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ARTICLE



Approaching imperial narratives one sense at a time: views and sounds at an Inka settlement in northwest Argentina

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ABSTRACT

Throughout history, empires have deployed a vast array of strategies to promote their worldview and to control the colonized. Amongst non-violent ones, hosting public ceremonies to show off an empire's capabilities and to enact and reinforce new desired relations and identities, seemed to be especially effective. This article presents new data and interpretations on how the Inkas employed ritual architecture to manipulate the somatic experiences of the colonized. Specifically, we analyze the public space of an Inka settlement located in the North Calchaquí Valley (Argentina) in order to show how the Inkas used architecture and spatial design to impose certain sensorial modalities and to manage their sequential stimulus and intensity. In an attempt to overcome a reigning visual paradigm among this line of inquiry, we present an analysis that combines visual and acoustical data collected on site, with three-dimensional modeling of terrain, architecture, and sound propagation. Results indicate that through a careful layout design that involved the management of visual and acoustic permeability, the Inkas not only organized groups and practices, but also created different experiences for different people.

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Introduction

Towards 1532 AD, the Inka Empire, or *Tawantinsuyu*, had already managed to annex and administrate a territory of more than two million km², from the Ecuadorian highlands to the Argentinian and Chilean Andes, and from the Pacific coast to the eastern Andean piedmont jungles. Throughout such a vast territory, and in a relatively short period of time (about one century after the foundation of Cusco, the imperial capital), the Inkas effectively integrated a wide array of disparate indigenous peoples with different traditions, practices,

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and belief systems. A complex road network (estimated at almost 40,000 km in length) was of key importance in this process of colonization and domination, allowing the Inkas to link their administrative centers, productive enclaves, fortresses, staging posts, ceremonial centers, and high altitude shrines.

As in every process of cultural contact and colonialism, a key aspect of Inka domination involved their interaction with the colonized. Scholars of *Tawantinsuyu* have established that hospitality, feasting, and exchange were central elements in Inka colonial policies. During highly ritualized celebratory events, as well as during state-sponsored pilgrimages to sacred places, the Inkas engaged local people and authorities in order to communicate to them the new order of things, to diffuse Inka cosmology, to pay homage to supernatural tutelary entities and, at the same time, to obtain local obedience and labor.

Seeking to understand Inka–local relationships, archaeological investigations have increasingly begun to study the spatial and material contexts where the Inkas hosted these events (Acuto 2010, 2012; Acuto and Gifford 2007; Bauer and Stanish 2001; Bray 2003; Coben 2006; Kosiba 2012; Kosiba and Bauer 2013; Mackey 2010; Morris and Covey 2003; Morris, Covey, and Stein 2011; among many others). It has been argued that these spaces were choreographically designed to stratify people, to define power relationships, and to establish connections with supernatural entities. Integration of local communities in imperial ceremonies entailed an exhaustive regulation of their participation in order to control their involvement and to segment specific groups within them. Investigations have shown that in these spaces, movements and views were specially planned. By occluding and sequentially revealing significant landscape features that played a major role in Andean cosmology (see Bauer 1998; Niles 1999), the Inkas were able to successfully deploy their cosmogony. Even though it has been well established that the Inkas took especial care in shaping people's interactions and experiences by directing their movements and sights (especially once inside public ceremonial spaces or during pilgrimage circuits), sound propagation management has not yet been addressed (see Meddens and Frouin 2011 as an exception).

For almost two decades, we have investigated Inka colonialism in the North Calchaquí Valley (Argentina), in quest of understanding Inka–local interactions (Acuto 1999; Acuto et al. 2004; Acuto and Gifford 2007; Acuto, Troncoso, and Ferrari 2012; Ferrari 2016; Jacob and Leibowicz 2011). We have been mainly dedicated to explore how local populations were strategically integrated into Inka ceremonies, as well as the experiences people lived in these contexts and the narratives they were exposed to. Seeking to enrich a traditional approach that overemphasized a resource-oriented expansive policy, we have claimed that Inka colonial policies in the North Calchaquí Valley could not be reduced to an economic-revenue scope. After all, processes of colonization throughout the New and the Old World proved to be far more complex, ideologically driven, and symbolically loaded.

This article examines the spatial design of Guitián, an Inka settlement in the North Calchaquí Valley, with the intention of establishing whether or not the Inkas

strategically employed architecture to manage visual and aural accessibility and, thus, to create disparate forms of participation in ritual events. To accomplish this task, we combined data from stratigraphic excavations, detailed masonry analysis, and three-dimensional architectural and terrain modeling, with on-site sound propagation measurements and sound pressure levels modelling.

Public spaces in Inka colonial dynamics

Public activities were integral aspects of past Andean communities' social dynamic and social reproduction – and still are. These contexts of encounter and interaction usually took place in large, open, and formalized spaces, or *plazas*. It has been claimed that these instances of feasting, conspicuous consumption, and ritual performances served to coordinate communal work, to organize the mobilization of labor and resources, to venerate ancestors and supernatural entities and, in some cases, to define and legitimize the status and power of the elites (Moore 1996; Nielsen 2006; Makowski et al. 2005 among many others).

Throughout Tawantinsuyu, *plazas* were privileged contexts where the Inkas promoted their imperial perspective, legitimated their presence and domination, and integrated and obtained labor from local communities. A major strategy to inculcate hegemonic principles was inviting the natives to ceremonies and hospitality feasts. These were hosted in large public spaces whose layout was carefully planned to set specific interactions and experiences. Galleries divided and organized the visitors, and platforms staged the main scenes and narratives to be seen and heard. Speeches, dances, music, conspicuous corn-beer drinking, and offerings and sacrifices were typical activities carried out in these places. Spanish chroniclers who documented these feasts and ceremonies, especially those that took place in Cusco as well as in other provincial ceremonial centers, explained that they were massive (e.g. Betanzos [1561] 1992, 124; Guamán Poma De Ayala [1615] 1980, 234). Selected groups from various ethnic communities traveled hundreds of kilometers to participate actively in them. They were impelled to firmly represent their ethnic filiation (Garcilaso de la Vega [1609] 1985, II, 39–40; Molina [ca. 1575] 2011, 38 [sixteenth century]). This entailed wearing their traditional clothing and jewelry and performing according to their position in a broader imperial context. Ensuring that protagonists, main guests, and spectators could easily be recognized and perform according to their capacity, was a major concern to the Inkas.

Inside many Inka *plazas*, a fundamental addenda choreographed the activities within the public space: the *ushnu*. *Ushnus* were artificial rock platforms (but also natural outcrops and modified or unmodified hillocks) located near the center of Inka *plazas*, towards their corners, or toward their sides. They were seats or stages from where Inka representatives conducted public ceremonies and connected and integrated the world and the entities that dwelled in it. According to Andean indigenous cosmology, the world was divided in three levels: heaven or *Hanan Pacha* (home of the celestial entities and forces), earth or *Kay Pacha* (home of the

humans and the natural and supernatural entities that dwelled in the territory), and the underground or *Ukhu Pacha* (home of the underworld and the ancestors). *Tawantinsuyu* sought to promote an equilibrated interaction between these entities, ensuring reciprocity and balance between these cosmological domains and, in so doing, warranting peoples' welfare (Staller 2008).

In order to interact and to develop ritual exchanges with these three levels and the entities and forces that lived in them, the Inkas built a series of material devices and conduits in the *ushnus*, such as channels, basins with drainages, offering pits, stairs, and vertical pillars (or *gnomon*) suitable for astronomical observations and celestial measurements (Farrington 2013; Hyslop 1990; Pino Matos 2005). Feeding Andean sacred entities was one key practice that the Inkas performed from the *ushnu*. By pouring liquids (especially corn-beer) inside the *ushnu*'s basins and guiding their circulation with drainage channels, the Inkas believed they fed the ancestors, the farmlands, and the entities that guarded the ethnic territory. *Ushnus* have also been conceptualized as fountains from where the Sun drank and, at the same time, the Inka nobility drank in honor of the Sun and the ancestors (Meddens et al. 2008; Staller 2008). Paying homage through offerings ensured the balance of Andean cosmological domains and the fertility and vitality of the land, benefitting human communities.

By sitting or standing on the *ushnu* platform, conducting public ceremonies and organizing peoples' order of participation and activities, the Inkas embedded both the natives and themselves in a broader cosmological narrative. One that communicated and reinforced the new order of things and the authority of *Tawantinsuyu* (Allen 2014). In this setting, the Inkas portrayed themselves as proficient mediators and competent agents able to hear and talk to the entities of the Andean cosmos through the *ushnu* (Meddens et al. 2008). Moreover, since being on the *ushnu* platform entailed sharing a common essence with the sacred landscape, the officiant presented himself as a sacred entity in its own right (Dean 2010).

In a time when knowledge was mainly transmitted through oral traditions and memory was fundamentally shaped by experience, ceremonies and feasts played a central role in gaining followers, and fully display *Tawantinsuyu*'s capabilities. Inka *plazas* were carefully designed to choreograph the protagonists, to embed the natives in imperial narratives, and to impress the spectators. Now, how can we approach past experiences within these public spaces and during ceremonial activities?

