CHAPTER ONE

On Scale

The storerooms of the Harvard Peabody Museum are filled with towering totem poles and tent posts, elongated dugout and birch bark canoes, and massive casts of stelae. The collection is at once a sprawling repository of art and industry and a microcosmic encapsulation of it because of the teaching museum's vast size relative to other institutions and the staggering quantity of objects humans have produced. Amid this panoply of evidence of the ways civilizations have thought and wrought, strived and thrived, a clutch of diminutive Andean artifacts raises outsized questions about the ways societies conceptualize, perceive, and interpret scale (PLATES 1 & 2).

Because the objects are so small—only a few centimeters long—curators have augmented their size. They have been grouped together, nestled into foam supports, and placed inside larger boxes. Removing a gray-blue lid, many of the contents may look like silver-colored wires, perhaps sewing needles. But, lifting one for inspection, a lump of metal placed toward one end makes clear that this particular object could never pass through cloth (PLATE 3). Its design is not for carrying thread but to spin it in the first place. The object takes the form of a drop spindle; except, at merely 9.8 cm long, it is only one-half to one-third the typical length. Because it is made from a precious silver alloy and not wood, it is twice as heavy as a fine, functional spindle. The two dozen burnished objects present unusably small versions of ancient Andean tools for spinning and weaving. There is even an intricate loom featuring a repoussé-chased textile. Although the shapes of the original implements were ergonomically developed to be manipulated by hands, these smaller, denser objects forge new relationships with human bodies. Holding any of these minutely crafted but seemingly useless tools, it is hard not to wonder: *What were their makers thinking?*

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Indeed, the logic or function of these objects is unclear. They were purchased from a dealer in Lima in 1947 with no documentation of where they came from or how they were found. They can be loosely attributed to the north coast of Peru after the year 1000, because of the iconography on the metal weaving.[1] When

> PLATES 1 & 2. Reduced-Scale Spinning and Weaving Tools

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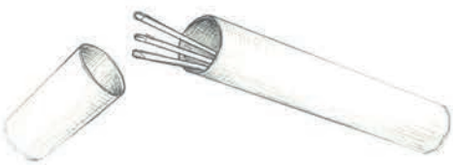

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PLATE 3. A Reduced-Scale Spindle and Its Referent

the enigmatic cache arrived at the Peabody Museum in 1948, the registrar who accessioned them had to decide what to officially call them. With little evidence to analyze beyond their physical forms, they were dubbed a "child's silver toy loom and parts thereof."[2] Because their scale meant they could not function as actual tools, the most plausible explanation—at least to a modern viewer—was that they were pretend or make-believe tools reduced in scale to fit a child's hands. What is critical to understand about this classification, however, is that other toys and things broadly consistent with modern Euro-American notions of childhood are not common in the Andean archaeological record, let alone ones made of valuable silver. This would-be rationalization was perhaps as illogical as the objects' scale in the first place. And yet, in spite of this contradiction, many remain labeled this way.

The fundamental significance of this episode—simple though it may be—is that the scale of an object communicated something to a viewer. Moreover, it potentially communicated different things to different viewers based on their cultural backgrounds. The thousand-year-old message that the registrar believed was successfully received was more likely something lost in translation. The scale of these objects was read through a cipher of cultural understanding, and one that was more midcentury New England than ancient Andean. The essential question is how does scale affect the way objects are ontologically perceived and perceived to have meaning in different cultural contexts?

SCALE & WORLD ART

Scale, as a perceptual quality of art, is not something customarily analyzed in the discipline of art history. Other physical traits such as form, material, technique, and style have been examined at length. And yet, the effects of the size of a work of art relative to the sizes of other works, the body of the viewer, and its spatial context have been less consistently considered. In actuality, scale plays a primary role in the ways viewers engage with and subsequently interpret objects. It is difficult to see size objectively; rather, sizes are associated with the observed sizes of other things, interpreted relationally, and determined to be significant. Critically, if viewers can derive significance from scale, makers can intentionally use scale as a means of signification. A product of subjective perception, scale is an essential criterion of art historical study.

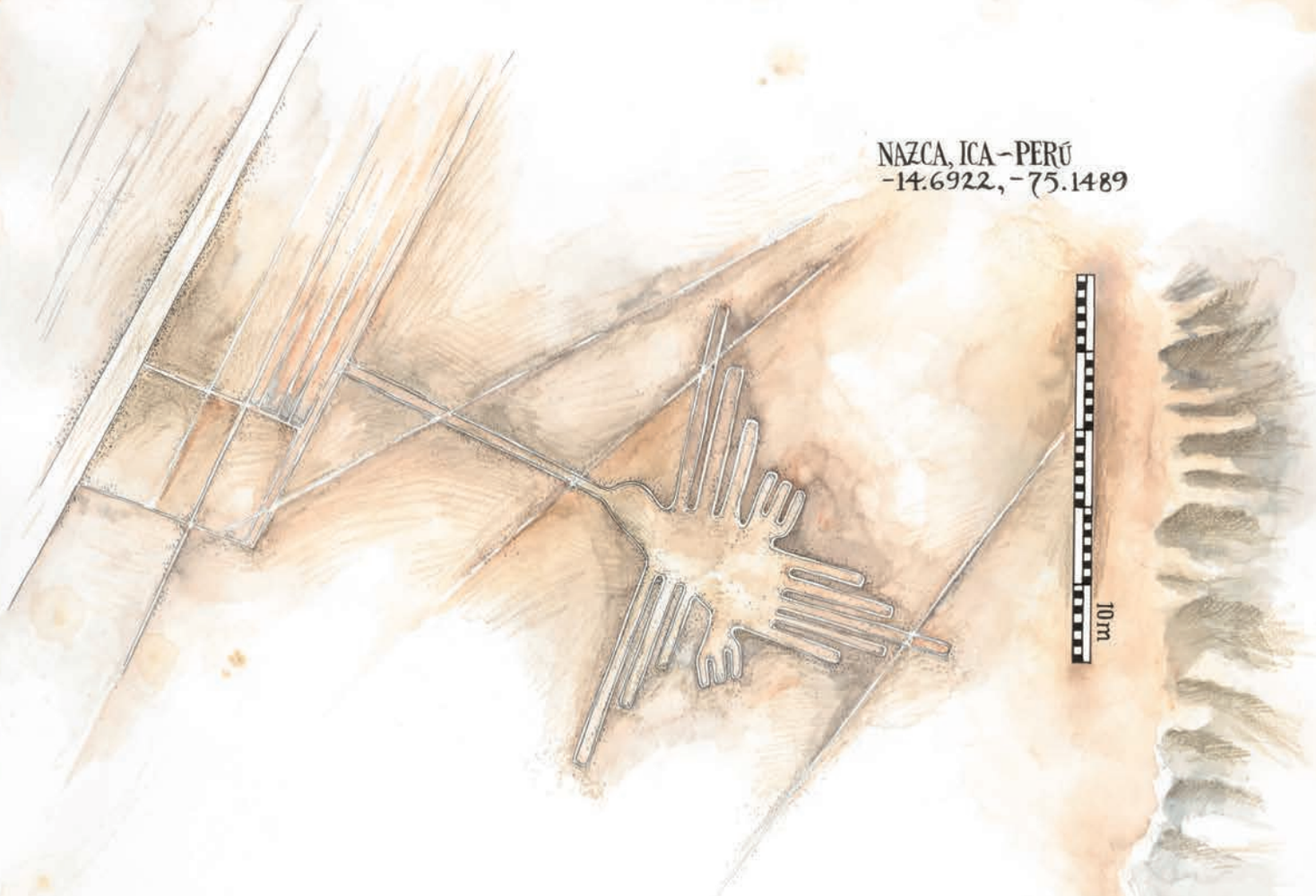
While scale may not be commonly considered in this historically Eurocentric field, objects with conspicuous scales are prominently encountered in more distant and ancient civilizations.[3] For example, Japanese netsuke, suiseki, and bonsai, as well as gardens broadly, are fundamentally predicated on scale. In suiseki, unworked rocks no larger than what could be placed on a tabletop and sometimes small enough to be held in a hand are aestheticized for the ways they resemble tremendous features of landscapes like mountains, crags, and bluffs.[4] They present what appear to be vast geographies for the eyes to explore while the body remains motionless. So, too, in bonsai, tiny trees are trained to look like landmark specimens of the genus. The illusion of scale is heightened through the cultivation of fine details simulating weathering and age. Likewise, ancient Egyptian art and architecture frequently engaged exaggerated scales, whether minute burial offerings like *ushabtis* and tomb models or the pyramids of Giza, the Great Sphinx, and statues of pharaohs.[5] In ancient Mesoamerica, Olmecs produced tremendous stone heads and little figurines—both

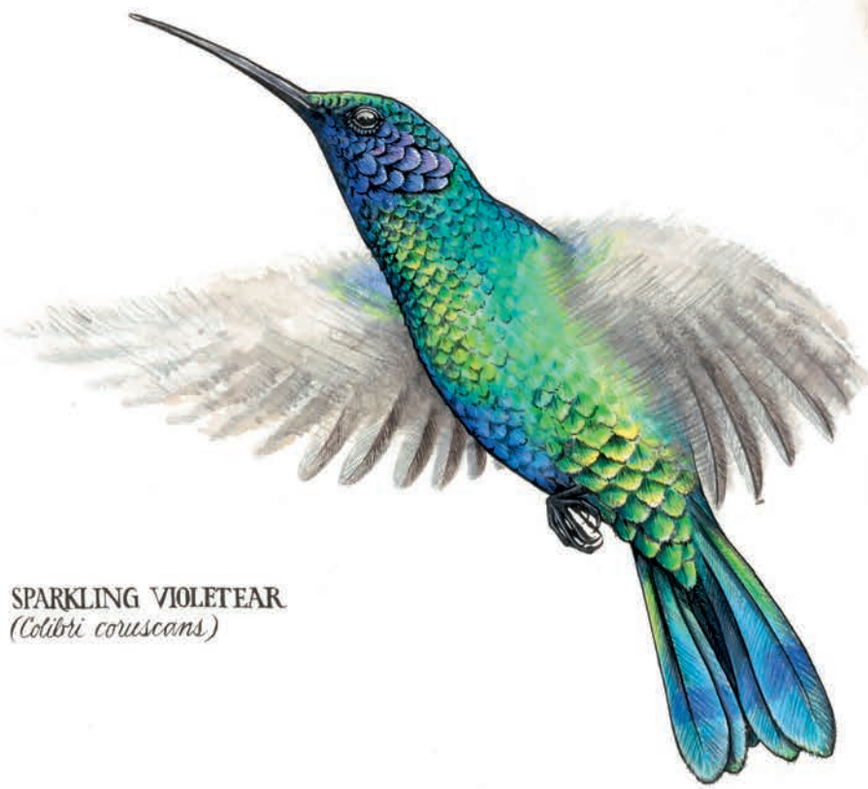
curiously exhibiting monumental qualities. Inhabitants of Easter Island carved hundreds of stone statues called *moai* that reached 10 m tall and weighed 75 metric tons. From Inuit carvings to Hopi *katsina* figures and Zuni fetishes, innumerable cultural artifacts—as museums like the Peabody attest—raise complex questions of the different ways societies have used scale to construct meaning. Without systematic studies of the issue, however, such objects can present interpretive challenges.

Of the cultural traditions where scale seems to have played a prominent role in signification, the ancient Andean world stands out as a locus. Most famously, the Nazca Lines are hundreds of geoglyphs raked into the surface of an alluvial desert plain between the years 400 and 650. Because of their sprawling size, the full extent of these earthworks only became apparent to the modern world with aerial surveys in the 1930s.[6] While most are nonfigural lines and geometric shapes, others represent a hummingbird, monkey, spider, tree, and flower, and measure around a hundred meters across (PLATE 4). The reasons people would make images on this scale have never been satisfyingly explained.[7] Less popularly known, equally poorly understood, and far more numerous are ancient Andean artifacts with drastically reduced scales, like the spinning and weaving "toys" in the Peabody. Such objects are now more commonly referred to as *miniatures*, and appear to have been continually produced throughout the region from the earliest phases of the archaeological record. Perhaps the most ancient example yet discovered is a tiny *shicra* bag excavated at the pre-ceramic site of El Paraíso on the outskirts of Lima dated between 1800 and 1500 BCE.[8] Shicras were net sacks containing rubble used as fill to construct massive temples. Although shicras typically contained around 25 kg of granite, this miniscule example weighed less than a kilogram and, instead of rubble, contained cakes of ground white rock wrapped in *pacae* leaves. The object did not have a structural function and has been interpreted as a dedicatory offering.

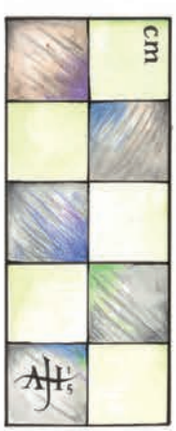
Since these early beginnings, seemingly all Andean civilizations produced miniature objects. Some have been prominently written about, such as the minute re-creations of tombs excavated at the Moche site of Dos Cabezas that date to around 500, the eighty greenstone figurines discovered at the Huari site of Pikillacta from between 550 and 700, the Chimú *maquetas* populated with figures found at Huaca de la Luna and dated to after 1440, and the Inca figurines dressed in diminutive textiles recovered with a Capacocha sacrifice atop Mount Llullaillaco from between 1430 and 1520.[9] This scholarship makes clear that the creation of miniatures was not simply associated with a particular Andean civilization, a single material, or a specific ritual practice but recurred across thousands of years, kilometers, and settlements. This diversity and duration suggests that the motivations to create such objects were constantly evolving. Among ancient Andean civilizations, there were likely significant cross-cultural differences in the ways scale was manipulated and interpreted. Critically, scale itself appears to have become a recursive mode of expression. Although unusually scaled objects were a pan-Andean phenomenon, the issue has not yet been examined at length.

