between communities, their leaders, and the cosmos.

Furthermore, the legacy of the Classic Maya collapse continues to influence interpretations of resilience in ancient societies. Archaeological research increasingly emphasizes that collapse does not necessarily imply total societal failure but rather transformation and continuity in new forms (Roman et al. 2018). The survival of Maya language, traditions, and descendant communities across the region demonstrates that while monumental centers may have fallen, Maya civilization endured. Recognizing this continuity challenges catastrophic narratives and encourages a more nuanced understanding of how ancient cultures responded to systemic stress. Ultimately, the Classic Maya collapse was not a singular event, but a complex process influenced by environmental stress, political instability, and shifting sociopolitical dynamics (Roman et al 2018; Medina-Elizalde et al. 2012).

The breakdown of centralized rule, combined with severe droughts and escalating warfare, created a period of upheaval that reshaped the Maya world (Raun et al, 2023). While the term "collapse" may still hold relevance in certain contexts, a more precise understanding of the period acknowledges both the destruction and the resilience of Maya civilization.

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