Materiality, spatiality, memory and experience: needs and challenges of an archaeology of the senses

Three fundamental principles are widely accepted among archaeologists interested in exploring past experiences. Firstly, the objects we use, even those involved in our most mundane activities, condition our understanding of the

world. Secondly, architecture organizes our encounter with people and objects, providing context, meaning, and information. Thirdly, people can manipulate material and spatial conditions to promote certain behaviors, meanings, and ideas, while simultaneously closing off certain others.

The materiality of even the most mundane objects we use in our everyday life precede our existence and might well transcend it. In fact, we learn from objects before we learn about them, and they will keep teaching beyond our individual life span. We learn about the world and we think the world primarily through objects (Gosden 2005), and this was especially the case in oral societies. This happens not only because objects are made by conscious humans, but also because they may extend the body to become cognitive or sensory devices themselves (Holbraad 2009).

We may always demand or expect certain function from a particular object but, more importantly, the object is always going to demand something from us. Probably, the most paradigmatic example of materiality's demand on the human body and human performances is architecture (Pallasmaa 2005). Whether as newborns or fully-grown adults, there is a material reality that exceeds our body volume, limits our movements, defines our gestures, frames and occludes what we should and should not see, and creates narratives by sequentially revealing certain world features. As well as objects, architecture may precede and transcend our individual existence. Its incidence on people's interactions and, above all, its perdurability, announces its importance for our understanding of past interactions and past conceptualizations of the world. Architecture reflects and produces social organization, creating, reinforcing, and modifying people's actions through a careful regulation of their interactions. It directs our encounters with other people, objects, and practices, informing us about their regular entanglements. In other words, architecture teaches us a 'way to do' and, more importantly, a 'way to be'.

Channeling movements and regulating entanglements invoke and defy our mnemonic existence. That is to say, through a spatial and material commitment, we inevitably get to test, learn, and rework how things should and should not be done. Memory evokes experience, experience evokes emotion, emotion evokes memories, and our past reveals itself as a continuous addition of experiential strata nourished by the entanglements we directly and indirectly took part of. Insofar as people create and signify spaces, they anchor meanings to be inherited by forthcoming generations (Thomas 2001).

Spatiality and materiality, as active dimensions in the production and reproduction of social life, become especially important during colonial encounters, when factions collide, worldviews mingle, and specific places for local and foreigners' interactions produce novel and unique spatial and material arrangements (Harvey 1994; Soja 1989). Experientially and historically signified landscapes and places produce, reproduce, and transform social life by promoting social categories and ideal or contestable relations between bodies, between people and objects, between non-human entities that shaped past

cosmologies, and among all of them. Colonizers might strategically rework the material world of the colonized to control material, temporal and spatial co-occurrence and to create narratives that may be intentionally promoting new identities and power relations.

Now, having taken into account this perspective on materiality and spatiality, how do we approach past experiences? It has been posited that we should move towards an 'Archaeology of the Senses' in order to fully understand how places shaped people's experiences in the past (Hamilakis 2011, 2013). Unlike what its name may suggest, its tenet does not necessarily entail a phenomenological reconstruction of ancient experiences. An Archaeology of the Senses seeks to study what senses were privileged among different cultures, how they were managed, and how they changed over time. In other words, this approach asks about how different societies came to manage their sensory perceptions, and how this management could have shifted due to new necessities, beliefs systems, or political-ideological strategies (Howes 2006). There are, however, two challenges for an Archaeology of the Senses.¹ On the one hand, the very nature of archaeological evidence, on the other, a traditional emphasis in modern societies on sight as the primary guiding sense for people's experiences.

Archaeologists work with just a sample of the past's material world. This is not a methodological choice though. The very nature of the evidence we work with dictates it. Just as buildings collapse and their rocks are re-used, objects break under soil pressure, their fragments migrate, and organic materials decompose. Unlike an anthropologist during ethnographic fieldwork, archaeologists do not see people and objects in action. We do not smell and taste their food, hear their voices and instruments, or observe their movements while they walk throughout their settlements. We do not participate in a fully embodied experience.

Overemphasizing sight might well derive partially from that previously mentioned circumstance. Traditionally, archaeologists have focused on how architecture directed and restricted people's views. What can and cannot be seen may well be one of the most important regulators of our encounters with other people, objects, and performances. This is how we learn and how we get to be socially informed social actors who are competent enough to communicate effectively. Nonetheless, some archaeologists have begun to warn us against an evident ocular centrism involved in this line of inquiry (Fahlander and Kjellström 2010; Feld 1996; Howes 2006 among many others). Neglecting the role of remaining senses² will always hinder a fully comprehensive approach. Sound dispersion should be considered a paramount quality of any built environment. Humans have a special interest in sound management: by altering spatial conditions, people take advantage of sound (and its absence) and intentionally inhibit, direct, and enhance its dispersion to empower experiences and enforce specific climaxes. A simple glimpse into our daily lives confirms the importance that have both being allowed and forbidden to hear and to be heard, and how sounds inform and structure our

behavior. Also, that the sounds we emit and the gestures and bodily postures we regularly (and oftentimes unconsciously) perform are equally effective and necessary for social intelligibility.

Archaeologists have recently begun to pay attention to the study of ancient soundscapes, recognizing this as a valid topic of investigation and as an integral methodological step during fieldworks (e.g. Devereux and Wozencroft 2014; Elliott and Hughes 2014; Feld 1996; Hamilton et al. 2006; Hepp, Barber, and Joyce 2014; Karampatzakis and Zafranias 2009; May 2014; McBride 2014; Meddens and Frouin 2011; Scarre and Lawson 2006; Scullin and Boyd 2014; Watson and Keating 1999; among others). However, the idea of 'soundscape' goes back to the late 1960s (Schafer 1967, 1969; Southworth 1969). Soundscape has been defined as the aggregate of all sound energy in any given context (the sonic environment), with emphasis on the way it is perceived and understood by those living in it (Truax [1978] 1984, 9–10). A soundscape includes

all sounds, those of biophony, geophony, and anthropophony, emanating from a given landscape to create unique acoustical patterns across a variety of spatial and temporal scales. (Pijanowski et al. 2011, 204)

Assessing human impact on soundscapes and vice versa is a major tenet along this line of inquiry. Nonetheless, this has not been an easy task. Archaeological projects that intend to reconstruct past sonic environments integrating architecture usually face many challenges to generate on-site data (see McBride 2014). Next, we present a case study and the methodological steps we have taken to approach past soundscapes.

The case study: *guitián* (SSalCac 2)

When the Inkas conquered the North Calchaquí Valley, they decided to locate their principal settlements away from indigenous towns and villages, in a marginal area of the local landscape (Figure 1). However, they placed a small ceremonial settlement, *Guitián*, in the vicinity of La Paya, one of the main local centers of the time. Elsewhere we have discussed why the Inkas developed this dual colonial strategy, as well as why and how they interfered in La Paya community's social dynamics (Acuto 1999; Ferrari 2016). As we have argued in these papers, by settling *Guitián* right next to La Paya, the Inkas sought to introduce this indigenous community into Inka ceremonialism and to put them in contact with *Tawantinsuyu's* worldview. This was a typical Inka strategy aimed at communicating the new colonial order, to ritually legitimate *Tawantinsuyu's* domination, and to obtain local support in Inka activities and projects.

Guitián comprises a local and an Inka sector (Figure 2). The local area presents three discrete groups of structures which layout and masonry corresponds to a local tradition of building that can also be found in many other settlements in the region: a combination of double-sided walls filled with