The last and greatest ancient Andean civilization, the Incas, seem to have engaged scale with the most sophistication and complexity. The Incas' capital was Cuzco in what is now southern highland Peru. More ambitious than their predecessors, they expanded in the 1400s to amass the largest empire the region had ever seen and one of the largest empires in the world at that time—stretching along the Andes Mountains from southern Colombia to central Chile (PLATE 5). In 1532, Spanish





SPARKLING VIOLETEAR
(Colibri coruscans)



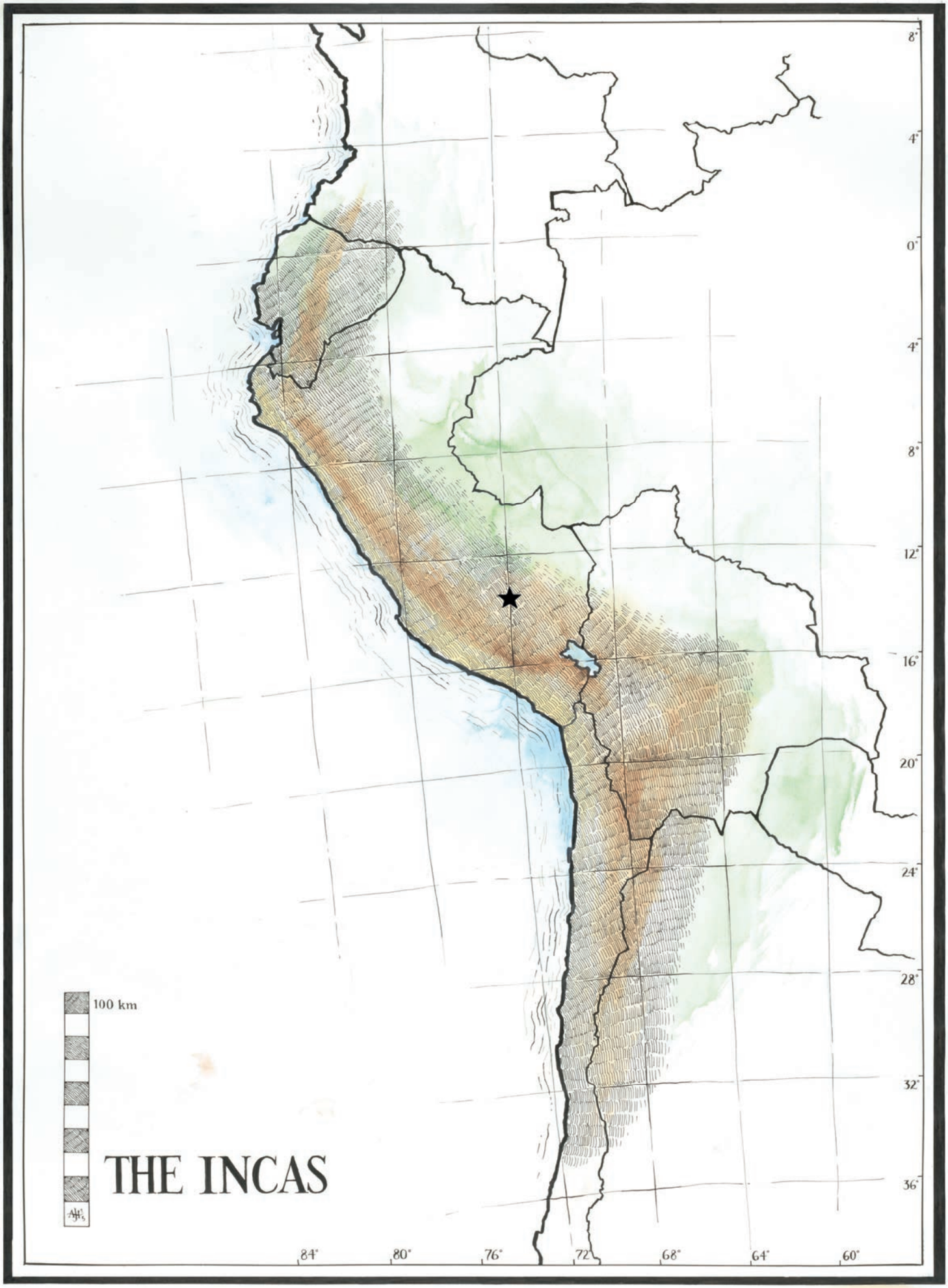


PLATE 5. A Map of the Inca Empire at Its Peak

forces led by Francisco Pizarro infiltrated their realm and abruptly captured their ruler, or Sapa Inca, Atahualpa, who was distracted by a bitter civil war with his half brother Huáscar. In addition to creating the finely dressed human figurines used in Capacocha rituals, Incas carved large numbers of stone figurines of llamas and alpacas, their primary livestock, called *conopas*. In the same way that the Peabody weaving tools were first described as toys, early scholarship mistakenly presented these as mortars or oil lamps because of small cavities in their backs.[10] Scholars now acknowledge them as a sort of receptacle for ritual offerings.[11] Similarly, Incas erected large slabs of rock in front of distant mountains and carved their contours to replicate the towering peaks. These sculptures challenge popular conceptions of either miniature or monumental art—somehow appearing to be both at the same time. They have been dubbed "echo stones," a term that seems to place them in a category by themselves.[12] Issues of scale, however, may not have been limited to Inca material culture and built environments. The Capacocha ritual was perhaps predicated on scale. Such miniature offerings were ancillary to the primary sacrifice: children. Were children regarded as reduced-scale adults? Although highly conspicuous in the archaeological record, these objects and practices are not well understood and have often been marginalized in scholarly characterizations of the Incas. Most importantly, they have not previously been recognized as sharing the same theoretical premise: scale.

Thus, recovering the role of scale in Inca material culture, built environments, and worldviews will not just add to our knowledge of this once great civilization but also may fundamentally restructure our understanding of it. One of the most complex Inca scaled creations, a sculpture called the Sayhuite Stone, has seemed so contrary to scholarly expectations for Inca art that the former director of what is now the Museo Inka in Cuzco insisted it must have been made by an earlier civilization (PLATE 6).[13] The top surface of the tremendous boulder is densely carved with an Escher-like landscape teeming with animals, people, and architecture. Although shaped with great care, the composition lacks a focal point, even appearing haphazard. Unfortunately, many of the figures are now difficult to make out because vandals have chipped away the areas of highest relief—in particular, the heads of the many pumas that loom over the landscape. In contrast, the stone's globular underside appears to have been shaped only by the movements of glaciers. Although the massive carving stands taller than a human being, it seems like a kind of miniature, microcosm, model, or map. Even though it was one of the earliest Inca monuments to have been formally studied and meticulously illustrated in the mid-1800s, it has only minimally informed scholarly interpretations of Inca art. Rather than expel it from the canon as a perceived outlier, the Sayhuite Stone suggests a need to reexamine perceptions of Inca art, to better understand how such an intricately wrought work played a defining role. Considered through the lens of scale, the Sayhuite Stone and myriad other objects and practices stand to redefine the Incas' artistic and intellectual traditions.

The Incas present a rich, if challenging, civilization through which to first examine ancient Andean engagements with scale. Their unprecedented efflorescence at the end of this region's long cultural isolation was the pinnacle of their tradition. What additionally distinguishes the Incas from other ancient Andean civilizations, however, is that they were copiously observed and written about by their Spanish conquerors. As addressed in the note on orthography, writing was not developed in

SAYHUITE, APURIMAC ~ PERÚ
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PLATE 6. The Sayhuite Stone

South America, and other indigenous systems of notation have not yet been fully deciphered. Thus, the Incas are the only ancient Andean civilization for which direct textual evidence is available. These Spanish colonial texts not only reveal histories, ideas, and practices but also describe important artifacts that were destroyed during and after the conquest. These texts are an essential resource for understanding the extent of scale's role in the Inca intellectual tradition. They provide a separate body of historical evidence that can be compared and contrasted with the available archaeological evidence, thus approaching the question of scale from two distinct angles.

Nonetheless, these sources are filtered through Spanish cultural, political, and religious biases of the 1500s and 1600s. Understandably, this perspective adds another dimension to this study. These texts necessarily call into question how European observers culturally interpreted scale when confronting Inca scaled objects. Just as the Peabody registrar misconstrued the scale of the silver tools, these authors certainly bore preconceived understandings of scale that shaped the ways they conceptualized the issue in Inca contexts. Fascinatingly, European authors generally only briefly discussed the scale of Inca objects, and often in belabored prose. Although scholars now label many of these artifacts as *miniatures*, the Spanish word *miniaturas* is surprisingly absent from colonial texts. It is as if the Spanish authors, like the Peabody registrar, saw the objects but did not see the complex implications of their dimensions. Moreover, they do not appear to have recognized that manipulated scales were a common trait connecting many diverse forms of Inca objects and practices. Thus, these texts not only elaborate interpretations of the Inca archaeological record but also elicit comparisons between the Incas' attention to scale and that of their European contemporaries. In so doing, a further comparison is inevitably raised between early modern European theorizations of scale and the way scale is generally addressed by modern scholars working within the European academic tradition.

The study of Inca scale not only stands to recast our understanding of this once prodigious South American civilization but also becomes linked in revealing ways to European thought. It identifies a lacuna in historic and modern conceptualizations of the Incas, takes a first step toward more broadly understanding how scale became a prominent means of signification in the Andes, and invites comparisons with other cradles of civilization around the world. Finally, it makes available theoretical understandings of scale manifest in Inca material culture and built environments as a resource for critical thought in the present. Indeed, scale is emerging as a salient issue in modern and contemporary art and architecture. Over the last century, sculptors, in particular, created increasingly large-scale works due to new industrial manufacturing processes and greater government spending on public art.[14] Henry Moore, for one, took inspiration from found objects to create maquettes small enough to be held in the hands. These sculptures were later cast at much larger sizes determined by the patron and setting, and bearing entirely different dimensional relationships with human bodies.[15] More overtly, Claes Oldenburg and Coosje van Bruggen enlarged inconsequential objects—a clothespin, a lipstick, a button—to the size of great public monuments.[16] Often called "anti-monuments," these sculptures not only problematized the nature of public art but also raised more complex questions about monumentality. The changing character of exhibition spaces has further catalyzed the production of monumental sculptures: cities have sought to rejuvenate declining centers by constructing imposing museums envisioned as focal

points of skylines, international tourist destinations, and locales for the public to congregate in. Dubbed the "Bilbao Effect" in recognition of Frank Gehry's Bilbao Guggenheim, this agenda can make the building's role as a space for exhibiting art seem like an afterthought.[17] Frequently comprised of unwieldy caverns, oddly angled walls, and insuppressible light, they cannot sustain or be sustained by small or fragile objects. Rather, these spaces beckon bold, substantively sized works manufactured from durable materials.[18] Structures like the Tate Modern, the Dia: Beacon, or the Denver Art Museum guarantee the continued global production of large works of art—at least for the life spans of these buildings.[19] Thus, Inca art both brings to the fore and offers perspective on a critical theoretical issue—in fact, universal to all objects—that can be investigated across the discipline of art history, and the humanities broadly, to reveal new points of continuity and difference between diverse cultures and time periods.

SCALE, SCHOLARSHIP & THE "WESTERN TRADITION"

The study of scale, especially in the context of the Incas, raises a number of complex issues about scholarship, the ways it is physically presented, and the cultural heritage of the ideas and terms it employs. Because of the absence of Inca written records, and because of omissions in Spanish ones, it is unknown whether the Incas had a word for *scale*, or relative size. If they expressed reduced scale with a word akin to *miniature*, it is similarly unknown. European authors recorded that Incas used the Quechua words *huchuy* for "small" and *hatun* for "large," as is evident in a number of Inca place-names, but linguists might in the future examine the shades of meaning between "large" and "enlarged" in colonial usage.[20] One well-known example, a site called Huchuy Qosqo or "Little Cuzco," seems to construct an explicit scaled relationship with the capital; however, the ruins only recently received this name, and were previously called Kakya Qawani.

What this means is that dimensional relationships can only be empirically observed as recurring and essential features of surviving Inca material culture and built environments, or interpreted from European accounts of Inca beliefs and practices. *Scale* is the word that best describes this phenomenon in present English usage. Because it is not possible to discuss Inca manipulations of scale using their own terminology, it is necessary to vet and define a scholarly vocabulary to use in this study. Further, because of gaps in Spanish records, many Inca names for particular kinds of objects went unrecorded. The modern words used to label them must be carefully chosen, as these terms inevitably insert such artifacts into broader ontological understandings of objecthood that determine how they will be considered, associated, and valued in the present.

Because of the physical nature of scale, the Incas' material culture and built environments present the greatest surviving bodies of evidence. As a result, art historical methods are the most suited for this study. Be that as it may, the question of how Incas used scale to obtain and demonstrate knowledge is relevant to adjacent fields like archaeology, anthropology, and philosophy, as well as architecture, landscape studies, religious studies, political science, and economics. As a result, it is advantageous to employ a general vocabulary and a clearly articulated theoretical approach so that this work remains accessible to other disciplines, as well as replicable for studies of other societies presented through different corpora of evidence.

As other scholars have recently observed, scale has been infrequently studied in art history.[21] Still others have pointed out that the concept of *scale* is commonly confused with *size*.[22] As a result, scale and its related issues have previously been discussed according to slightly different definitions, for instance, in studies of ancient Chinese art and modern sculpture.[23] Overall, few book-length art historical works have been devoted to the topic, and there have been limited attempts to develop a systematic or comprehensive theoretical approach. Because art historical discussions of scale have often occurred in articles or midway through examinations of other subjects, they can be difficult to locate for specialists of other regions or time periods. Overall, miniatures have received the most theoretical attention.

While art historians have not developed a systematic method of considering scale, because of the interdisciplinary nature of this research, it is important to know whether useful models have been advanced in other disciplines. A cursory survey of recent works suggests scale has raised similar conundrums in other fields. Geographers Robert McMaster and Eric Sheppard have observed that "different concepts of scale are employed in geography's various subdisciplines, making any modern definition difficult. Although much has been written recently on scale in geography, there has been little attempt to integrate across these subdisciplinary perspectives."[24] They further add that, "a major difficulty in discussing scale is the disparate language used by geographers and others."[25] With regard to design and architecture, Anders Munch has stated, "the question of scale has not been the subject of great attention throughout the history of architecture … the guiding principle in architecture has throughout history been that the geometrical shapes were ideals conceived as identical units irrespective of the size in which they were built."[26] In music theory, Alexander Rehding has observed with regard to the melodies of Wagner and Mahler, "it is perhaps surprising that a comprehensive taxonomy of musical monumentality does not exist in the musicological literature. … Despite the significant role that monumentality indisputably plays in nineteenth-century music, it is not a well-defined musicological concept."[27] What is fascinating is how prominent and ubiquitous the issue of scale is in these disciplines and yet seemingly without a history of overt theorization.

These scholars in other disciplines reached a number of important realizations that can inform and strengthen art historical studies of scale. Rehding has suggested that scale possibly seemed so obvious or simple that musicologists saw little need to examine it further.[28] This explanation may well be relevant in the visual arts: scale plays an immediate role in visual perception, often catalyzing a visceral sense of dwarfism or gigantism in viewers, not only potentially bypassing self-conscious critique but also making such analysis seem belabored or redundant. Even Edmund Burke, in 1757, in the opening lines of his discussion of "Vastness" in *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful* observed that the power of greatness of dimension in catalyzing the sublime "is too evident, and the observation too common, to need any illustration."[29] Scale's omnipresence, its blatancy, means it cannot be overlooked but is perhaps only seen as a defining quality of objecthood under certain circumstances.[30] What, then, are those circumstances, and how are they cultivated or invoked by makers?

Cartographic scale provides another case study. Historically, the scale of a map was largely decided by cultural divisions of landscape and the dimensions of the paper, which were determined by the way the map was intended to be used. Only in

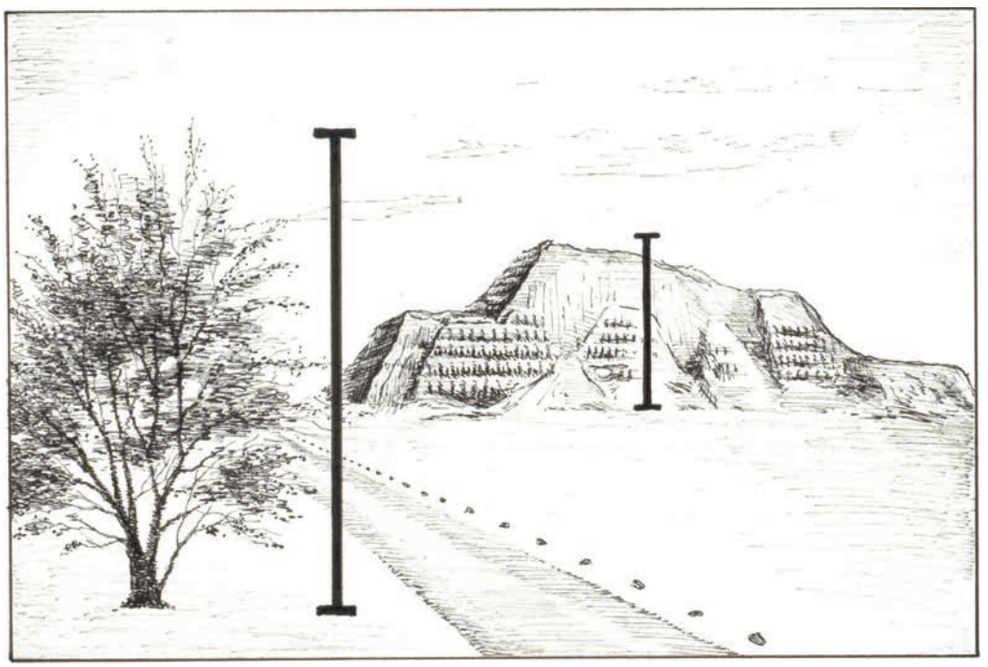


FIGURE 1. Photographs ingrain distance-based diminution. In this composition, the shrub in the foreground is dimensionally larger than the distant Huaca del Sol, a massive adobe temple on the north coast of Peru.

France in the late 1700s did the project of making maps "to scale" and at consistent scales become a priority. The scale of the groundbreaking Carte di Cassini was related through the representative fractions (RF) of 1:86,400.[31] However, individual cartographers still manually determined the level of detail manifest in a map (the smallest islands, cities, or roads)—a process called cartographic generalization.[32] The digital age has thrown cartographic scale into flux. Without a fixed paper size, cartographers have had to create embedded scales that resize along with the image. Additionally, in the absence of a sentient cartographer, it is a challenge to program algorithms that reveal appropriate levels of detail at every scale. (For example, Google's world map shows San Diego, Phoenix, and Dallas, but not the US capital, Washington, DC, or its largest city, New York, due to the congestion of the Eastern Seaboard.) What this suggests is that disciplines that have centrally confronted scale since their inception may negotiate the issue in habituated ways, which may not be reconsidered until they have explicitly failed. Cartography further raises a central concern for art history: How does the visual depiction of objects within

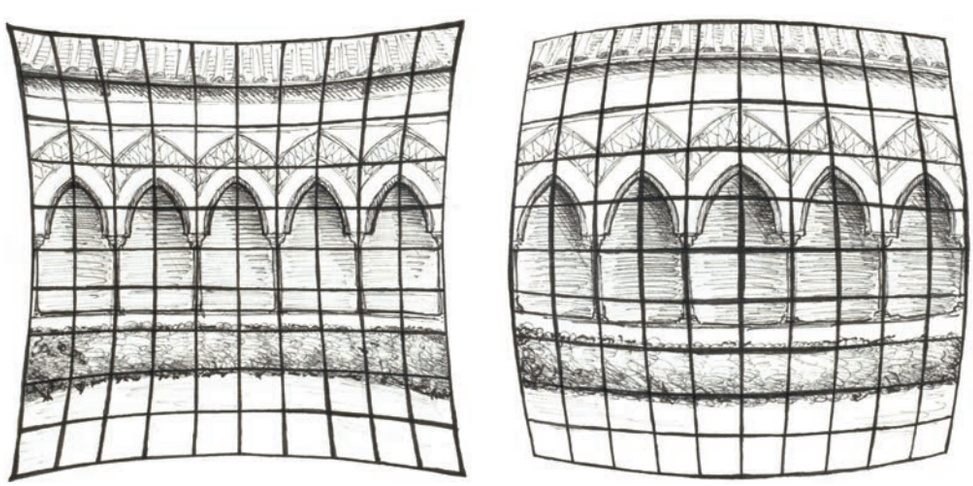


FIGURE 2. Camera lenses introduce pincushion *(left)* and barrel *(right)* distortions. These phenomena are most obvious when photographing geometrically regular objects, like this colonnade from the cloister of Monreale, Sicily. Compositional distortion is more problematic, however, when it cannot be readily visually detected.

scholarship, either on paper or digitally, influence a viewer's mental conception of the object's dimensions and nature?

Just as cartographic generalization was long a self-determined process, so too is the way scale is visually represented in art historical scholarship. The field has adopted conventional approaches to picturing objects that are perhaps not critically considered. Art historians physically examine works, thereby making their scales known, but may overestimate their audience's ability to gauge the dimensions of an object from a given figure or slide. At present, objects are primarily depicted through photographs, which ingrain distance-based diminution and foreshortening (FIG. 1). The mechanisms of camera lenses further exaggerate these phenomena, as different focal lengths introduce barrel and pincushion distortions (FIG. 2). Typically, objects are photographed individually against a featureless background achieved through a sloped piece of white, gray, or black paper (FIG. 3). This apparatus is called an "infinity cove" because of the way it creates the appearance of infinite space devoid of visual cues that might suggest an object's dimensions (FIG. 4). Similarly, rectangular two-dimensional works of art are cropped, removing the picture frame and any sense of the object's relationship with external space. In contrast to fields like archaeology, art historical images rarely include visual scale markers.

In published scholarship, these photographs, scaleless by design, are placed into page layouts and resized so that text blocks can flow smoothly around them (FIG. 5). Side-by-side images attain identical heights regardless of the actual sizes of the objects depicted within. If the backgrounds are white or if they have been digitally erased, it may not be possible for viewers to discern whether the objects in a given layout were photographed simultaneously (and therefore appear at a consistent scale) or separately and digitally compiled (FIG. 6). This makes comparisons of their size either impossible or very misleading. The maximum size that images can attain is dictated by the dimensions of the paper. Full-page detail photographs can depict objects much larger than in real life. While this brings greater visibility to minute details, this new way of seeing is disorienting to those who have never seen the object in person.[33] Measurements of objects are generally only printed numerically in image captions, making this information easy to overlook.

These manipulations of scale remain in effect when teaching art history but are more dramatically distorted by slide projection. Projection enlarges an image based on the arbitrary size of the lecture hall or seminar room (FIG. 7). Introductory survey courses, often classes with the greatest enrollments, take place in the biggest auditoriums with the largest screens. For many viewers, this may be the grandest scale at which a given work is ever seen; to what extent might the scale of projection cultivate the perceived monumentality of "The Canon"?[34] Who has not been surprised by the real-life smallness of the *Mona Lisa* or the largeness of *The Last Supper*? Such a

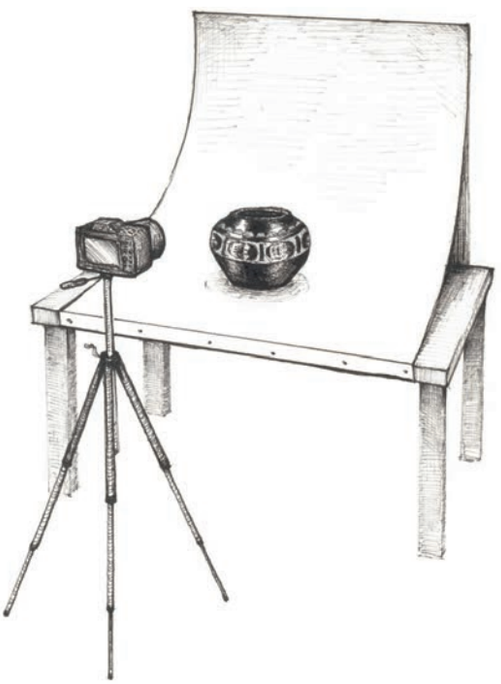


FIGURE 3. Objects like this Maria Martinez pot in the Harvard Peabody Museum are often photographed in an infinity cove to maximally emphasize the object's form without distracting background elements.

FIGURE 4. An infinity cove yields an image that isolates an object in scaleless space, providing little to no visual understanding of its actual size.

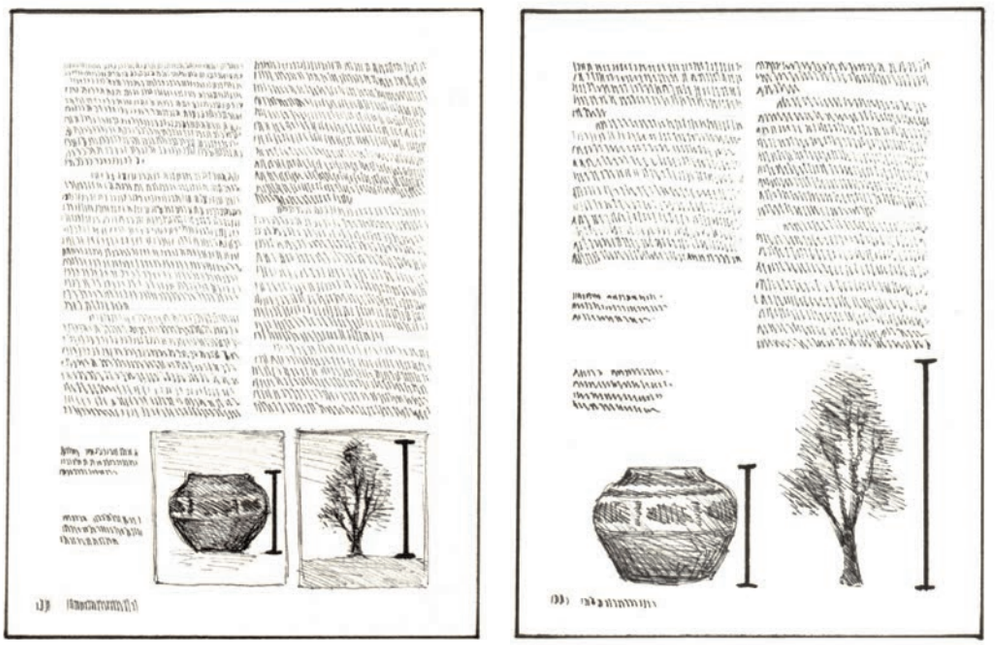


FIGURE 5. Page layouts often distort the apparent scale of objects in adjacent photographs.

FIGURE 6. Digitally erasing the backgrounds of photographs makes it impossible to discern whether objects were photographed together at the same scale, or separately at different scales and compiled.

basic misunderstanding of a work is an explicit failure of art historical teaching and scholarship. Digital slide projection further corrupts the scale of images because files can be continually resized from one slide to the next by clicking and dragging their corners (FIG. 8). When preparing a digital slide presentation, there is the constant temptation to resize images to add a title, label, or reference. Because digital images do not have innate physical dimensions, the representations they convey may never appear at a consistent scale throughout a talk, lecture, or semester. These issues of the digital age recall concerns raised by Jonathan Crary as early as 1990, when he cautioned that technology now allows for the creation of images that no longer bear any reference to the position of an observer in a "real," optically perceived world.[35]

Across the discipline, these practices have been adopted without considering their effect on scholarship. Ultimately, the apparent scale of an object can be simultaneously distorted in at least five superimposed ways: (1) optical diminution ingrained

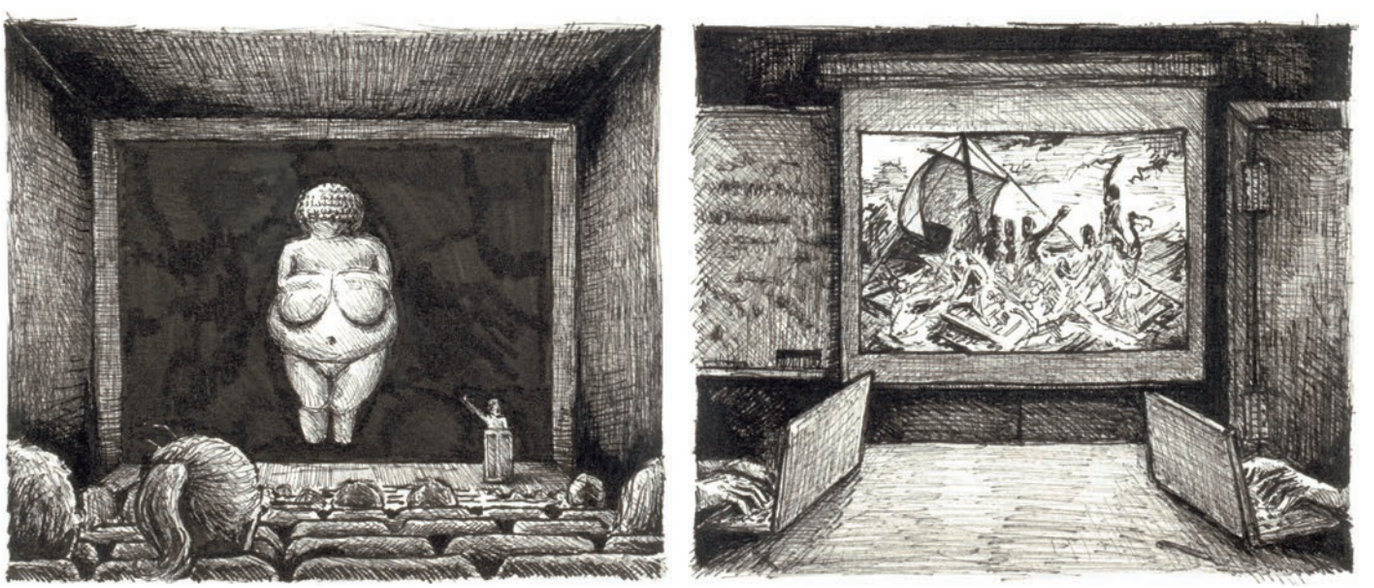


FIGURE 7. The dimensions of classrooms determine the size at which art is first seen, whether drastically enlarged like the *Woman of Willendorf* or greatly reduced like *The Raft of the Medusa*.

in photographs; (2) camera lens distortions; (3) isolation in physical space, cropping, or digital erasing of backgrounds; (4) inconsistent scales between neighboring or consecutive images; (5) and reduction or enlargement based on the dimensions of a page or room. This not only goes a long way toward proving that scale is not widely considered within art history but also suggests that it *cannot* be critically discussed from the current norms of scholarship. The present work analyzes the scales at which Incas created material culture and built environments, but current art historical approaches to publishing photographs of objects would distort or omit critical visual evidence. When comparing the dimensions of objects in different museums, because it would not be possible to photograph them alongside one another, the relationship being discussed would disappear into the white margin of the paper between two photographs. Were it even possible to photograph these objects in a single image, the differences in their dimensions, their placements within space relative to the camera lens, and the focal length of the lens would all distort their apparent dimensions.

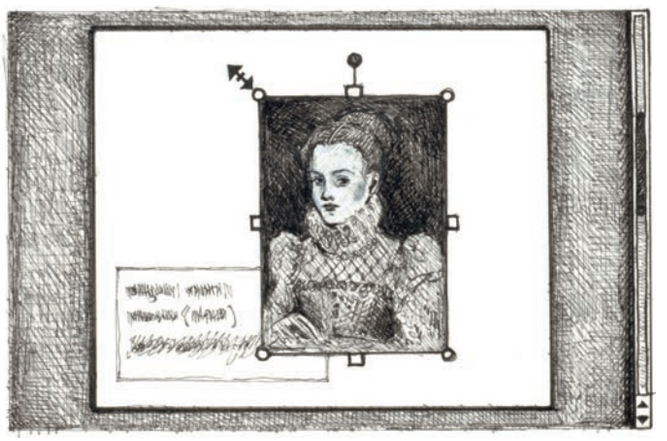


FIGURE 8. Digital slides allow images to be constantly resized within a lecture or presentation, which makes it impossible for viewers to meaningfully interpret their dimensions.