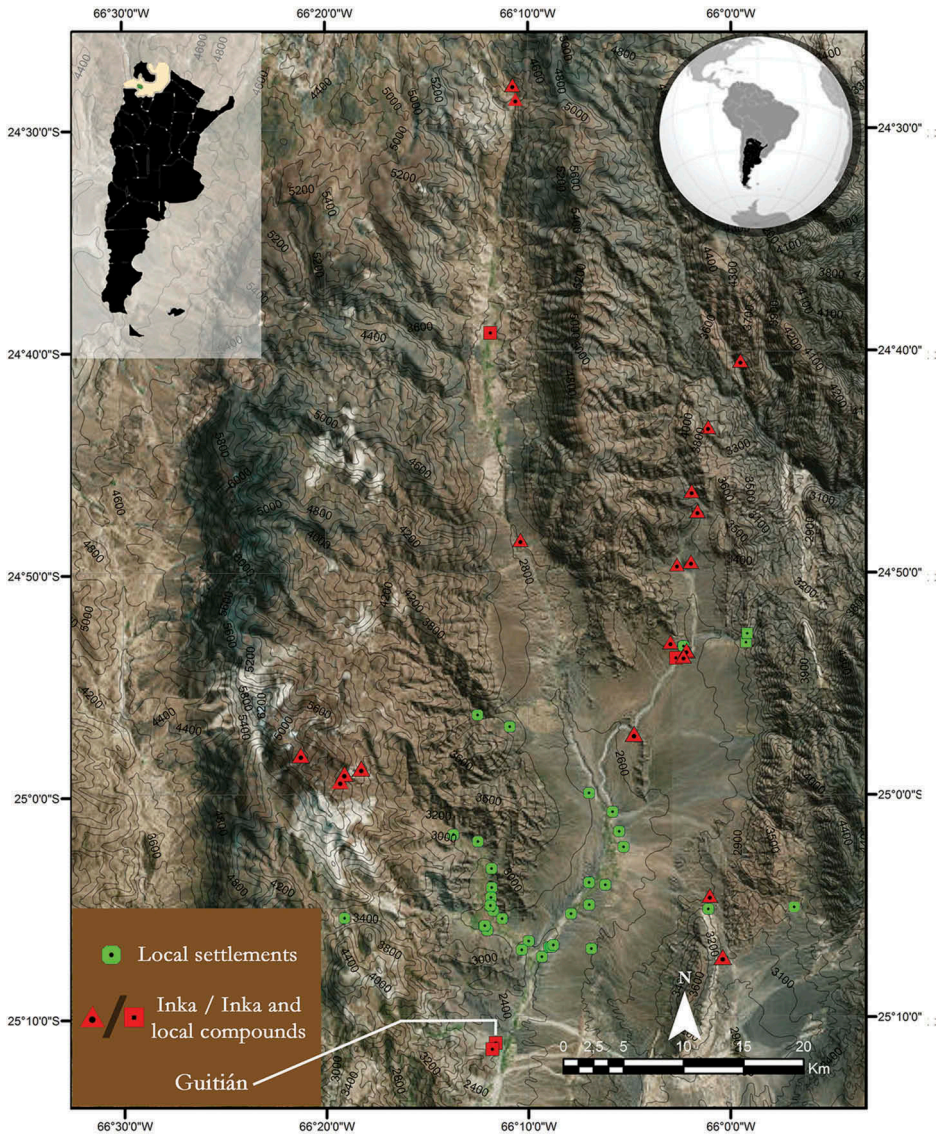


Figure 1. North Calchaquí Valley, local and Inka settlements, and settlements with Inka and local compounds. (Authors.)

rubble, and excavated surfaces later coated with locally available boulders. In this sector of the site, pathways allowed people to walk in-between and above buildings without major material restrictions. The combination of semi-subterranean architecture and raised pathways meant that a person walking around the local area of Guitián was almost never confined between walls.

As expected, the Inka sector was quite different. The main structure in this part of the site is a *plaza* with an *ushnu* platform. This *plaza* is surrounded by four large residential compounds and a classic Inka administrative rectangular building, known as *kallanka*, all with direct access to

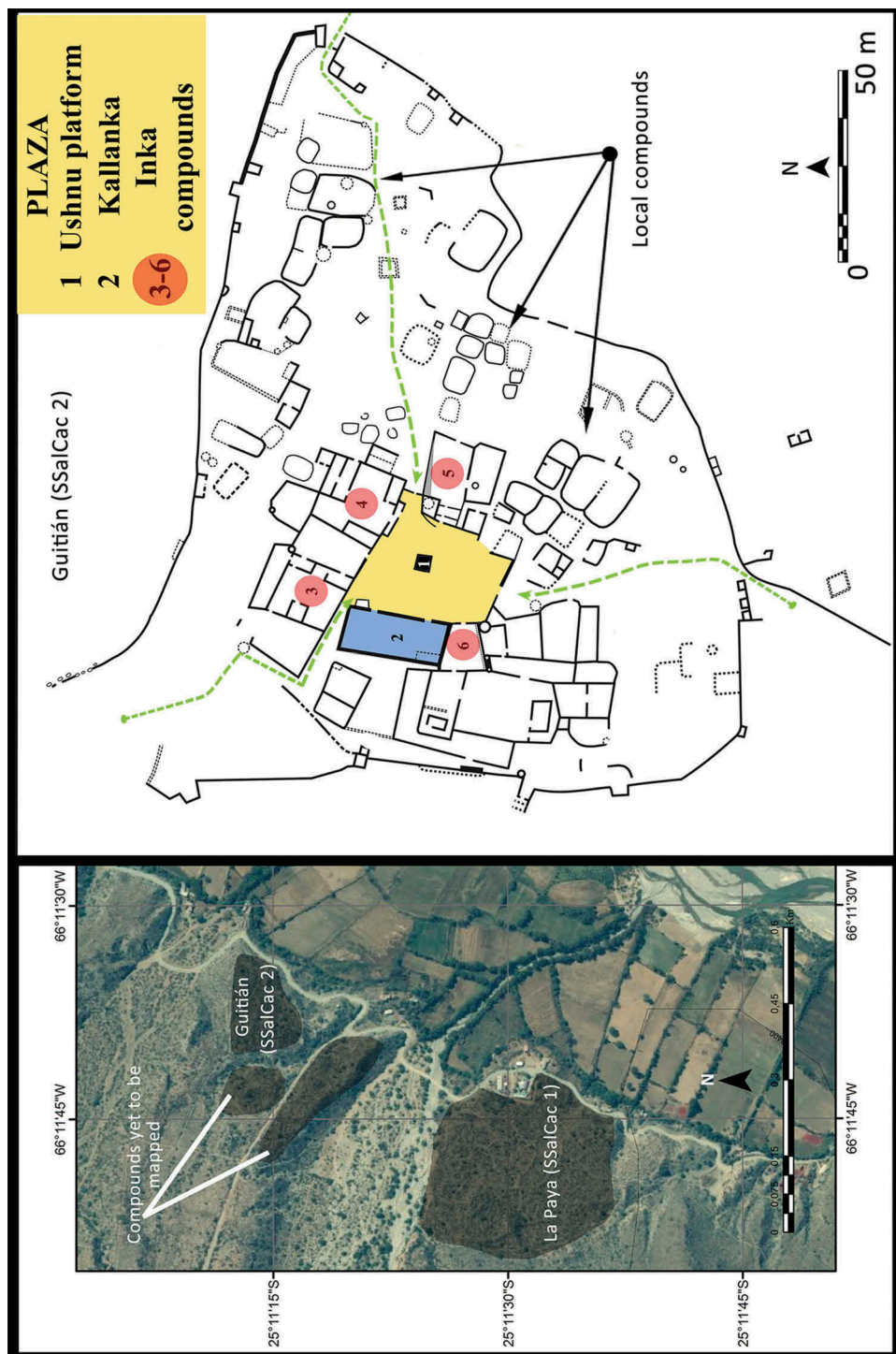


Figure 2. Guitián's floor plan highlighting the ushnu platform, the plaza, and Inka compounds connected with it. Left: nearby settlement's location. (Authors.)

the public space. Two-meter high walls defined the perimeter of the *plaza* and the remaining structures immediately orbiting around it, occluding the interior of the plaza to those who were outside this ceremonial compound, such as the local inhabitants of Guitián.

There were nine ways to access Guitián's *plaza*. Whereas six accesses connected the Inka buildings and the *plaza*, the remaining three linked the *plaza* with three pathways that lead to three apertures in settlement's perimeter wall, connecting the *plaza* with the exterior areas of the settlement. One of these pathways crossed the local area. The remaining two ensured that the visitors that entered the *plaza* walked surrounded with Inka buildings. Hereafter, we will call those three accesses to the plaza, 'public accesses'.

Each public access exhibits its own characteristics, offering different sights to visitors to the site (Figure 3). The northeastern access connected the plaza with the local area through a small aperture that prevented local inhabitants seeing much of what was going on within the plaza. The southern entrance, probably used by those who arrived in the site from La Paya, offered the approaching visitors a framed view of the ushnu platform. The northwestern access demanded

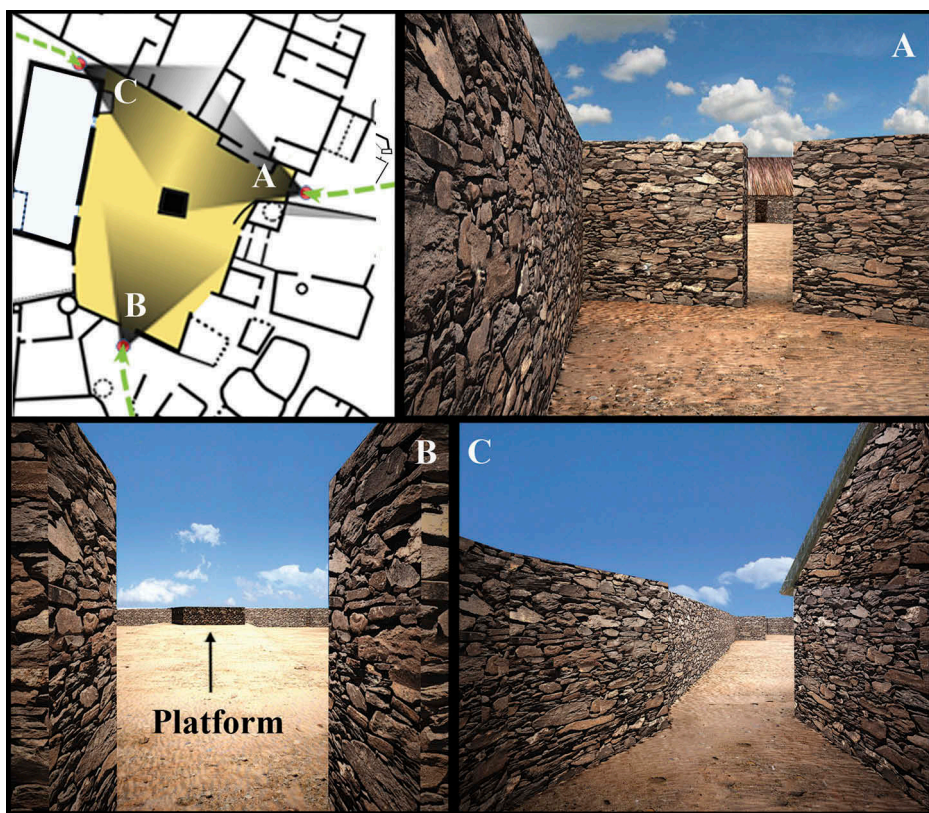


Figure 3. Three-dimensional reconstructions to illustrate sights offered by northeastern (A), southern (B), and northwestern (C) public accesses towards the plaza. (Figure credits: Authors.)

visitors to walk through a 10-meter hallway. Flanked by walls, people were not allowed to see what was going on in the plaza until entering into it. Once inside Guitián's plaza, people found themselves in a quite secluded space surrounded by tall walls, gabled roofs, and strategically located accesses that obstructed their views to the exterior of the plaza and to the interior of the Inka residential compounds, forcing attendants to concentrate on what was going on in the plaza in general, and in what Inka representatives were doing on the *ushnu* platform in particular (see Acuto, Troncoso, and Ferrari 2012).