This work attempts to visually document the scale of objects in more deliberate ways. Rather than relying on photographs, it builds a visual argument through analytical illustrations created by the author from firsthand physical studies of all the artifacts. Drawn and painted in graphite, ink, watercolor, colored pencil, and gouache, these illustrations eschew perspective to render objects in a manner similar to architectural elevation drawings. A representative face was selected for each object, akin to an architectural facade. The dimensions of the object that lie parallel to this face were then rescaled and plotted on the surface of the paper. Foreshortening was only incorporated if a critical aspect of an object's structure would be illegible without it (as may be the case with the circular opening of a container). Following John James Audubon's approach to ornithological illustrations in *The Birds of America*, the diagrammatic image was modeled through light and shadow to convey volume.[36] What results is an image that simulates three dimensions, like a photograph, but is produced as if the object were squashed beneath the lid of a photocopy machine.[37]

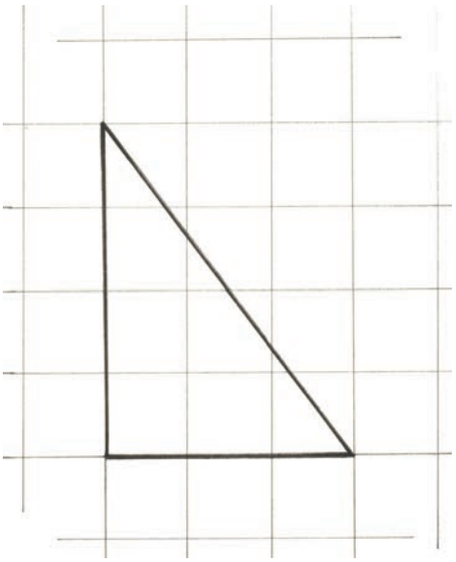
This method of illustration allows readers to make more meaningful visual comparisons of the sizes of objects. Wherever possible, the objects in a given composition are depicted at the same scale, attested by an embedded scale marker. While the approach recalls archaeological atlases of the late 1800s, these forbearers generally expressed dimensional information through lexical scales or ratios, which—like the representative fractions of maps—are rendered meaningless when digitally reproduced.[38] In contrast, the scales embedded in these analytical illustrations remain accurate throughout digital resizing. Additionally, the objects are juxtaposed with silhouettes of human hands and bodies to conjure haptic and phenomenological understandings of their dimensions. These hands and bodies are intentionally modern—fitting a size 8 glove and measuring 180 cm tall—in order to convey scale to a modern viewer. Ancient Andean bodies were smaller in stature. As a result, viewers can interpret the objects' dimensions in at least three different ways: in relation to other objects, to metric measurements, and to themselves.

Simulated foxing has been introduced to fulfill a number of significant functions. The dimensions of the watercolor paper determined the aspect ratio of the trim size of the eventual printed book. This static rectangle is difficult to compositionally structure given the diverse shapes and sizes of the artifacts. The foxing serves to frame compositions, to articulate and punctuate empty spaces, and to visually tether objects to their correct labels.[39] It makes allusion to the heritage of academic illustration in order to provide uninitiated viewers with cues for how to visually interpret them. Moreover, in demarcating the surface of the paper, it is meant to provide a constant visual reminder of the absence of virtual space within the compositions. The objects exist alongside the superficial foxing. Above all, the foxing emphasizes the images' artifice. These analytical illustrations are not "objective."[40] They are an extension of my textual analysis and provide a counterpart to it. They should neither be considered substitutes for photographs nor for the objects themselves. The illustrations seek to provide visual information and analysis not already available through other sources, whether in online museum databases, other published scholarship, or through firsthand examination of artifacts. Should photographs be desired, the accession numbers of the objects are provided both in the illustrations and in the margins of this text, allowing them to be located in the online databases of their respective museums.

Finally, because these illustrations are works of scholarship and acknowledgment of textual sources is mandatory throughout academia, sources of visual knowledge that endow the illustrations are included in explanatory notes at the back of this book. The presence of a note is indicated by a cantuta flower  after the caption.

A variety of disciplines from art history to musicology, cartography, and architecture have observed a need for more substantive theorization of scale. As Dipesh Chakrabarty has acknowledged, much scholarship is written with an inheritance of historically European concepts and categories.[41] This interdisciplinary movement toward developing more systematic understandings of scale perhaps signals a greater historic phenomenon. It is striking that ancient Andean scaled objects perplexed European observers in the 1500s and 1600s, "Western" museums that accessioned these objects in the 1800s and 1900s, and scholars working within the Euro-American tradition in the present day. It is thus worth questioning how European thought has historically theorized physical dimensions, particularly with regard to art and architecture. While the "Western Tradition" is as much a damaging shorthand as characterizations of "non-Western" cultures, specific canonical texts continue to be curated and taught throughout academia as foundational to scholarship. Just as Incas potentially developed their own specialized understandings of scale, so too might these European works theorize physical dimensions in idiosyncratic ways that scholarship now inherits. While a comprehensive examination of scale in European thought is a project unto itself, in the context of this study of the Incas, it is helpful to assess how their European conquerors might have theoretically considered size in order to better understand the ways they wrote about objects and practices they observed. Furthermore, this discussion introduces a number of key European concepts that can be built upon to show how Inca uses of scaled relationships provide a valuable resource for critical thought.[42]

Perhaps the most influential early European understanding of physical space was, and still is, geometry. Compiled by Euclid around 300 BCE, *The Elements* documented the relationships between lines, angles, and figures plotted within invisible



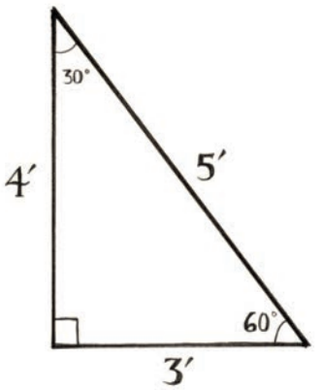


FIGURE 9. A 3-4-5 right triangle plotted in geometric space

FIGURE 10. A right triangle measuring 3 feet by 4 feet by 5 feet

planes. Euclid's proofs produced these shapes without numbers—what is now called "synthetic" geometry. As a result, the figures did not have specific sizes but existed as scaleless spatial concepts. To gauge Euclid's impact on art and art history, it is only necessary to peruse the opening pages of canonical works like Vitruvius's *Ten Books on Architecture* from the first century BCE, Alberti's 1435 formulation of perspective in *On Painting*, and Dürer's 1525 *Treatise on Measurement*, itself foundational to his *Treatise on Human Proportion* completed in 1528, which all directly cited Euclidean geometry as the foundation of artistic knowledge.[43] In the European sphere, artists and intellectuals have long been instructed to think geometrically about the forms of objects.

When applied in the concrete world, geometry takes on fixed and measurable intervals. René Descartes later formalized this analytic approach with the introduction of the coordinate plane (FIG. 9). Through measurement, a 3-4-5 triangle transforms into one conceived as 3 feet by 4 feet by 5 feet (FIG. 10). Measurements are now the primary way sizes are considered. They may even be mistaken for sizes—but this is not the case. The present world is so distanced from the advent of measurement that the prototypes forming each kind of unit may be forgotten. A "foot" does not innately or abstractly exist but is a cultural convention invented by certain societies and derived from the size of a human foot. Something that is 3 feet long is actually being compared to the cumulative length of three physical human feet, making measurement a comparison of relative size—which is to say, scale.[44] Scale is the very basis of measurement; however, this is not widely acknowledged because the inherent relativity and subjectivity of scale is what measurement, with the aid of a prototype, seeks to overcome.[45]

Geometric thought often encourages working from a whole to solve for a part. If one angle and one side of a right triangle are known, the unknown lengths of the hypotenuse and the remaining side can readily be solved for. When Dürer, in his *Treatise on Measurement*, set out to teach his readers how to estimate the height of a tower, this was precisely the technique he detailed.[46] He recommended that a giant invisible right triangle be plotted in real space, in which the tower served as one side (FIG. 11). By determining the lengths and angles of this phantasmal shape, the size of the tower could be mathematically derived. What this means, however, is that rather than contemplating the height of the tower outright, it became subsumed into

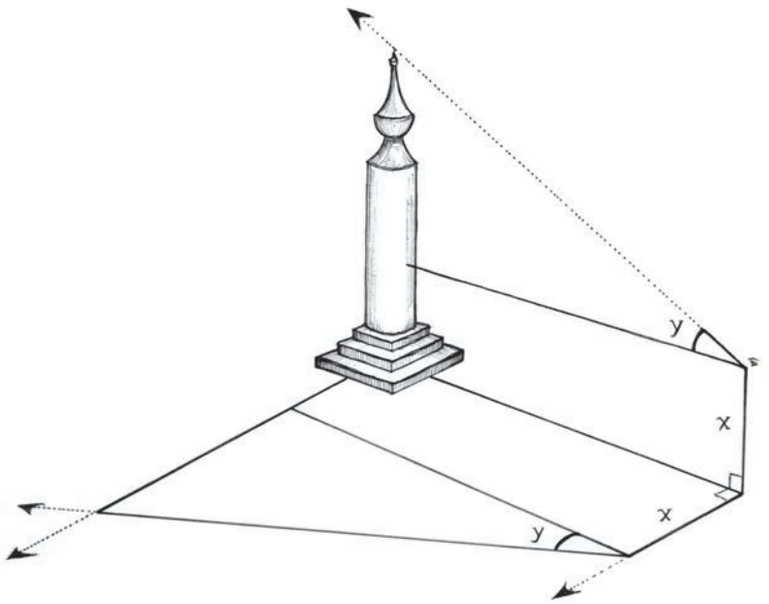


FIGURE 11. Dürer instructed that viewers, standing at right, should measure their distance from the tower and use an astrolabe to determine the angle of the sightline to its top. Plotting this distance and angle laterally along the ground allowed the height of the tower to be similarly measured laterally.

a larger geometric figure. Geometry promulgates internal thinking: the internal relationships between parts of a figure are often more useful than its external relationships to other figures.

Since European antiquity, these internal relationships have been discussed as proportions, and, as Anders Munch observed, are paramount to the way art and architecture have been conceptualized.[47] In his immensely significant architectural treatise, Vitruvius described proportion as the relationship of the "module" to the whole.[48] All of his instructions stated how many modules should comprise various elements of a building rather than providing absolute sizes. Critically, modules were not fixed units but, for a Doric temple with six columns, 1/42 of the width of the facade.[49] Each column should be fourteen modules tall and two modules wide (FIG. 12). In theoretical terms, this approach to architecture, these repetitions of parts apportioned within a whole, was inspired by the proportional relationship perceived between parts of the human body and the body overall.[50] Vitruvius argued that just as the foot was idealized to be one-sixth of the height of a person, the height of a column should have a prescribed fractional relationship with a facade to achieve visual harmony.[51] The practical virtue of this approach was that any builder could follow Vitruvius's text to create any building of any size because the instructions were always relative. Conceptually, his structures existed at all scales. In practice, the absolute size of a building was perhaps a foregone conclusion determined by factors like the land available at a building site. As a result, discussion of the relative size of one building to another was not a priority.

Vitruvius only discussed absolute sizes when the sizes of human bodies complicated his fundamentally relative approach. Although he instructed readers how to build visually harmonious buildings at any scale, the finite sizes of human bodies meant certain elements within buildings should not be infinitely rescaled, such as stairs, parapets, and passageways. This constraint periodically forced him to issue correctives so that particular rooms would not grow too large for the activities that would transpire within.[52] Similarly, he provided different rules for determining the curvature, or entasis, of columns depending on their heights, due to the finite height of human viewers and the changing visual effects of taller and taller columns.[53] The

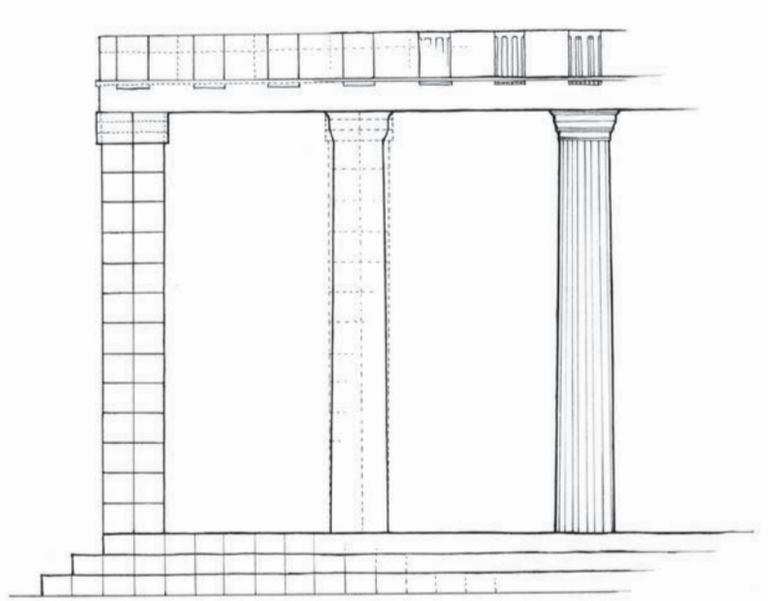


FIGURE 12. Vitruvius conceptualized each element of a building's design as repetitions of a module. This approach maintained the building's internal proportions when the design was constructed at any scale.

irony is that Vitruvius used the internal proportions of the human body to inspire the internal proportions of his architectural structures, but the absolute sizes of human bodies perpetually confounded the absolute sizes of his architectural structures. In these moments, he acknowledged the potential scales of his buildings, but only to maintain consistency in their functions and visual effects.

But perhaps the most influential way that the European intellectual tradition has theorized size, particularly with regard to the creation of art, was the development of "perspective." Leon Battista Alberti's formulation of one-point perspective in *On Painting*, completed in 1435, united many of these theoretical trains of thought, instructing artists how to manipulate the relative sizes and shapes of objects within compositions to create the illusion of three-dimensional space upon a two-dimensional surface.[54] He approximated vision as a cone or pyramid, and argued that at whatever distance from the eye this cone might be bisected by a picture plane the composition would be proportionally the same (FIG. 13).[55] Vision was a continuum. This conceptualization resonates with that of Vitruvius: just as his relative approach implied that "good" architecture retained its merit at any absolute size, Alberti considered a successful perspectival rendering "accurate" at any absolute size. What mattered were the internal proportions, not the theoretical implications of its external relationships—its scale.

And yet, as was the case with Vitruvius, the absolute size of the human body, the distance between the eye projecting this cone of vision and the canvas, in some

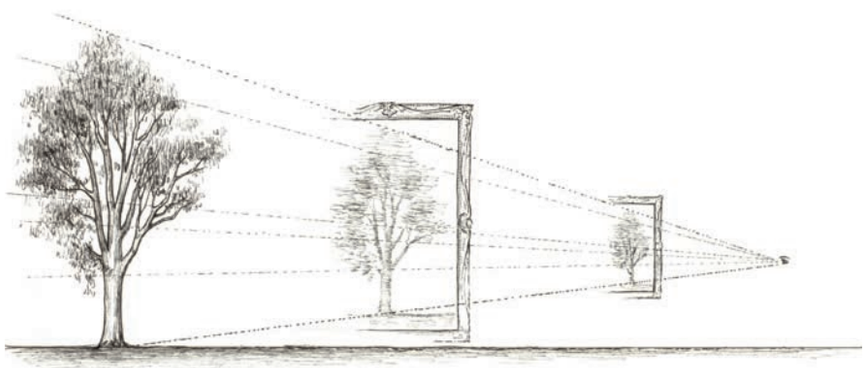


FIGURE 13. Alberti theorized a cone or pyramid of vision that reproduced a proportionally identical composition at any scale.

FIGURE 14. When standing over the appropriate point marked on the floor, the perspectival projection painted by Andrea Pozzo on the ceiling of the Chiesa di Sant'Ignazio di Loyola in Rome creates a convincing illusion *(left)*. From other points within the nave, the illusion collapses *(right)*.

ways thwarted Alberti's project. Perspective is predicated upon Euclidean space. The receding orthogonals are only mathematically "correct" when the viewer's eyes occupy the single dimensionless point at the tip of the cone, a geometric impossibility given binocular vision.[56] From any of the other points in front of a painting where viewers might stand—the entirety of geometric space minus one dimensionless point—the attempt at perspective is ineffective and mathematically inaccurate. This understanding was made painfully clear by Andrea Pozzo in his painted ceilings of the Chiesa di Sant'Ignazio di Loyola in Rome.[57] The illusionistic space he created through perspectival projection only makes sense when standing at a particular spot marked on the floor (FIG. 14). The conceit of a perspective painting's composition is an imaginary eyeball detached from a brain perpetually suspended in front of a canvas (FIG. 15).[58] But, to recall the ways art history is often taught, the Albertian cone of light that emanates from a projector's lens casts shadows on the wall of a darkened lecture hall like Plato's cave, all but eradicating questions of scale (FIG. 16).

Elsewhere, Alberti encapsulated the lacuna surrounding European theorizations of scale when he noted: "a very small man is proportional to a very large one; for there was the same proportion of span to stride, and of foot to the remaining parts of the body in Evander as there was in Hercules, whom Cellius conjectures was taller and bigger than other men. Yet, the proportion of the limbs of Hercules was no different from that of the body of the giant Antaeus, since the symmetry from the hand to the elbow, and the elbow to the head, and all other members, corresponded in both in similar ratio."[59] That is, Alberti discussed figures of normal, large, and enlarged statures, yet rather than contrasting their physical differences equated their physiques on the basis of similar internal proportions. This anecdote illustrates how theorization of scale might be bypassed through more dominant cultural interests in adjacent concepts like proportion, ratio, measurement, and geometry.[60]

Although these texts are a mere cross-section, they capitulate a number of fundamental ways physical dimensions were theorized in the European sphere, at least up to the so-called discovery of the New World. In these examples, art and architecture

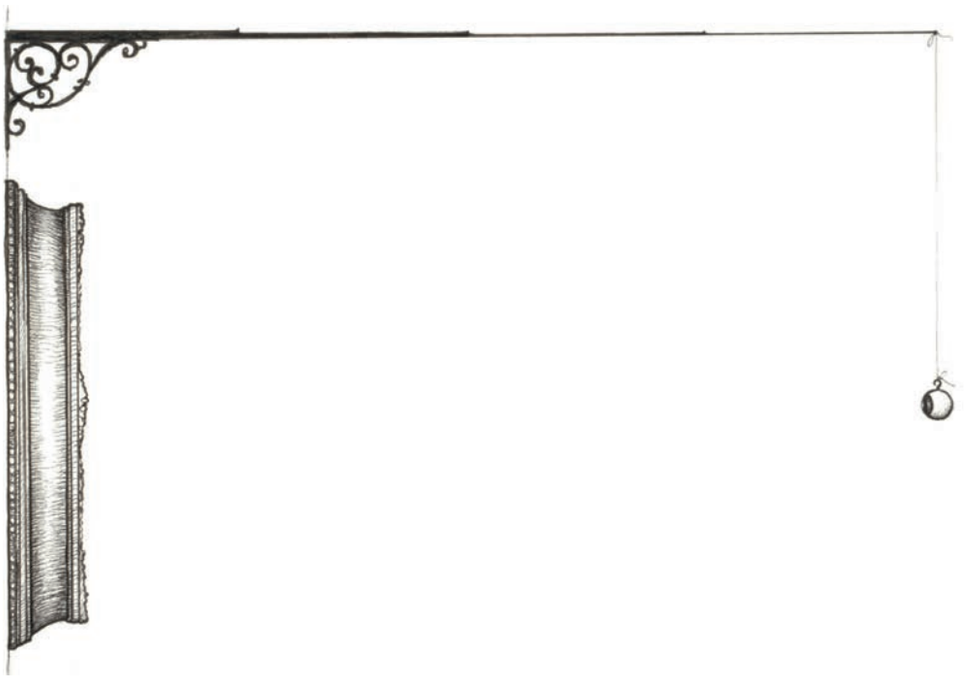


FIGURE 15. A perspective on perspective

were repeatedly conceptualized as existing at all scales simultaneously, making analysis of the size of one work relative to another less relevant. While these influential discussions of geometry, ratios, measurements, and proportions acknowledged issues of scale, even in sophisticated ways, they elided straightforward presentation of it as a basic concept.[61] This suggests European observers of the Incas in the 1500s and 1600s might not have been primed to recognize or interpret the ways Incas embedded and expressed knowledge through scale. Although Spanish chroniclers regularly acknowledged manipulated scales in Inca material culture and built environments, they rarely sought to explore its cultural, intellectual, or ideological implications. What will be shown in the following chapters is that Incas invoked scale in quite different ways, such that the concept might not have had the same valences it did for their European contemporaries. Inca attentions to scale present a corpus of objects, practices, and beliefs that may provide new ways of considering scale in other cultural contexts.

The etymological history of the word *miniature* further makes clear that colonial Spaniards did not have access to modern scholars' vocabulary for describing the

FIGURE 16. Art History, Alberti, and the Allegory of the Cave

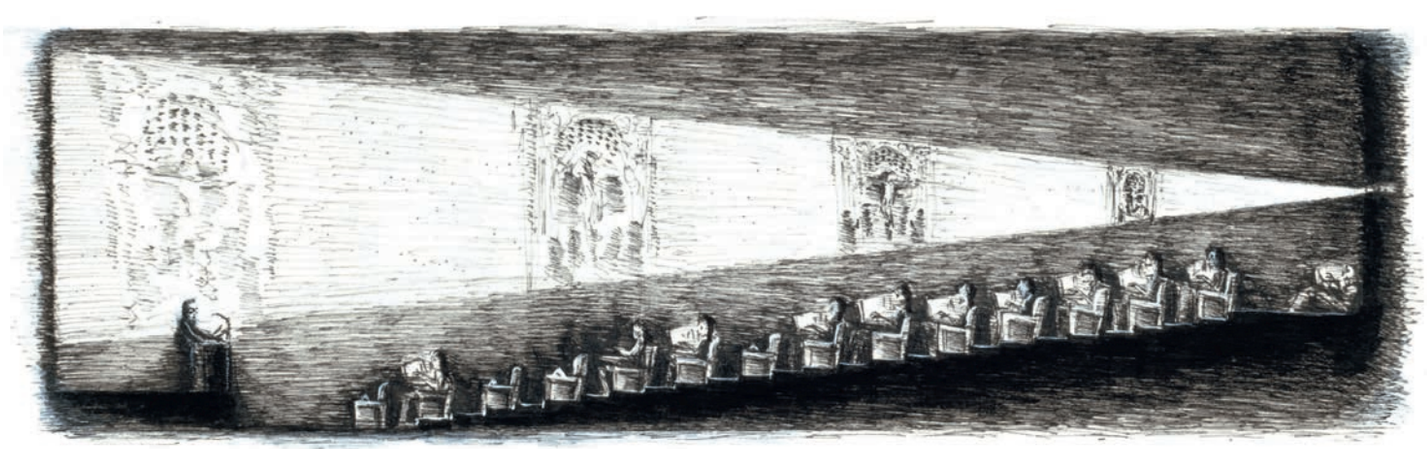


FIGURE 17. The Rio Miño or Minho

Incas' material culture. They never used the Spanish word *miniaturas* because this meaning had not yet been invented.[62] While it might be assumed that *miniature* is an ancient word derived from the Latin root *minus*, meaning "lesser than," it is actually born out of *minium*, a word used by Pliny in his *Historia Naturalis* in the year 77 to describe lead oxide and other red minerals associated with the Rio Miño, which partially separates Spain from Portugal (FIG. 17).[63] In medieval Europe, red lead was made into ink for rubricating manuscripts (FIG. 18).[64] The artists who used minium ink became known as miniaturists—not because their drawings were small in scale but because they were red.[65] When these artists became successful creating portraits in the 1500s and 1600s, their paintings became known as portrait miniatures, again, not because of their scale but because of the occupation of their makers. Claude Lévi-Strauss famously used François Clouet's portrait "miniature" *Elisabeth of Austria* as an archetype for reduced scale, calling it a *modèle réduit* in the original French, but this argument was somewhat anachronistic.[66] Clouet, who completed the painting in 1571, was one of the first of these book and portrait miniaturists.[67] The word *miniature* only gained connotations of referentiality and reduced scale after this professional transformation, and was eventually adopted as a loanword in most major languages.[68]

What this means is that the array of Inca objects now described as miniatures were never ontologically associated in this way by either colonial Spaniards or by the Incas themselves. When this word is applied to Inca material culture, scholars not only perform an act of conceptual translation but also curate a selection of objects according to the present definition of the word.[69] This definition is not simply something reduced in scale. Rather, reduced scale is bundled together with vestigial traits from the word's earlier meanings.[70] Miniatures are expected to be reduced in scale with regard to their referents, small in size relative to human bodies, like portrait miniatures, and highly detailed, like book miniatures.[71] There is no way of knowing if this multifaceted definition would have been synonymous with an Inca concept. Although Incas made some objects that to a certain degree meet this description (such as conopas), they may also have made objects that bucked it, but that they nonetheless considered conceptually or theoretically related (such as the stone slabs replicating mountains measuring many meters tall). Referring to one as a miniature but not the other imposes an academic differentiation upon material that Incas themselves may not have recognized.

Miniatures have been previously theorized as a cross-cultural class of objects, but in actuality the word only describes this set of shared morphological traits. Different societies might create different kinds of objects with these same formal characteristics for entirely different reasons.[72] Thus, declarations of what miniatures are or signify might not be universally applicable, such as Lévi-Strauss's assertions that "all miniatures seem to have intrinsic aesthetic quality," and that by "being smaller, the object as a whole seems less formidable. By being quantitatively diminished, it seems to us qualitatively simplified."[73] While these statements may prove true in particular circumstances, scale has been studied so infrequently that they risk

FIGURE 18. Ground minium pigment from an artists' supply shop

homogenizing the views of diverse societies in the meantime. To attempt to recover Incas' emic understandings of scale, these objects and spaces must be studied on their own terms—even if a terminology to do so is not immediately accessible.[74] It may be prudent, therefore, to develop a more generic concept of reduced-scale objects, a genus that miniatures, certain kinds of toys, and other objects of diverse functions could be subsumed within.

Finally, the etymological transformations of *miniature* also highlight that a clear counterpart was never commandeered to describe things enlarged in scale. The terms *bigness*, *immensities*, *the gigantic*, and the Wagner Effect have all been advanced, although *monumental* is most often used in art history.[75] Just as *miniature* gained its meaning from the smallness and referentiality of portrait miniatures, *monumental* relates things to the sizes of public monuments. This usage dates from the 1600s, or around the time that *miniature* began to connote reduced scale. The scaled relationship between these extremes, however, is the most linguistically amorphous: things that are *life-size*, *natural size*, *actual size*, or *to scale*.

This constellation of works and words suggests that when Europeans first encountered the Incas in the early 1500s, dimensional relationships between objects and their implications were not being widely or deeply theorized in European thought.[76] But this was perhaps changing: a number of scholars have drawn attention to innovative ways that woodblocks were used to replicate images at precise and significant scales throughout the late 1400s and early 1500s.[77] Similarly, although life casts had been created since antiquity, this scaled process took on greater significance in the Renaissance as artists sought to imitate or replicate nature.[78] As portrait miniatures began to emphasize reduced scales in the late 1500s and early 1600s, scale became a more salient and conspicuous issue in Flemish painting and Italian sculpture.[79] As Susanna Berger noted after reading an early draft of this text, the 1600s saw the inventions of both microscopes and telescopes, which dramatically extended our ability to perceive extreme scales.[80] Galileo's *Starry Messenger*, completed in 1610,

was the first scientific work to publish findings made with a telescope, while Robert Hooke's *Micrographia* of 1665 was the first successful publication of observations made through a microscope. It is particularly notable for its stunning illustrations, a number of which unfolded to much larger than the book.[81] Jonathan Swift's *Gulliver's Travels*, published in 1726, suggests that by the early 1700s, scale shifting had become more popularly contemplated. Swift attested to the influence of microbiology in his portrayal of Lilliputians as flea-like acrobats who could jump many times their body lengths. Even so, the English word *miniature* appears only once and, true to its roots in portraiture, was used to describe Gulliver's appearance.[82] Voltaire penned a largely derivative short story called *Micromégas* in 1752 that emphasized the impact of astronomy through its portrayal of a giant extraterrestrial visiting differently scaled planets.[83] These narratives of exploration suggest that encounters with remote cultures like the Incas played a role in catalyzing theoretical contemplation of scale in Europe. Indeed, Swift aligned his tale with the discovery of the New World by placing Brobdingnag in the one corner of the globe where a large landmass could remain hidden: the northwest coast of the Americas.[84]

This brief analysis of European theorizations of physical dimensions, and the implications these bodies of knowledge hold for texts written by European authors about the Incas in the 1500s and 1600s, establish a number of important premises: first and foremost, dimensions of objects can be considered in culturally specific ways. While significant dimensional relationships can be empirically observed in Inca material culture, it is important to consider how to analyze them without further imposing European perspectives. As Dipesh Chakrabarty has stated of other Eurocentric scholarly terms, existing vocabularies and theoretical frameworks are "both indispensable and inadequate" for analyzing the Incas' intellectual engagements with scale.[85] Additionally, the curious absence of colonial Spanish theorization of Inca attentions to scale has a fascinating historical explanation: Spaniards themselves may not yet have been considering the scale of objects and spaces in so direct or theoretical a manner, making it unlikely they would overtly analyze Inca practices. Finally, the complex ways Incas used scale to create and convey meaning make it necessary to develop a more systematic theoretical framework for analyzing scale, as well as for visually documenting it in published and presented scholarship.

A THEORY OF SCALE

To discuss the role of scale in Inca art and thought, especially without the words and concepts the Incas used, and in the absence of systematic art historical studies of scale that could serve as a model, it is necessary to broadly consider what scale is, how it can be art historically examined, and what vocabulary is most useful in this endeavor. A theoretical framework can be distilled by considering scale at three levels: first as an abstract concept, then as an experienced phenomenon, and finally as an interpreted quality.

Scale in the Abstract

As a number of scholars, critics, and artists have noted, the concept of *scale* is often confused with *size*.[86] Although the two are intimately related, they have very different properties and effects. The most relevant definition of *size* in *The Oxford English*

Dictionary is "II. 10. a. The magnitude, bulk, bigness, or dimensions of anything." In short, size is the absolute dimensions of an object. Size is an intrinsic and physical property of an object that remains constant both in isolation and in the context of other objects.

In contrast, the most relevant definition of *scale* is "III. 12. a. Relative or proportionate size or extent; degree, proportion." The key words are *relative size*. While size is the absolute dimensions of an object, scale is the size of an object compared to the size of another object (FIG. 19). Because scale is relational and requires one object to be compared to another—unlike size—an object in isolation cannot have a scale. What would it be compared to? In contrast to size, scale must be an extrinsic quality of objects and therefore not a physical property. If so, scale is not a constant.

The shortcoming of this definition is its use of the word *proportion*. Just as size and scale have become confused, so too have scale and proportion. However, proportions, as they were historically discussed, are dimensional relationships within an object's composition. It is useful to maintain this definition. While scale is external, proportion is internal. As a result, scale and proportion have different properties and must be studied in different ways: the proportions of a painting's composition can be discussed from a projected photograph; the scale of the painting cannot. Separately defining these phenomena allows physical dimensions to be discussed in more nuanced ways. An object that is dimensionally small or even "miniaturized" in scale can bear exaggerated internal proportions that give it a "monumental" appearance.