During ritual-ceremonial events, the local residents of Guitián probably used the northeastern door to enter into the plaza, whereas those who came from the neighboring settlements employed the southern and northwestern entrances. This was different for the Inkas, whose homes were directly connected to the public space.

But now, besides views, what did people hear during Inka ceremonial events? How did the layout of this *plaza* affect sound dispersion? Could sound propagation inform us about complementary things to be taken into account when examining Inka *plazas'* design throughout the Empire? More importantly, how did sight and audibility complement each other?

Materials and methods: inherent problems and solutions

Seeking to understand the experiences that local people had while visiting Guitián to participate in ceremonies hosted by the imperial representatives, we proposed the following hypothesis: The Inkas carefully designed Guitián's public space in order to create different experiences while approaching and entering the *plaza*. This design was not only oriented towards sight administration, but also towards sound management. To test this hypothesis, we applied different field and lab techniques.

First, we took Guitián's original floor plan and re-established the *plaza's* and the *ushnu's* coordinates and wall thicknesses. Second, we tested sound dispersion from the center of the *ushnu*, establishing 12 axes that radiated from *ushnu's* center towards *plaza's* limits (Figure 4). Along each axis and at every three meters we measured sound pressure levels produced by a shell trumpet, a drum, and the voice of one of us.³ Measurements started 0.3 meters away from the sound source and were repeated one meter away before starting with the three-meter spacing. In order to test wall surfaces' incidence on sound wave reflections, we also took additional measurements across the best-preserved walls. On-site measurements were conducted during the morning to avoid the typical afternoon strong winds of the region. These activities allowed us to generate an isobel map (a map that joins equal points of sound level) to represent sound dispersion within the *plaza*, to identify the incidence of vegetation in on-site results, and to control and establish sound pressure level standards at different distances from the sound source. However, isobel maps generation proves to be most useful only when

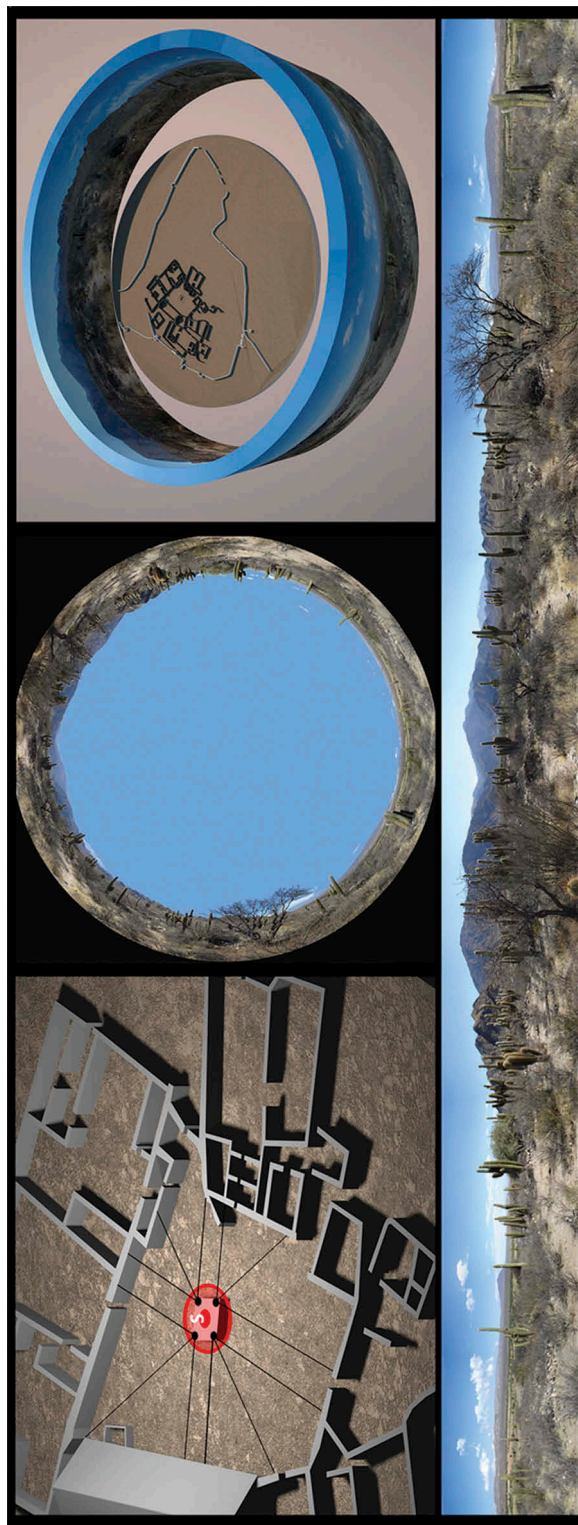


Figure 4. Left: Three-dimensional settlement model, sound source (S) and on-site measurements' axes. Center (up and down): Landscape dome and panoramic. Right Landscape dome and three-dimensional model. (Figure and photograph credits: Authors.)

every reflective surface is well preserved or when open field measurements (without obstacles) are being made (see Meddens and Frouin 2011). As stated before, this is a circumstance that archaeologists seldom face (if at all).

Given the obstacles presented by poor wall preservation and profuse vegetation, we had to create a scaled three-dimensional settlement model (Figure 4). For this, we took into account not only the map of the site, but also the information obtained through excavations in the *plaza*, the platform, and other architectural compounds. These excavations allowed us to identify the original *plaza's* floor, to establish a minimum height for its walls (two meters), and to find that the *ushnu* ceremonial platform was slightly elevated. It was built over a mild elevation so that its upper surface was at least 1.5 meters above the *plaza's* original floor. Future investigations will allow us to determine which other structures (in addition to the kallanka) were roofed.

Once the three-dimensional model of the settlement was generated, we added a geo-referenced landscape dome that we created with panoramic photographs taken from the *ushnu's* center (Figure 4). This allowed us to link the views that architecture allowed while entering, staying, and leaving the *plaza*, with changing sound pressure levels along hypothetical paths. Finally, to complement open field measurements within the *plaza*, we tested and applied different software to evaluate sound dispersion from the center of the platform towards the surrounding structures.⁴ Further variables' values assigned to the model can be consulted in Table 1.

Open field measurements taught us that an inherent variability generated by wind, vegetation, and executants' expertise is inevitable. During fieldwork, we found out that both the shell trumpet and our voices did not offer sufficiently regular values. We took control measurements at various times at the same spot with the same sound source and, in some cases, decibel readings differed more than what we were willing to accept for this study. In the case of the shell trumpet, the most plausible explanation for those irregular readings is our lack of expertise in playing this wind instrument. This lack of expertise also results in exhaustion due to the necessity of maintaining a long, sustained and constant sound. In the case of voice, the main problem was the incapacity to maintain a constant loudness due to vocal exhaustion and the increasing effort needed. Drum hits did not offer any of those exhaustion and expertise-related challenges. On the contrary, a sound created by a simple, repetitive and not very demanding body

Table 1. Further variables considered in the model. Tests have been made under 20°C and 0.765 Atm. Speed of sound has been fixed on 343.3 m/s. Specular and diffuse reflection probability has been assigned according to materials and constructive techniques.

Surfaces and boundaries	Material	Absorption coefficient	Specular/diffuse reflection probability
Walls	Stone	0.02	0.2/0.8
Platform	Stone	0.02	0.2/0.8
Roof	Thatched	0.3	0.1/0.9
Soil	Standard valley soil	0.2	0.3/0.7

movement proved to be sufficiently regular to model its dispersion. Hence, every result presented hereafter is based on drum hits (240 Hz and 80 dB at 0.3 m).

Results: dispersion, pressure zones, and sound pressure levels

Ray dispersion simulation (Figure 5) indicates that the entrances to the plaza effectively and selectively inhibited and channelized sound ray dispersion. Moreover, results indicate that the spatial design and architecture of Guitián's public space not only ensured people's attention by obstructing their views outside this enclosure, but also contributed to the concentration of sounds since the sounds emitted from the platform had a discrete distribution. When testing sound dispersion from the center of the *ushnu*, it is noticeable that sound vectors distribute mainly within this public space. Due to the tall walls that defined the perimeter of the *plaza*, the majority of reflections stayed within the *plaza*. Even though at the moment we do not have further information to complete the distributive effects of roofs (usually gabled in Inka architecture), they would have further blocked sound dispersion outside the *plaza*.