Measurement has a complex relationship to size and scale.[87] Often thought of as size, measurements are comparisons to prototypes, and an issue of scale.[88] Societies invent systems of measurement to make judgments of scale less subjective, more uniform, widely intelligible, and replicable.[89] Societies also impose standard practices for taking measurements: such as height, length, and width; however, these are subjective choices. An object could equally be measured by circumference or surface area depending on what aspect is of greatest interest. Furthermore, the accuracy of these measurements is contingent on the precision of the tool used to take the measurement.[90]

Scale can be conveyed in a number of ways. At its most basic, scale is described through words like "small" and "large." Because these adjectives are inherently relational, they do not truly refer to an object's size but its scale.[91] Specificity can be achieved if the dimensions of one object are directly used to determine the dimensions of the other object. The resulting comparison might be related as a numerical scale, such as 1:48. This states that one object is 48 times the dimensions of the other. Measurement can impart even greater precision, such as the measured scale "1 inch is equal to 1 mile." These examples suggest further reaches of the abstract topic.

Scale in Practice

In the abstract, scale is the size of one thing relative to the size of something else. In practice, this comparison is always perceived by someone within a specific spatial context. As such, both the human body and the physical environment play critical roles in the way scale is functionally perceived.[92]

First, all humans must be able to perceive scale, as less evolved animals can judge the size of prey or predators. Moreover, scale is not a culturally learned concept but one that is universally experienced. Regardless of your culture, gender, education,

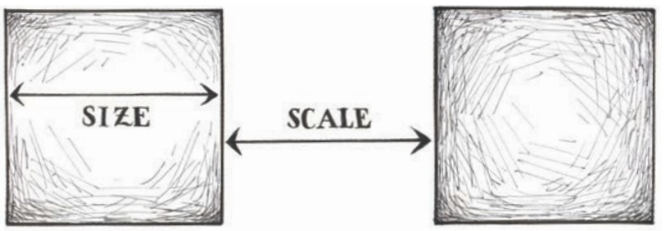


FIGURE 19. The difference between *size* and *scale*

or religion, you were once smaller than you are now. The human condition from infancy to adulthood is marked by a change in size. Thus, the question is not whether societies perceive scale but how.

As growth suggests, the body's role in perceiving scale is paramount. Our size determines our frame of reference and is commonly used for comparisons, especially in units of measurement. We thus perceive scale in different ways at different points in our lives. This change in size, as well as maturity, becomes a measure of social identity. Adult societies perceive the reduced scale of children in socially constructed ways. Childhood is a form of otherness. Because children live in an adult-sized built environment that is for the most part improperly scaled to the sizes of their bodies,[93] their perception of the scale of the world is fundamentally different from that of adults.

Our bodies, through sensory organs, allow us to perceive our environment. The majority of information about scale reaches our brain through vision, because it is ongoing and limitless in the number of objects it observes. Touch, however, is critical for sensing scale and is often more accurate than vision. Vision estimates scale, but touch allows the spatial dimensions of an object to be directly, physically equated with the dimensions of our fingers, hands, arms, and so on. While at any given moment vision assesses scale from a single point of view, touch determines scale in three dimensions.[94] When selecting between numerous similarly sized objects, such as at a fruit stand, it is often more efficient to compare sizes manually.

Cultural identity can affect the way minds are trained to perceive scale. A classic psychological study demonstrated that cultures can be differently susceptible to optical illusions predicated on scale.[95] Euro-Americans, for instance, have been reportedly more inclined to see the Müller-Lyer illusion, where the direction of the arrows causes one line to appear longer than the other (FIG. 20). In contrast, members of developing societies in Africa have been found to be more likely to see the horizontal-vertical illusion, where the vertical line seems longer than the horizontal one. What is perhaps most interesting about these illusions is that our minds remain susceptible to them even once their true natures are revealed.

This study connected these apparent cultural differences in scale perception to the second major influence on the experience of scale: spatial context.[96] Specifically, to explain Euro-American susceptibility to the Müller-Lyer, the authors proposed a "carpentered-world hypothesis." Noting that right angles are uncommon in nature but ubiquitous in urban environments, they suggested a tendency to see the arrows as orthogonal lines, in the fashion of Alberti. Thus, the inward-angled lines looked like the near edge of a box, while the outward-angled ones resembled its far edge. Because the apparent size of objects diminishes with distance, Euro-American minds perhaps suspected the "farther" line of being longer. Conversely, the researchers explained the susceptibility of African subjects to the horizontal-vertical illusion through "the foreshortening of receding horizontals." Because they lived in plains devoid of vertical lines, the researchers hypothesized that they intuitively read the illusion as existing within a flat space—such that the "vertical" line appeared to be a horizontal one extending far into the distance. Although these explanations seem highly reductive, differential cultural susceptibility to optical illusions has since been replicated on many occasions.[97] Most relevant here, perhaps, was a study conducted

in the Andes between people living at 1,300 m and 4,000 m, which further evidenced environmental influences on perception.[98]

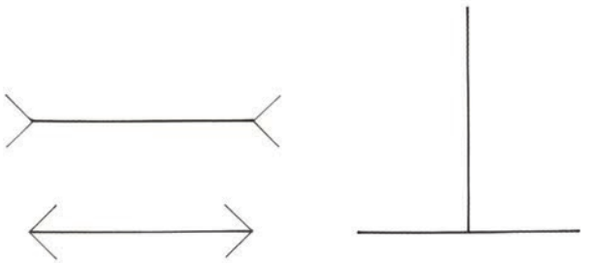


FIGURE 20. The Müller-Lyer and Horizontal-Vertical illusions

As these psychological studies encountered, experiences of spatial contexts are challenging to quantify because they are so personal, transient, and cumulative. An object may loom large in an interior space but be minimized in an open exterior. This shift can only be perceived by an individual who experiences the transition and is further interpreted in relation to memories of past spatial experiences. Whereas the dimensions of human bodies vary within a narrow range, the topographical scales of landscapes vary widely, from mountains, to plains, to canyons. Moreover, landscapes are inconstant and can change through processes like deforestation and desertification. Urbanization presents a spectacular new range of heights, extents, and densities. How is the scale of condensed Hong Kong experienced in comparison to the sprawl of Los Angeles? In studies of archaeological civilizations, environmental scale is a critical issue that must be considered even if it is challenging to reconstruct.

But perhaps the most pivotal way experiences of space have changed over time is through technological and scientific advances. Trains, cars, planes, and space travel have drastically expanded a person's potential purview. Landscapes can be taken in more quickly and disjointedly than ever before. Far greater swaths of the globe can be witnessed and wandered in a single lifetime. At the same time, microscopes and telescopes of the 1600s have been dramatically surpassed. Physical dimensions have not only exceeded what the body itself can perceive but also what the mind can realistically comprehend. How small is a neutron compared to an electron? How can the earth's 12,700 km diameter be meaningfully related to the sun's 1,391,000 km diameter, let alone the 150,000,000 km between them? Our ability to study space has exceeded our ability to conceptualize it. Informed by this knowledge of the universe, is it possible to gaze upon a mountain peak with the same appreciation or awe that might have been felt even just a few centuries ago, for instance, by Joseph Addison in his formulations of the Sublime—or has the Sublime been sublimated? [99]

Scale & Meaning

Scale matters. To gain a sense of how scale might take on a variety of symbolic meanings in different cultures, it is helpful to consider parallel studies of color. Like color, scale is not an intrinsic property of an object but is external and a result of human vision.[100] The color of an object can appear differently in different contexts, and so too can its scale. Although colors and scales exist in continuous spectrums, both are often conceptualized in segments of their ranges. Cool colors can be soothing and warm colors agitating, just as some scales seem to be inviting and others imposing. The color spectrum can be divided into red, yellow, and blue, just as scale might be parsed as small, medium, and large. These distinctions, however, of *cool*, *warm*, *red*, and *blue* are culturally determined. Just as some cultures never distinguished certain colors, such as the Mayas' blue-green, there is the potential for different cultures to conceptualize scale in different ways.[101] Moreover, when colors are repeatedly associated with certain

objects and ideas in a particular cultural context, they can take on these symbolic meanings: red suggests love, black signifies death, green means ecofriendly. But again, these associations are neither culturally universal nor temporally constant. Furthermore, individual colors can have multiple connotations even within the same culture—while red suggests love, it can also signify anger, stop, and heat. Scale's expressive capacity has the potential to be equally dynamic, contradictory, and edifying to art historical study.

Although scale infinitely exists between all objects in the universe, only some of these relationships are considered salient. When a person assesses the scale of something, the process reveals the way the object is both perceived and conceived. The constellation of other things used as points of comparison indicates how he or she conceptualizes the object. These may include things related ontologically, similar in appearance or function, near in physical space or recent time, from a distant memory, or simply the person's own body. Because two individuals might relate an object to different contexts, it can be perceived to have different scales simultaneously. Two people could also agree on the scale of an object, but judged against different contexts. For this reason, scale is significant to art historical scholarship because, more explicitly than other perceived qualities like color or composition, scale indicates how a work of art is observed, how it is classified, and what significance it is believed to have. Scale invests size with subjective interpretation, allowing scale to become a fundamental part of meaning.

All works of art can be perceived to have meaningful scales. They might be considered in relation to their oeuvre, to contemporary works by other artists, to a lineage of preceding objects, or to the works they later inspired, resulting in any number of interpretations. Scale is additionally a critical consideration in exhibition design, as the relative sizes of neighboring works and exhibition spaces can influence the ways the scale of a work is perceived. These issues might be generally described as "scale" and are omnipresent in art historical study. Certainly, such considerations of scale would have been as prevalent in Inca society as in any other. Be that as it may, this work argues that Incas developed more advanced interests in scale that exceeded these quotidian examples, discussed in the following chapters as scaled relationships.

If meaning can be interpreted from scale, it can also be intentionally conveyed by it. While the scales of most objects are openly compared to any number of things, some objects are perceived to have a specific scale in relation to a particular object. So-called miniatures are one example of a scaled relationship, as are some children's toys, like dolls, dollhouses, and playhouses. Models also create scaled relationships with their subjects, such as train sets, architectural models of proposed buildings, mock-ups and prototypes of manufactured objects, scientific models of anatomical, cellular, or atomic structures, as well as dioramas and many museum exhibits. Maps, globes, and model solar systems document the scale of the earth. Casts, facsimiles, and mannequins, as well as theatrical sets, props, masks, and costumes, are created at particular scales that determine their function and meaning. They are not just representations but, through a variety of human behaviors, including sacred belief, make-believe, playing, acting, and scientific study, are interpreted as scaled re-creations. Were their scales to somehow change, so too would their utility and meaning.

When examining our own culture, it is perhaps not necessary to describe such objects collectively or generally. Their specific names and purposes are already known. When analyzing a foreign or ancient artifact with an empirically salient scale, however, it is useful to have a generic term that acknowledges this relationship without projecting a cultural interpretation. A scaled object could be said to appear to be another object at a manipulated scale. More specifically, it is an object whose size is not freely compared to the sizes of other things but instead is perceived in relation to a referent object. The difference or similarity in size evident in the scaled relationship carries meaning that reshapes the way one or both objects is conceived.

Because scale is a continuous spectrum, three broad scaled relationships can exist between a scaled object and its referent: reduced scale, commensurate scale, and enlarged scale. As matter cannot be created or destroyed, an enlarged- or reduced-scale object is one that merely looks like it has changed scale relative to a viewer's understanding of another object. While reduced and enlarged scales are familiar and incorporate aspects of miniatures and monumentality, commensurate scale may not be as intuitively understood. An object representing an object at the scale of the object must *be* the object, no? Instead, commensurate scale corresponds to the often overlooked category of things that are *life-size*, *natural size*, *actual size*, *full-size*, or *to scale*.[102] Because of its incorporation of the word *life*, *life-size* is sometimes interpreted to mean human-sized, or scaled to the viewer. The presence of *-size* further obscures the fact that the term more accurately describes an issue of scale. *Commensurate scale* better conveys that the object is the size of its referent.

As objects are rescaled, they may change shape. In biology, this phenomenon is identified as either isometric or allometric growth. Frogs are a classic example of isometric growth. After the tadpole phase, they maintain constant anatomical proportion despite growing larger.[103] In contrast, animals that grow allometrically gain new anatomical proportions, such as long-legged foals and big-footed puppies. In art history, these internal size relationships have historically been described as proportions. Thus, an architectural model is usually proportionately reduced in scale while a model solar system is disproportionately reduced in scale, since the distances between the planets are abridged.[104] The same distinction can be made about groups of rescaled objects: the contents of a dollhouse are proportionately reduced in scale while the charms on a bracelet are disproportionately reduced in scale—each charm is differently rescaled to attain a size befitting a wrist. Combined, scale and proportion enable more nuanced discussions of how an object's dimensions have been manipulated.

These terms provide more structured and balanced ways of discussing scale and scaled relationships. They also advance a different approach. Whereas *miniature* has been used as a catch-all term for many kinds of reduced or small things, and has typically been theorized as an object type, these terms shift the focus outside the object (because scale is external and relational) to the relationship between the object and its referent. While a *miniature* is a specific understanding of objecthood developed in Europe during certain centuries, and remains a valid term within that cultural context, a more general concept of scaled relationships might enable discussion of empirically observable issues of scale in cultural contexts where emic ontologies and terminologies are not fully known. Miniatures, certain kinds of toys, theatrical props, maps, life-casts, and so on, might all be considered various species of scaled objects.

ANDEAN SCALED RELATIONSHIPS

Over millennia, Andean civilizations regularly used scaled relationships to invest objects with meaning. As a result, the region's archaeological record provides a wealth of examples of scaled relationships. These objects reveal subtle insights into scaled relationships while historically contextualizing later Inca cultural practices.

3842-823, 3842-824, 3842-826, 3842-827, 3842-828, 3842-830, 3842-832, 3842-833, 3842-834, 3842-835, 3842-836, 3842-837, 3842-838

A paradigmatic scaled relationship can be appreciated in the reduced-scale textiles woven by Paracas peoples on the south coast of Peru as early as 100 BCE. The Tropenmuseum in Amsterdam has an impressive corpus of at least thirteen examples.[105] One diminutive mantle measures only 7.2 cm long by 3.6 cm wide (PLATE 7). An actual Paracas mantle, such as one in the Etnografiska Museet in Göteborg, measures 48 cm by 157 cm. Other mantles are well over 250 cm in width. These sprawling textiles were used by Paracas peoples to wrap their dead for burial, and the resulting mummy bundles could reach 1.5 m in diameter (see PLATE 9). Both the scaled object and referent were made as burial offerings, but nothing could be wrapped in the reduced-scale ones, and they contributed little volume to the bundles.

3842-832

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It might be tempting to refer to such a diminutive object as a *representation* of a Paracas mantle; however, this does not accurately characterize its nature. The object does not merely represent the physical characteristics of a Paracas mantle like a would-be portrait miniature but legitimately possesses them. The reduced-scale textile was woven on a tiny loom exactly as its referent. It was embroidered with the same techniques and colors of threads, and manifests the sophisticated patterning that defines Paracas embroidery—wherein motifs were rotated, flipped, and recolored according to complex schemes. But while the original motifs would have been composed of hundreds of stitches, these have been reduced to approximately sixteen. As a result, the minute creature is difficult to visually identify. Structurally, materially, ideologically, these objects *are* Paracas mantles—simply ones with smaller dimensions.

And yet, subtle differences also distinguish them. These Tropenmuseum textiles were disproportionately rescaled; that is, they were all reduced in scale but to different degrees. Paracas ponchos were typically much smaller than mantles, such as one in the Etnografiska Museet that is 72 cm by 73 cm. However, the reduced-scale mantles and ponchos in the Tropenmuseum are identically sized. Moreover, while actual ponchos were usually square-shaped, the proportions of the reduced-scale poncho were made to match the rectangular mantles. In the ancient Andes, disproportionate reductions in scale were common. Sets of objects were often reduced to the same size rather than by the same degree.

1935.32.0209

3842-826

In reality, it is not possible to create a rescaled object with perfectly maintained internal proportions. Of all objects, textiles most clearly articulate the rescaling process because of the finite and countable interactions between threads. Although these reduced-scale Paracas textiles seem similar to their referents in almost infinite ways, there is a material limit to which the altered scale can be maintained. The cloths have only thirty-some warps and sixty-some wefts—far fewer than actual mantles—just as the overall number of embroidered motifs is greatly reduced. Although the two-ply threads may be slightly finer than those of their referents, their reduction in scale is nowhere near as great as that of the objects overall. At a microscopic level, the micrometer width of the camelid fiber remains essentially the same as in the referent. At an atomic level, there is no difference between them.

ETNOGRAFISKA MUSEET
STATENS MUSEER FÖR VÄRLDSKULTUR
GÖTEBORG~SVERIGE
#1935.32.0185

TROPENMUSEUM
AMSTERDAM~NEDERLAND
#3842-832

Thus, scaled objects only seek to create the illusion of being rescaled. Most importantly, the maker's illusion anticipates the scale at which the viewer will examine the object. This is critical evidence of the artist's intentions.

Because perfectly proportional rescaling is not possible, artists must decide which of the referents' traits to preserve in the rescaled version. This is especially the case when using biological materials that exist at finite sizes. Another Paracas burial offering, a reduced-scale fan in the Peabody Museum, was made of yellow feathers, likely from a blue-and-yellow macaw (*Ara ararauna*). Measuring only 7 cm tall, it faithfully replicates the structure of its referent, a 17 cm tall fan, also in the Peabody (PLATE 8). However, while the referent fan was created from flight feathers with a stiff quill, such feathers were too big for the reduced-scale object. Rather than trimming larger feathers, the maker chose down feathers, which evolved for insulation. The down feathers of the reduced-scale fan are physically incapable of moving air—the primary function of a fan—but were still anchored together with a brown cotton string, exactly as in the referent fan. Like the handling of motifs in the reduced-scale mantles, this structure was not derivative of the object's function but rather defining of its identity.

38-28-30/4178

38-28-30/4179

What is most remarkable about these fans, however, is that they were found in the same mummy bundle: "Bundle 16," one of the four Paracas mummies presented to Nelson Rockefeller by archaeologist Julio C. Tello on behalf of the Peruvian government. Bundle 16 was brought to Harvard University in 1938 and scientifically unwrapped. The referent fan was encountered over the right shoulder of the deceased in the outermost layer alongside objects of bone, shell, and wood. More deeply inside the bundle, the reduced-scale fan was wrapped in a cloth tied around the deceased's neck with eight reduced-scale gold objects, including a crown, a nose ornament, and tweezers, as well as a selection of reduced-scale feathered textiles, including two slings (PLATE 9).[106] While scholarship has often explained miniatures as substitutes for their referents, in this case the reduced-scale object and referent object were simultaneously present in the same burial. Moreover, the larger fan was associated with poorer offerings farther from the body, while the smaller fan was associated with gold objects nearer to the body—a more prestigious location. It might have been expected that their positions would have been reversed: the personal fan of the deceased, always within arm's reach, placed next to the body; the "miniature," less useful in life, perhaps even unknown to the deceased, added to the outside of the bundle by sparing descendants. Instead, the reduced-scale fan was considered more significant. Moreover, the shared trait of the objects grouped at the neck of the deceased was not their material value but their reduced scale. Was scale their most prized characteristic?

38-28-30/4215, 38-28-30/4216, 38-28-30/4217, 38-28-30/4218, 38-28-30/4219, 38-28-30/4220, 38-28-30/4221, 38-28-30/4222

38-28-30/4176a and b, 38-28-30/4177a, b, and c, 38-28-30/4170, 38-28-30/4175

Another common explanation for scale shifting is economization or conspicuous consumption. "Miniatures" are often suggested to be cheaper. A reduced-scale crown in the Museo de Arqueología in Trujillo, Peru, foils this logic (PLATE 10). Made by the Chimús of the north coast after the year 1000—the same culture who made the reduced-scale spinning and weaving implements—the crown is elaborately covered in miniscule feathers from brightly colored paradise tanagers (*Tangara chilensis*). Like the Paracas fans, the biological origins of the feathers presented the makers with certain challenges. While the chartreuse feathers from the birds' heads measured around 2 mm in length and could be affixed in their natural state, the much larger electric blue feathers from their breasts had to be lacquered with glue and laminated

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to the object's surface so that their larger size would be less apparent. Because of its reduced scale, the crown may seem like an economization in the number of feathers used when compared with actual crowns, such as one in the Museo de Oro in Lima; however, the reduced-scale version was created over a base of precious silver alloy rather than a more typical one made of wood. The metal, however, was completely covered and is not visible. The object was likely intended as a greater luxury than its referent—but this is anything but conspicuous when gazing upon its mere 16 cm height.

Scaled objects rely on perception to sustain their identities. The Berlin Ethnologisches Museum conserves a small net bag containing a ball of red thread (PLATE 11). The object is so generic that it is difficult to say when or where it was made. It likely was found in one of the museum's many textile workbaskets, which derive from the central coast and the Late Intermediate Period. The bag functioned as a thread holder and could be anchored to something else through a length of cord. Upon closer inspection, the cord was originally constructed as a 26 cm long reduced-scale sling. The bifurcated cradle is articulated in precisely the same way as its referent's. Perhaps the sling was commissioned from a textile artist but never claimed. This small cord-like object may have been held inside a weaving basket for a period of time until the weaver decided to repurpose it. Should scholars still regard it as a scaled object? This evidence suggests that when it entered the archaeological record, it was perceived very differently from how it was first conceived.

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This example raises the reverse possibility that an object not originally manufactured as a scaled object could later be invested with a scaled relationship. That is, a found object could be perceived to embody a referent object at another scale as a result of belief, make-believe, or some other behavior. Certainly this occurs when children play with found objects, turning a cup into a bathtub for a doll, or any number of other scenarios. In archaeological contexts, this phenomenon is difficult to document. Once excavated, the cup only looks like a cup. This reuse seems to have occurred with an object often found attached to mummy bundles from the central coast and Late Intermediate Period. Reeds some 50 cm long were wrapped with threads in ornate patterns. A wad of cotton often dangled from the upper end. Wilhelm Reiss and Alphons Stübel, who excavated burials at Ancón on the central coast of Peru in the late 1800s, interpreted them to be distaffs (FIG. 21). However, later scholars recognized they did not have the structural integrity to be distaffs. Moreover, distaffs for spinning cotton in antiquity had not been documented. They consequently cast doubt on this identification. As the next chapter elaborates, Reiss and Stübel appear to have been mostly correct: the objects were nonfunctional, commensurate-scale distaffs. While some of the wads of cotton really were only wads, others were the stubs of actual cotton cones left over after spinning. These found objects, the exhausted stubs of cotton cones, seem to have been used to portray their former selves in commensurate-scale relationships.

When analyzing archaeological materials, some types of utilitarian objects can be difficult to identify as scaled objects. The Paracas mantles and feather fan were clearly manufactured at scales that prevented them from performing their original functions, but tools with a broader range of functional sizes can have ambiguous scales.

> PLATE 8. A Paracas Reduced-Scale Feather Fan and Its Referent

>> PLATE 9. Paracas Mummy Bundle 16

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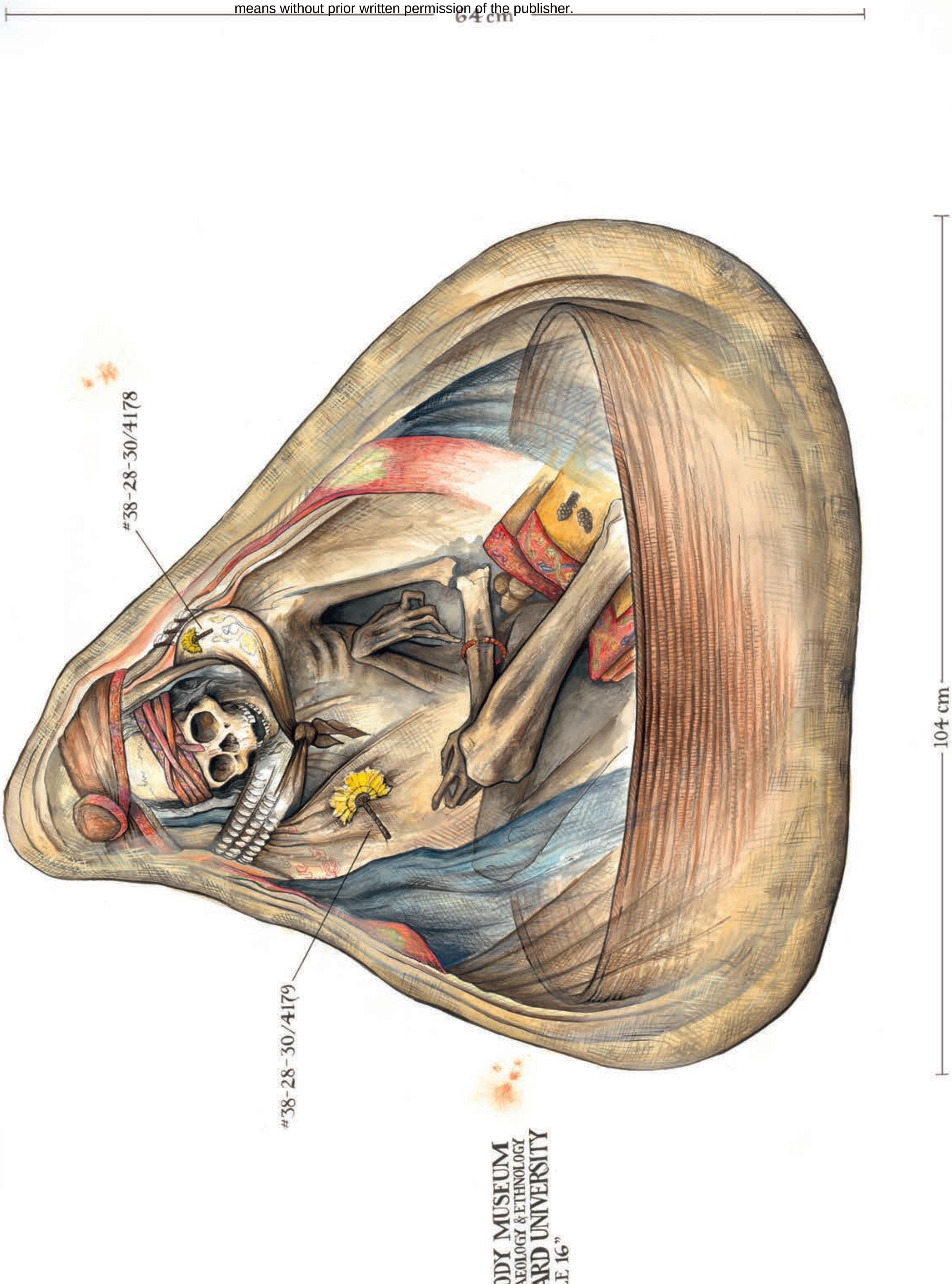

MUSEO DE ARQUEOLOGÍA
DE LA UNIVERSIDAD NACIONAL
TRUJILLO, PERÚ
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MUSEUM OF COMPARATIVE ZOOLOGY
HARVARD UNIVERSITY
PARADISE TANAGER
(Tangara chilensis chilensis)