Our study indicates that the northwestern access and hallway in and out of the *plaza* extended sound dispersion by capturing and channeling it towards the exterior of the public space; something that clearly does not happen with north-eastern and southern public accesses. Pressure zones estimations⁵ (Figure 6) support the layout's capacity to concentrate sound distribution within the *plaza* and the capacity of the northwestern hallway to extend it well beyond the *plaza's* surface. However, it does not offer an indicator of perceived loudness for people approaching the *plaza*, entering, and being around the *ushnu* platform.

To test the decibel levels people would have received, we completed the model with 17 probes distributed within the *plaza*, three probes one meter outside its public accesses, two additional probes in northwestern hallway, one additional probe in southern pathway, and three more amongst Guitián's local buildings and pathways. The main goal of probe positioning was to register perceived dB. Probe positioning (1.5 meters from surface) and volume intends to represent a human head position and minimal side movements within a 0.3 meters horizontal radius and a 0.3 meters vertical axis (Figure 7).

Results indicate that a person standing in the plaza had an average reception of 60.66 dB (Figure 7) – i.e. 10.21 dB more than standing immediately behind its accesses and 21.84 dB more than standing in local periphery pathways. According to loudness perception standards (see Scharf 1978), a person located inside the *plaza* would have perceived sounds twice as loud as someone located one meter outside its public doorways and four times louder than someone located in the local periphery. Such management of disparate aural accessibilities was not limited to the settlement scale. It might have been a resource intentionally micromanaged. That is, controlled for every body's position and every step taken towards, within, and away from the *plaza*.

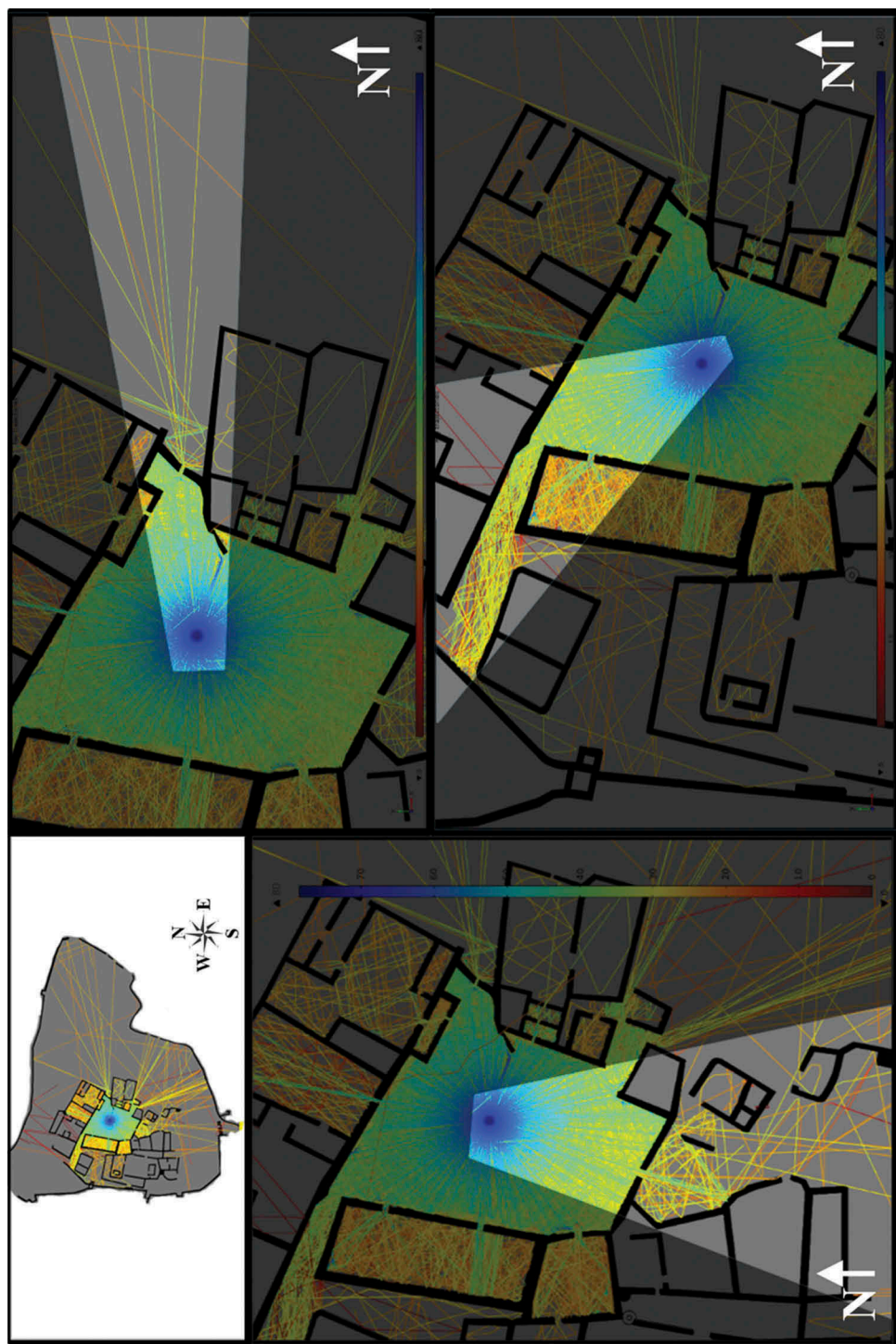


Figure 5. Transverse plane showing a simulation of the dispersion of 5000 sound rays from the center of the ushnu ceremonial platform. Emphasis is made on the capacity of public accesses to block or channelize rays. (Authors.)

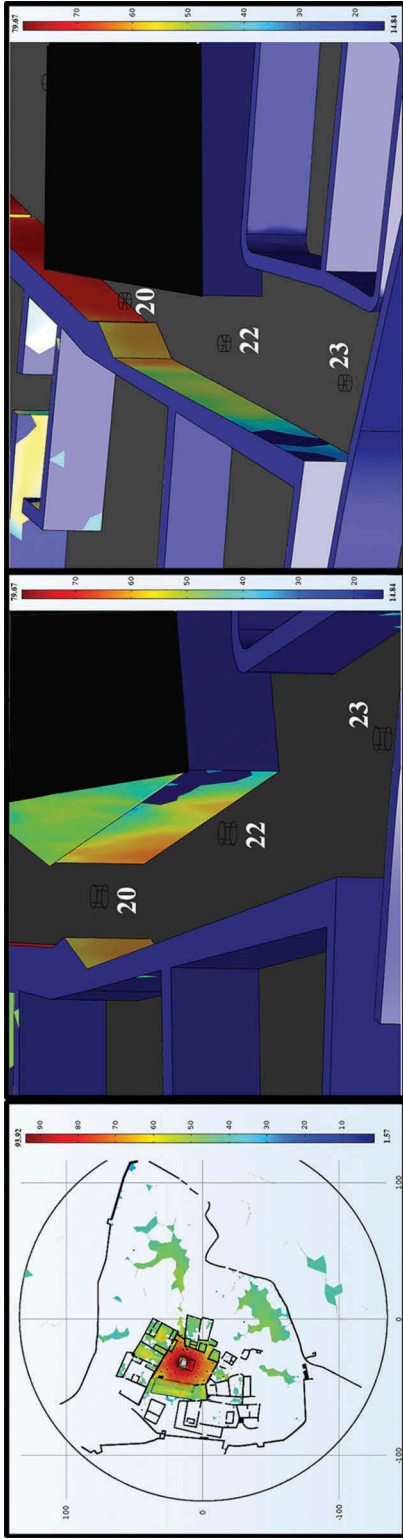


Figure 6. Sound pressure levels against floors and kallanka's roof (left). Center and right: Sound pressure levels against the walls of northwestern hallway. (Authors.)

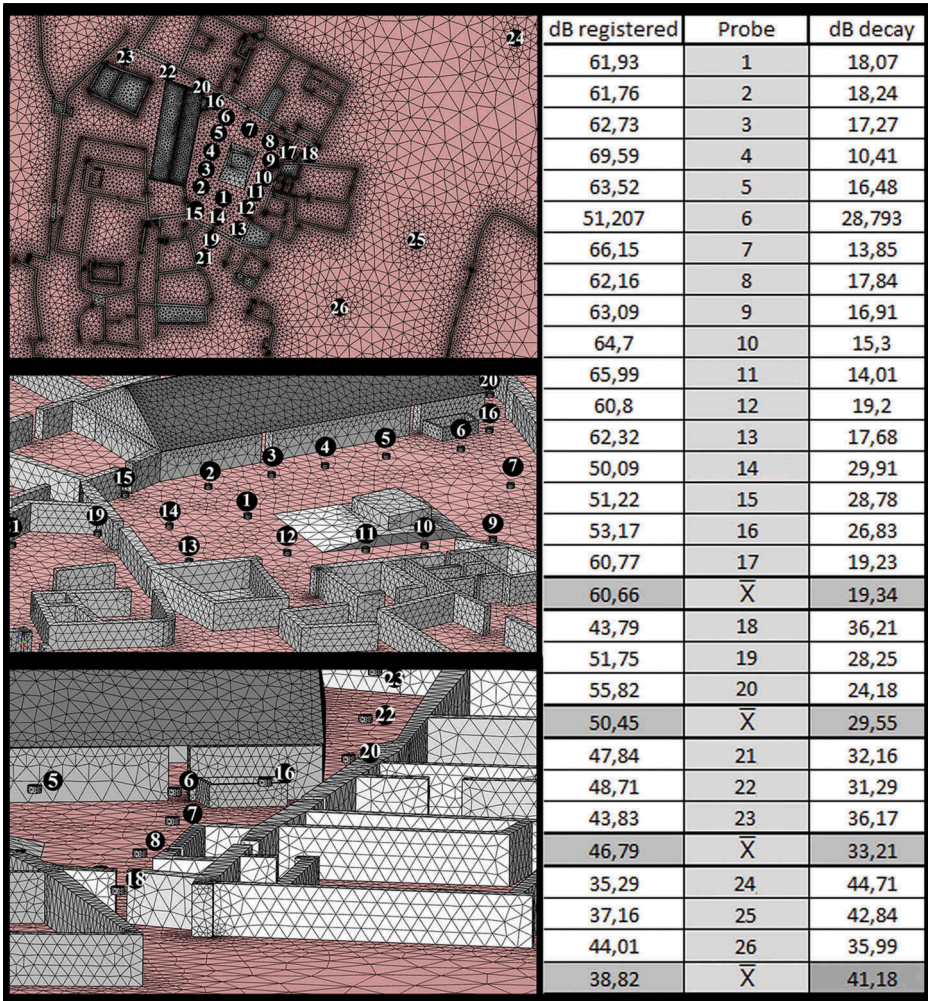


Figure 7. Locations of probes and dB received, dB decay, and mean dB within the plaza, behind accesses, and in local periphery. (Authors.)

As stated before, public accesses to the *plaza* offered different sights during people's arrival to participate in public events. Now, how did these sights correlate with perceived loudness? We have already shown that the only entrance that visually anticipated the scene was the southern public access. Its position and width successfully framed the *ushnu* platform announcing its importance in this Inka spatial choreography. The northeastern access and the northwestern hallway both inhibited looking inside the *plaza* and did not allow visitors to see the full *ushnu* platform until entering the *plaza*. Even though the northeastern doorway and the northwestern hallway restricted vision toward the interior of the *plaza*, they affected sound dispersion in a different way. According to loudness perception standards, a person standing one meter outside the northwestern doorway would have perceived sounds more than twice as loud as one person standing one meter outside

the northeastern access and and slightly louder than being one meter outside from southern access. Hence, public accesses offered three combinations of visual and acoustic perceptions. Approaching Guitián's *plaza* from the south allowed people to see and hear without major restrictions. Approaching from the northeast greatly inhibited sight and loudness perception. Approaching through the northwestern hallway limited visual accessibility while enhancing loudness perception.

Guitián's spatial layout might have promoted aural accessibility for those entering through the northwestern access well before they would have been able to actually see what was going on in the *plaza* (Figure 8). Moreover, results indicate that being as far as 27 meters outside this access would have entailed almost the same dB reception as being just one meter away from the northeastern entrance.

It has been documented that instruments played a major role at the time of convening people to feasts and ceremonies (e.g. Arriaga 1621, 8). We also wanted to determine whether public accesses' design may have served to announce that people were approaching the plaza. As stated before, sound played a major role in ruling factions' entrances and performances, but chroniclers also signaled its importance in accompanying people during large and small-scale movements (see Ávila [1598] 1966, 146). Chroniclers have written that during pilgrimages and small-scale ceremonies, ethnic identification through bodily performance and clothing was complemented by certain sounds – e.g. chants, trumpets, drums (Garcilaso de la Vega [1609] 1985, II, 39). Hence, people entering through public accesses might have announced themselves before entering the *plaza*. The question arises: What could be said about public accesses' anticipatory capabilities?

To evaluate this alternative setting, we inverted source-receiver locations, especially focusing on the northwestern hallway and the southern access (Figure 9).

Results indicate that inverting source-receiver locations for the southern entrance (probe 19) and the *ushnu* might have entailed a negligible loudness perception difference of 0.49 dB. This is not the case when we put the sound source in northwestern hallway (where probe 20 registered 55.82 dB with the sound source over the *ushnu* platform). In this case, someone standing over the platform would have perceived sounds 8.84 dB lower (46.98 dB). In other words, the northwestern hallway might have been more effective for capturing and channeling sounds that came from the *ushnu*, than for channeling back sounds that were being made while walking down the hallway to enter the *plaza*.

Discussion, concluding remarks, and future directions

A major difficulty when evaluating the spatial properties of built environments emerges from a certain degree of uncertainty regarding people's movements. This is particularly challenging when we study spaces that were built to host a large body of people and that have several accesses. Guitián's layout is not an uncommon case of Inka settlement planning. Many other settlements throughout *Tawantinsuyu* had public spaces with a variety of doorways (see Hyslop



Figure 8. Sights and dB offered to people one meter before crossing public accesses. (Authors.)

1990). Inferring whether each doorway was thought to be entered and exited by a specific group of people, or whether doorways were thought to promote a circuit where a group entered the public space through one door and exited through another, posits major difficulties. Let us consider both possibilities and what they might have entailed for those who visited Guitián's plaza. Let us consider one hypothetical setting where Guitián's public accesses to the plaza were built so that three different groups entered the plaza and, after

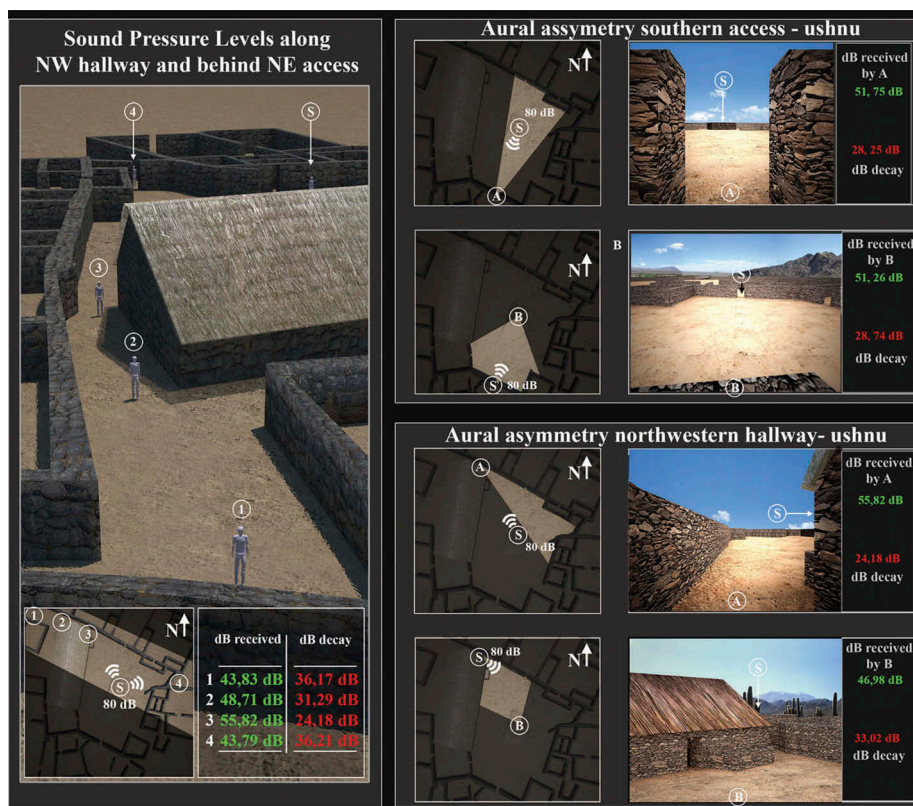


Figure 9. Aural asymmetries once inverting source's (S) and receiver's (R) location. (Authors.)

participating in an imperially-sponsored public event, returned to their abodes crossing the same accesses they used to enter the plaza. Let us also consider another hypothetical setting where Guitián's public accesses were built to promote a circuit where only one group entered the plaza through a public doorway and exited through another one.

According to the first setting, and the results presented here, each public access provided different sensorial stimulus by managing how much each group could see and hear while approaching the *plaza*. For every group, crossing the threshold of each of these doorways created a sudden increase in sight and acoustic availability (especially for the northeastern visitors) and a sudden visual revelation of the full setting for the northwestern and southern visitors. As stated before, local constructive techniques and elevated pathways ensured that locals were almost never confined between walls. Also, nearby local settlements do not have public spaces as large as Guitián's, so for local people who visited Guitián to participate in a ceremonial event hosted in the *plaza*, walking through public accesses and entering this large, impressive, and acutely choreographed space surely involved a major contrast and experiential novelty. Even if sounds were only emitted once every guest was in the *plaza*, its layout design ensured that sound dispersion concentrated within the public space.

Spanish chronicles and ethnographical investigations on Andean ceremonialism account for the paramount role of sounds in representing ethnic filiations, and guiding who comes into play and what to do during ceremonial activities (e.g. Bolin 2006; Garcilaso de la Vega [1609] 1985, II, 40; Guamán Poma De Ayala [1615] 1980, 231–234). Hence, we should consider the possibility that these public accesses helped imperial representatives to direct a general choreography. Perhaps a clean visual access between the *ushnu* platform and the southern access, as well as a relatively enhanced aural accessibility for northwestern hallway, was intended to ensure the effectiveness of visual and aural signs to display imperial narrative in its full potential.

Spanish chronicles and ethnographic investigations also documented that people that participated in pilgrimages, processions, and other ceremonial events permanently played instruments and chanted verses while being on the move (e.g. Ávila [1598] 1966, 145; Bolin 2006, 133; Garcilaso de la Vega [1609] 1985, II, 39). The results presented here indicate that Guitián's public accesses may have not had a major role in anticipating people's arrival through the sounds they made while approaching the *plaza*. Sight surely played a major role especially in the case of the southern public access, which location and width helped to maintain the line of sight between the people that were approaching the *plaza* from the south and whoever might have been over, or in front, or at the sides of the *ushnu*.

Once inside the *plaza*, difference in stimulus while approaching it was diminished. Being surrounded by tall walls, people were strongly inhibited from seeing out of this enclosure. The platform had the leading role in this scene and people orbiting around it had a similar visual and aural accessibility.

The second hypothetical setting entails further assumptions and seems to be particularly difficult to corroborate. Certain characteristics of Guitián's public accesses make us think that they were thought to promote a circulation circuit and not just to provide three exclusive entrances and exits for three different groups. The narrowness of the northeastern doorway (0.6 meters) did not permit the entrance of more than one person at once. Furthermore, its location avoided local inhabitants meddling in imperial affairs on a day-to-day basis. This suggests that Inka architects did not design this doorway to promote the participation of Guitián's local inhabitants. The southern access, with its capacity to frame the *ushnu* platform and maintain a line of sight between the *ushnu* and the people that approached the *plaza* from the south, suggests that it was designed to show a specific scene while people were entering the plaza and not while people were exiting it. Differently from the other entrances, the northwestern door had a remarkable characteristic: in addition to circumscribing the visual field of those who walked through it, it has the capacity to capture and to channelize sounds outwards from the *plaza* rather than inwards.

According to this alternative hypothetical setting, the southern and north-western public accesses could have been part of a circuit. Selected visitors could have approached Guitián through its southern entrance in its perimeter wall, entered the *plaza* through its southern public access and, after feasting, performing, and witnessing imperial performances, exited through the northwestern hallway while still being accompanied with sounds coming from the *plaza*.

We realize that the hypotheses considered in this discussion need further development and material support. Nonetheless, we have shown that when the Inkas deployed their strategies to embed the natives in imperial narratives and transfer imperial cosmogonies, choreographical participation not only addressed sight management but also aural accessibility in order to create novel experiences among the natives, while reinforcing imperial status in a broader cosmological context. This case study broadens the field of Inka ceremonialism and, by positing new challenges to our understanding of strategic sensory management, partially breaks away from a reigning visual centrism that has traditionally permeated archaeological investigations and perceptions.

Notes

1. A third major obstacle that deserves further development involves our comprehension of the dynamics of being sentient. Not only how many senses we should consider, but also their historical and culturally specific importance. How we experience the world and whether synesthesia or inter-sensoriality models are analytically suitable and even representative of our becoming, is a topic yet to be fathomed (see Howes 2006 for a discussion of this issue).
2. As many as we may consider aside from the Aristotelian's, like thermoception, nociception, equilibrioception, proprioception, interoception, etc. (see Fahlander and Kjellström 2010).
3. The main reason behind choosing these sound sources is that they are frequently mentioned in chronicles, usually related to feasts, ceremonies and pilgrimages (see for example Acosta [1590] 2003, 268; Betanzos [1561] 1992, 126–127; Garcilaso de la Vega [1609] 1985, II, 39–40; Garcilaso de la Vega [1609] 1985, I, 107, 113; Molina [1575] 2011, 39 [sixteenth century]).
4. Many items of software and plug-ins have been developed to run these tests and to offer suitable results to be compared with on-site measurements and to refine variables, amongst them, I-SIMPA, COMSOL, Ramsete, CATT-Acoustic.
5. Sound itself consists of pressure waves. As such, sound intensity along a thin pressure zone near a given surface is enhanced due to the sum of the incident and the reflected sound wave. Therefore, sound pressure levels may offer an indicator for a layout's general behaviour regarding sound dispersion, but not necessarily what a person might have heard.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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References

- Acosta, J. [1590] 2003. "Historia natural y moral de las Indias." *Biblioteca Virtual Universal*. <http://www.biblioteca.org.ar/libros/71367.pdf>.
- Acuto, F., C. Aranda, C. Jacob, L. Luna, and M. Sprovieri. 2004. "El impacto de la colonización inka en la vida social de las comunidades del Valle Calchaquí Norte." *Revista Andina* 39: 179–201.
- Acuto, F., and C. Gifford. 2007. "Lugar, arquitectura y narrativas de poder: Experiencia y percepción en los centros Inkas de los Andes del Sur." *Arqueología Suramericana* 3 (2): 135–161.
- Acuto, F. A. 2012. "Landscapes of Inequality, Spectacle, and Control: Inka Social Order in Provincial Contexts." *Revista Chilena De Antropología* 25: 7–62.
- Acuto, F. A., A. Troncoso, and A. Ferrari. 2012. "Recognising Strategies for Conquered Territories: A Case Study from the Inka North Calchaqui Valley." *Antiquity* 86 (334): 1141–1154. doi:10.1017/S0003598X00048304.
- Acuto, F. A. 1999. "Paisaje y dominación: La constitución del espacio social en el Imperio Inka." In *Sed Non Satiata. Teoría Social en la Arqueología Latinoamericana Contemporánea*, edited by A. Zarankin and F. A. Acuto, 33–76. Buenos Aires, Argentina: Ediciones del Tridiente.
- Acuto, F. A. 2010. "Living under the Imperial Thumb in the Northern Calchaquí Valley (Argentina)." In *Distant Provinces in the Inka Empire. Toward a Deeper Understanding of Inka Imperialism*, edited by M. Malpass and S. Alconini, 108–150. Iowa City: University of Iowa Press.
- Allen, C. J. 2014. "Ushnus and Interiority." In *Inca Sacred Space Landscape, Site and Symbol in the Andes*, edited by F. Meddens, K. Willis, C. McEwan, and N. Branch, 71–77. Londres: Archetype Publications.
- Arriaga, P. I. 1621. *Extirpación de la idolatría del Pirú*. Lima: Gerónimo de Contreras Impresor de Libros.

- Ávila, F. [1598] 1966. *Dioses y Hombres de Huarochirí*, Translated by J. M. Arguedas. Lima, Perú: Instituto de Estudios Peruanos, Estudio Biobibliográfico Pierre Duviols.
- Bauer, B., and C. Stanish. 2001. *Ritual and Pilgrimage in the Ancient Andes: The Island of the Sun and the Moon*. Austin, Texas: University of Texas.
- Bauer, B. S. 1998. *The Sacred Landscape of the Inca*. Austin: University of Texas Press.
- Betanzos, J. [1561] 1992. *Suma y narración de los Incas*. Cochabamba: Fondo Rotatorio Editorial de Culturas Aborígenes de América, tomo I. Ariol SRL.
- Bolin, I. 2006. *Growing up in a Culture of Respect. Child Rearing in Highland Peru*. Austin: University of Texas Press.
- Bray, T. L. 2003. "Inca Pottery as Culinary Equipment: Food, Feasting, and Gender in Imperial State Design." *Latin American Antiquity* 14 (1): 1–23. doi:10.2307/972233.
- Coben, L. S. 2006. "Other Cuzcos: Replicated Theaters of Inka Power." In *Archaeology of Performance. Theaters of Power, Community, and Politics*, edited by T. Inomata and L. S. Coben, 223–259. Lanham, MD: AltaMira.
- Dean, C. 2010. *A Culture of Stone*. Durham: Duke University Press.
- Devereux, P., and J. Wozencroft. 2014. "Stone Age Eyes and Ears: A Visual and Acoustic Pilot Study of CarnMenyn and Environs, Preseli, Wales." *Time and Mind: the Journal of Archaeology, Consciousness and Culture* 7 (1): 47–70.
- Elliott, B., and J. Hughes. 2014. "Sonic Horizons of the Mesolithic: Using Sound to Engage Wider Audiences with Early Holocene Research." *World Archaeology* 46 (3): 305–318. doi:10.1080/00438243.2014.909097.
- Fahlander, F., and A. Kjellström. 2010. "Beyond Sight: Archaeologies of Sensory Perception." In *Making Sense of Things. Archaeologies of Sensory Perception*, edited by F. Fahlander and A. Kjellström, 1–13. Stockholm: Postdoctoral Archaeological Group, University of Stockholm.
- Farrington, I. 2013. *Cusco. Urbanism and Archaeology in the Inka World*. Gainesville: University Press of Florida.
- Feld, S. 1996. "Waterfalls of Song: An Acoustemology of Place Resounding in Bosavi, Papua New Guinea." In *Senses of Place*, edited by S. Feld and K. Basso, 91–135. Santa Fe: School of American Research Press.
- Ferrari, A. A. 2016. "Espacialidad local e Inka en el Vale Calchaquí Norte (Salta, Argentina): reevaluando el alcance de la intervención imperial en La Paya." *Estudios Atacameños. Arqueología y Antropología Surandinas* 53: 53–74.
- Garcilaso de la Vega, I. [1609] 1985. *Comentarios reales I*. Venezuela: Fundación Biblioteca Ayacucho.
- Garcilaso de la Vega, I. [1609] 1985. *Comentarios reales II*. Venezuela: Fundación Biblioteca Ayacucho.
- Gosden, C. 2005. "What Do Objects Want?" *Journal of Archaeological Method and Theory* 12 (3): 193–211. doi:10.1007/s10816-005-6928-x.
- Guamán Poma De Ayala, F. [1615] 1980. *Nueva Corónica y Buen Gobierno. Tomo 1*. Venezuela: Fundación Biblioteca Ayacucho.
- Hamilakis, Y. 2011. "Archaeologies of the Senses." In *The Oxford Handbook of the Archaeology of Ritual and Religion*, edited by T. Insoll, 208–225. Oxford: Oxford University Press.
- Hamilakis, Y. 2013. "Eleven Theses on the Archaeology of the Senses." In *In Making Senses of the Past: Toward a Sensory Archaeology*, edited by J. Day, 409–419. Carbondale: Southern Illinois University Press.
- Hamilton, S., R. Whitehouse, K. Brown, P. Combes, E. Herring, and M. Seager Thomas. 2006. "Phenomenology in Practice: Towards a Methodology for a "Subjective" Approach." *European Journal of Archaeology* 9 (1): 31–71. doi:10.1177/1461957107077704.

- Harvey, D. 1994. "The Social Construction of Space and Time. A Relational Theory." *Geographical Review of Japan* 67 (2): 126–135. doi:10.4157/grj1984b.67.126.
- Hepp, G. D., S. Barber, and A. Joyce. 2014. "Communing with Nature, the Ancestors and the Neighbors: Ancient Ceramic Musical Instruments from Coastal Oaxaca, Mexico." *World Archaeology* 46 (3): 380–399. doi:10.1080/00438243.2014.909100.
- Holbraad, M. 2009. "Ontology, Ethnography, Archaeology: An Afterword on the Ontography of Things." *Cambridge Archaeological Journal* 19 (3): 431–441. doi:10.1017/S0959774309000614.
- Howes, D. 2006. "Scent, Sound and Synaesthesia. Intersensoriality and Material Culture Theory." In *Handbook of Material Culture*, edited by C. Tilley, W. Keane, S. Küchler, M. Rowlands, and P. Spyer, 161–172. London: Sage.
- Hyslop, J. 1990. *Inka Settlement Planning*. Austin: University of Texas Press.
- Jacob, C., and I. Leibowicz. 2011. "Montañas sagradas en los confines imperiales. Nevado de Ca-chi, Salta-Argentina." *Revista Haucayapata. Investigaciones arqueológicas del Tahuantinsuyo* 2: 71–90.
- Karampatzakis, P., and V. Zafranias. 2009. "Did Hades Accept Visitors? the Acoustical Properties of the Underground Crypt of the Acheron Nekromanteion, Preveza, Greece." 15th Annual Meeting of the European Association of Archaeologists, Riva del Garda, Trento, September 15–20.
- Kosiba, S., and B. Bauer. 2013. "Mapping the Political Landscape: Toward a GIS Analysis of Environmental and Social Difference." *Journal of Archaeological Method and Theory* 20 (1): 61–101. doi:10.1007/s10816-011-9126-z.
- Kosiba, S. 2012. "Emplacing Value, Cultivating Order: Places of Conversion and Practices of Subordination Throughout Early Inka State Formation (Cuzco, Peru)." In *The Construction of Value in the Ancient World. Cotsen Advanced Seminar Series, 5*, edited by J. K. Papadopoulos and G. Urton, 97–127. Los Angeles: Cotsen Institute of Archaeology Press – UCLA.
- Mackey, C. 2010. "The Socioeconomic and Ideological Transformation of Farfán under Inka Rule." In *Distant Provinces in the Inka Empire. Toward a Deeper Understanding of Inka Imperialism*, edited by M. Malpass and S. Alconini, 221–259. Iowa City: University of Iowa Press.
- Makowski, K., M. Córdova, P. Habetler, and M. Lazárraga. 2005. "La plaza y la fiesta: reflexiones acerca de la función de los patios en la arquitectura pública prehispánica de los períodos tardíos." *Boletín de Arqueología PUCP* 9: 297–333.
- May, S. 2014. "Silbury Hill: Public Archaeology, Acoustic Archaeology." *World Archaeology* 46 (3): 319–331. doi:10.1080/00438243.2014.909102.
- McBride, A. 2014. "The Acoustics of Archaeological Architecture in the near Eastern Neolithic." *World Archaeology* 46 (3): 349–361. doi:10.1080/00438243.2014.909150.
- Meddens, F., and M. Frouin. 2011. "Inca Sacred Space, Platforms and Their Potential Soundscape. Preliminary Observations at Usnu from Ayacucho." *Revista Haucayapata, Investigaciones Arqueológicas del Tahuantinsuyo* 1: 24–40.
- Meddens, F., N. Branch, C. Vivianco, N. Riddiford, and R. Kemp. 2008. "High Altitude Ushnu Platforms in the Department of Ayacucho Perú, Structure, Ancestors and Animating Essence." In *Pre-Columbian Landscapes of Creation and Origin*, edited by J. E. Staller, 315–355. New York: Springer.
- Molina, C. [ca. 1575] 2011. *Account of the Fables and Rites of the Incas*, Introduced by Brian Bauer and translated and edited by B. Bauer, V. Smith-Oka, and G. Cantarutti. Austin: University of Texas Press.
- Moore, J. 1996. *Architecture and Power in the Ancient Andes. The Archaeology of Public Buildings*. Cambridge: Cambridge University Press.
- Morris, C., and A. Covey. 2003. "La plaza central de Huánuco Pampa: Espacio y Transformación." *Boletín de Arqueología PUCP* 7: 133–149.

- Morris, C., A. Covey, and P. Stein. 2011. *The Huánuco Pampa Archaeological Project Volume I: The Plaza and Palace Complex*. New York: American Museum of Natural History.
- Nielsen, A. E. 2006. "Plazas para los antepasados: Descentralización y poder corporativo en las formaciones políticas preinkaicas de los Andes circumpuneños." *Estudios Atacameños* 31: 63–89.
- Niles, S. A. 1999. *The Shape of Inca History: Narrative and Architecture in an Andean Empire*. Iowa City: University of Iowa Press.
- Pallasmaa, J. 2005. *The Eyes of the Skin. Architecture and the Senses*. Chichester: Wiley-Academy.
- Pijanowski, B., L. Villanueva-Rivera, S. Dumyahn, A. Farina, B. Krause, B. Napoletano, S. Gage, and N. Pieretti. 2011. "Soundscape Ecology: The Science of Sound in the Landscape." *BioScience* 61 (3): 203–216. doi:10.1525/bio.2011.61.3.6.
- Pino Matos, J. 2005. "El ushnu y la organización espacial astronómica en la sierra central del Chinchaysuyu." *Estudios Atacameños* 29: 143–161.
- Scarre, C., and G. Lawson, eds. 2006. *Archaeoacoustics. McDonald Institute Monographs*. Cambridge: McDonald Institute for Archaeological Research.
- Schafer, R. M. 1967. *Ear Cleaning. Notes for an Experimental Music Course*. Toronto, Canada: Clark & Cruickshank, a Division of Berandol Music Limited.
- Schafer, R. M. 1969. *The New Soundscape: A Handbook for the Modern Music Teacher*. Don Mills: BMI Canada Limited.
- Scharf, B. 1978. "Loudness." In *Handbook of Perception*, edited by E. C. Carterette and M. P. Friedman, 187–234. Vol. 4. New York: Academic Press.
- Scullin, D., and B. Boyd. 2014. "Whistles in the Wind: The Noisy Moche City." *World Archaeology* 46 (3): 362–379. doi:10.1080/00438243.2014.921099.
- Soja, E. 1989. *Postmodern Geographies: The Reassertion of Space in Critical Social Theory*. London: Verso.
- Southworth, M. 1969. "The Sonic Environment of Cities." *Environment and Behavior* 1: 49–70. doi:10.1177/001391656900100104.
- Staller, J. E. 2008. "Dimensions of Place: The Significance of Centers to the Development of Andean Civilization: An Exploration of the Ushnu Concept." In *Pre-Columbian Landscapes of Creation and Origin*, edited by J. E. Staller, 269–313. New York: Springer.
- Thomas, J. 2001. "Archaeologies of Place and Landscape." In *Archaeological Theory Today*, edited by I. Hodder, 165–186. Cambridge: Cambridge Polity.
- Truax, B. [1978] 1984. *Acoustic Communication*. New Jersey: Ablex Publishing Corporation.
- Watson, A., and D. Keating. 1999. "Architecture and Sound: An Acoustic Analysis of Megalithic Monuments in Prehistoric Britain." *Antiquity* 73: 325–336. doi:10.1017/S0003598X00088281.