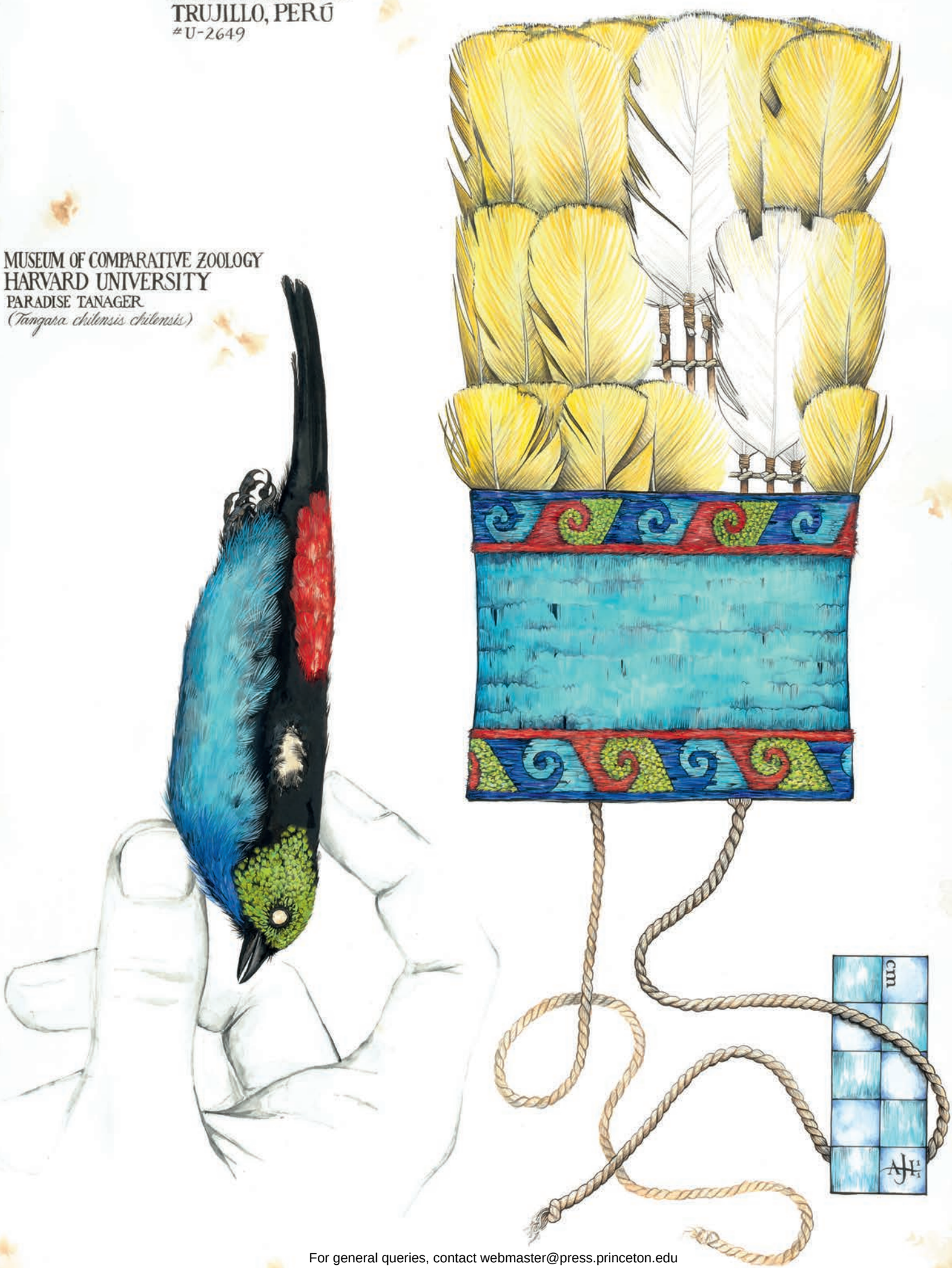

PLATE 10. A Chimú Reduced-Scale Feather Crown and a Paradise Tanager

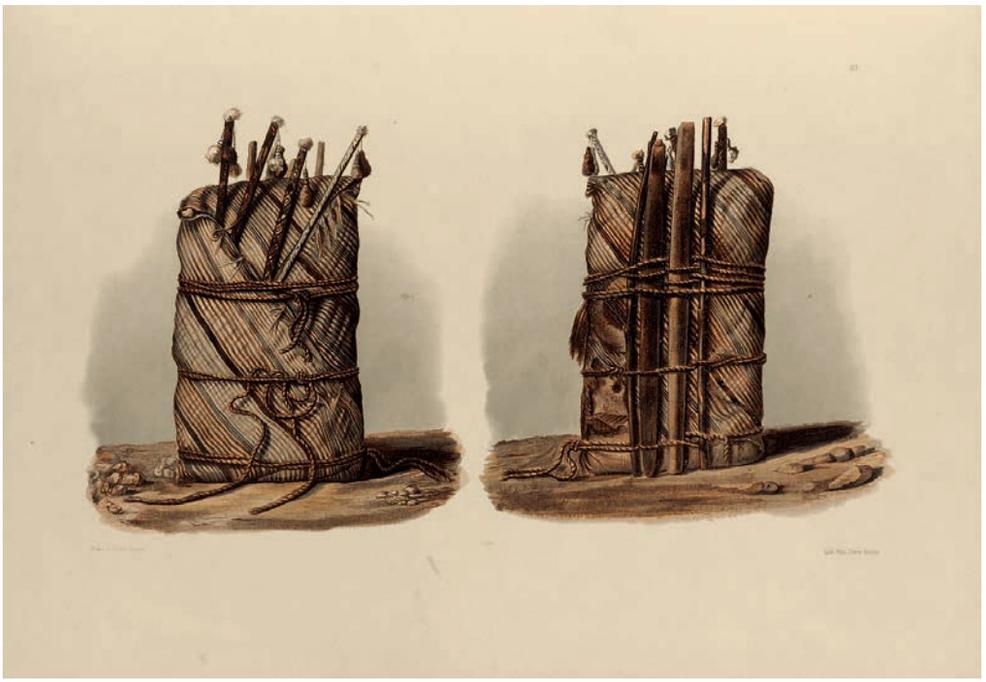

FIGURE 21. Reiss and Stübel excavated mummy bundles with commensurate-scale distaffs and other weaving implements affixed to their exteriors. "Plate 23: Front and Back View of a Mummy with Weaving Implements," from *The Necropolis of Ancon in Peru*, by W. Reiss and A. Stübel, 1880–87. Chromolithograph by Wilhelm Greve. Original dimensions 49.5 cm by 34.5 cm.

Vessels are perhaps the most challenging. Because of the simplicity of many vessel shapes, their potential utility at any dimension, and the low threshold for achieving this utility (in essence, concavity), small vessels can be difficult to distinguish from reduced-scale ones, just as large vessels can be indistinguishable from enlarged ones. This conundrum manifests in the collection of the Museo Larco in Lima where a group of eleven *tumi* knives were classified as *miniaturas*. While a standard-size tumi in the collection measures 22.5 cm long and weighs 350 g, these measure between 3.5 cm and 8.3 cm long and weigh between 2 g and 14 g. The small objects appear interchangeable in photographs, but when handled it is clear that eight are mere silhouettes of knives without structural integrity or sharpened blades (PLATE 12). The remaining three were small functional knives for precision cutting. Although these small knives have the same dimensions as the reduced-scale ones, they are sturdier and weigh twice as much. Most importantly, their blades have signs of use: scalloped indentations worn into the cutting edge.[107]

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ML100323, ML100324, ML100330

Therefore, as in any act of communication, scaled relationships can become lost in translation. If a scaled object's attempt to channel its referent goes unrecognized, or even if it is recognized as a scaled object but its referent is not, its message becomes indecipherable. It is unclear what it is, whether it is reduced, commensurated, or enlarged, and the cultural significance of this potential scale. Only scaled relationships where both the scaled object and the referent can be identified can be meaningfully studied. Bill Brown noted this problem in Claes Oldenburg's *Typewriter Eraser, Scale X* at the National Gallery in Washington, DC.[108] An archaic technology, a typewriter eraser is generally unrecognizable to modern audiences. Scaled relationships demand that viewers be fluent in a civilization's material culture to comprehend their references. For cultures like the Incas, gaps in the archaeological record and differential preservation of materials can obscure certain scaled relationships.

> PLATE 11. A Reduced-Scale Sling Used as a Yarn Ball Holder and Its Referent

>> PLATE 12. A Small Tumi for Precision Cutting and a Reduced-Scale Tumi

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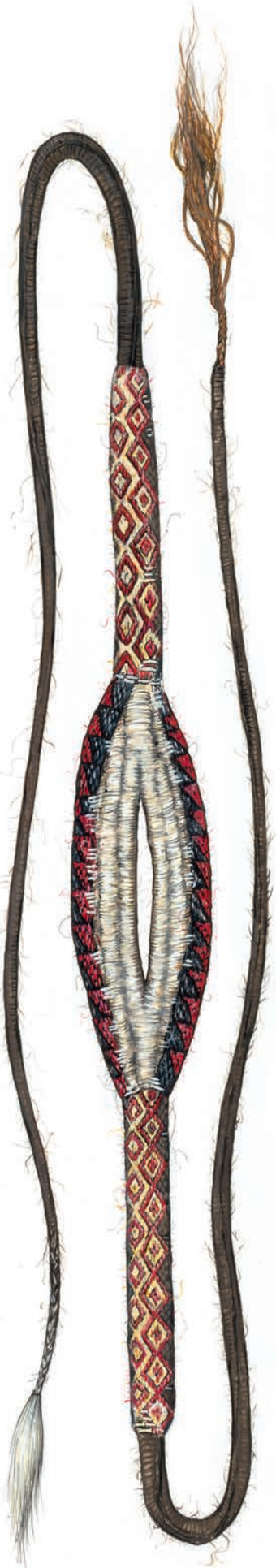

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STAATLICHE MUSEEN ZU BERLIN
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THE INCA INTELLECTUAL TRADITION

The following chapters explore wide-ranging aspects of Inca material culture, built environments, and worldviews to evidence the ways they utilized scaled relationships to embed and communicate meaning in their world. These practices reveal new ways that art and architecture functioned within their society, and invite comparisons with other civilizations in the Andes and elsewhere. But just as the preceding discussions of European concepts historically contextualized scale in sixteenth-century European thought, so too is it necessary to introduce further facets of Inca knowledge to indicate scale's role in their broader intellectual tradition.[109]

The main challenge to defining the Inca intellectual tradition—and one of its defining features—was their technology for recording knowledge. As previously noted, the Incas never utilized writing to record the many languages spoken across their empire. Fiber was an extremely important medium in Andean societies and was used by Incas to store and transport information. Likely based on a device first developed by the earlier Huari civilization, the Incas utilized a system of knotted and conjoined strings that they called a *quipu*.[110] Meaning was imparted through different shapes, combinations, and numbers of knots, as well as the ways the cords were arranged, attached, colored, spun, and plied. Unfortunately, no colonial writer sufficiently described the process through which information was encoded, making it difficult to access the knowledge in extant examples.

It is also unclear what relationship quipus may have had with spoken languages. A dialect of Quechua was utilized by the Incas as an administrative lingua franca. However, as linguist Bruce Mannheim has explained, "although local elites were educated in the administrative language, the Inkas do not appear to have made an effort to implant a unified standardized language across the empire. On the contrary, even the area around the Inka capital itself was a linguistic mosaic. In the central highlands of Peru, Southern Peruvian Quechua represented an eggshell-thin overlay on the Quechua languages already spoken there."[111] As chronicler Miguel Cabello Valboa described in his *Miscelánea Antártica* of 1586, "they speak so many languages, so different from each other … that I believe there aren't numbers high enough to count them, there are so many. This is so notable that in many provinces one doesn't go a league without coming across another language, as remote and distinct from the first as Castilian Spanish from Basque, or from English, or from African languages."[112] Because of this immense linguistic diversity, it is worth questioning whether quipus bore any relation to a spoken language or were a system of notation that could be vocalized in any language.

These issues make deciphering quipus a great challenge. In the early 1900s, L. Leland Locke successfully revealed how numbers were encoded by demonstrating mathematical sums.[113] In the century since, scholars have meticulously studied the surviving corpus of approximately eight hundred quipus, but more complex or abstract methods of signification are still not well understood.[114] For the present study, this means that if surviving quipus attest to Inca engagements with scale, such knowledge cannot yet be recovered.[115]

Locke's breakthrough revealed much about Inca numerical and mathematical concepts. The Incas actually counted similarly to the Hindu-Arabic numerals we use today (FIG. 22). Their number system was base ten and demarcated zero through an absence of knots. Units of 10, 100, and 1,000 were represented using a single

overhand knot in various placements. The numbers 2 through 9 were created with a knot visually similar to a hangman's knot, which scholars call a "long knot." Its number of coils denoted its value. Critically, 1 received its own special knot. The practical reason for this was that a long knot cannot be made with only one turn. Moreover, were 1 recorded through a single knot, it would be easily confused with 10 and 100. The source of this confusion, however, is of great theoretical importance. Quipu knots were read relationally. The number 1 cannot be understood relationally, as it is single and alone, and thus was demarcated by a unique knot. This reliance on relationality to construct and convey meaning is the very basis of scaled relationships.

The decipherment of the number system made possible extensive studies of Inca arithmetic. Nonetheless, more sophisticated forms of mathematical knowledge have been difficult to prove in quipus because of their complex structures. In the European tradition, geometry provided methods for considering spatial relationships between objects. The Incas, however, did not develop the same theoretical understanding. As the chronicler El Inca Garcilaso de la Vega explained, the Incas "knew a great deal of geometry because this was necessary for measuring their lands, and adjusting the boundaries and dividing them. But this was physical knowledge, obtained with strings and stones used for counting and dividing, and nothing to do with heights in degrees or any other speculative method."[116] Quipu scholar, anthropologist, mathematician, and textile specialist Carrie Brezine has suggested that in the absence of Euclidean geometry, Incas might have conceptualized space through textile structures—to a very different end.[117] While a Euclidean plane is without depth and extends infinitely, a textile plane has two surfaces, internal structure, and is bounded by selvages. Further, whereas points can be freely connected within a Euclidean plane, a textile plane preferences the perpendicular relationships between vertical

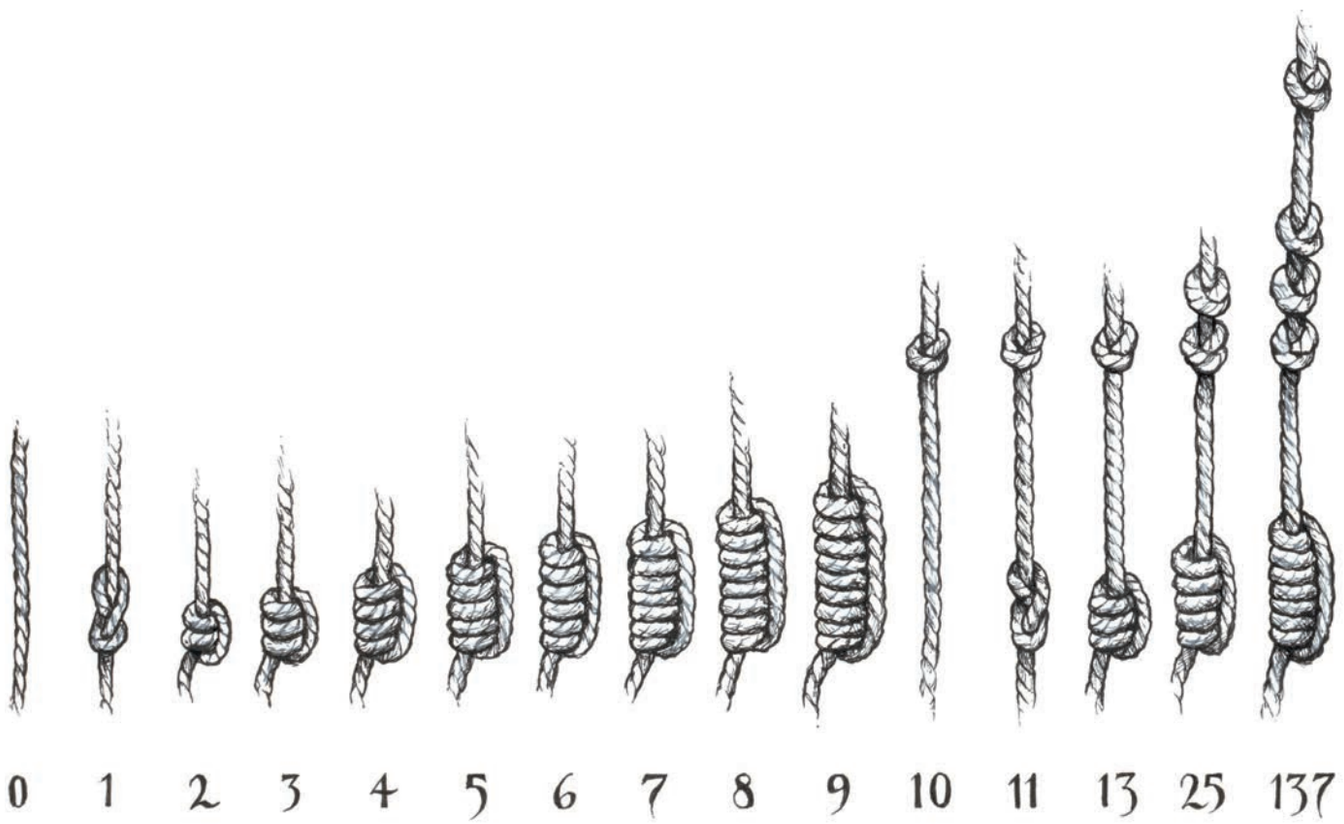

FIGURE 22. A selection of Inca numbers expressed in quipu knots

warps and horizontal wefts, making diagonals and curves less common. Although Brezine's hypothesis is challenging to prove, it is soundly extrapolated from the Andean archaeological record, and suggests that assumptions about Inca geometry and spatial understandings based on Euro-American models may be incautious.

The issue of measurement also raises important questions about the ways Incas conceptualized scale.[118] A number of chroniclers reported that the Incas developed units of measurement based on prototypes supplied by the human body—not unlike the American and British foot. The Incas' most common unit of length was a *ricra*, the distance from the fingertip of one outstretched arm to that of the other (FIG. 23). Ricras were supposedly standardized through a rod called a *cota kaspi*, although archaeological examples have not been identified. At least one study has suggested that the ricra (or a distance of 1.6 m) may recur in architecture and agricultural terraces around Cuzco.[119] Subsequent units further partitioned the arms: a *sikya* was from the center of the chest to the tip of an outstretched finger; a *cuchuch* was the elbow to the hand; a *capa* was the wrist to the fingertip; a *yuku* was the thumb to forefinger; and a *rokana* was the length of a finger. The utility of this system was that anyone handling an object had the tools to measure it at their fingertips—or almost anyone.[120] Children would have been excluded, suggesting measurement was a socially stratified practice. A further limitation was that each unit could not

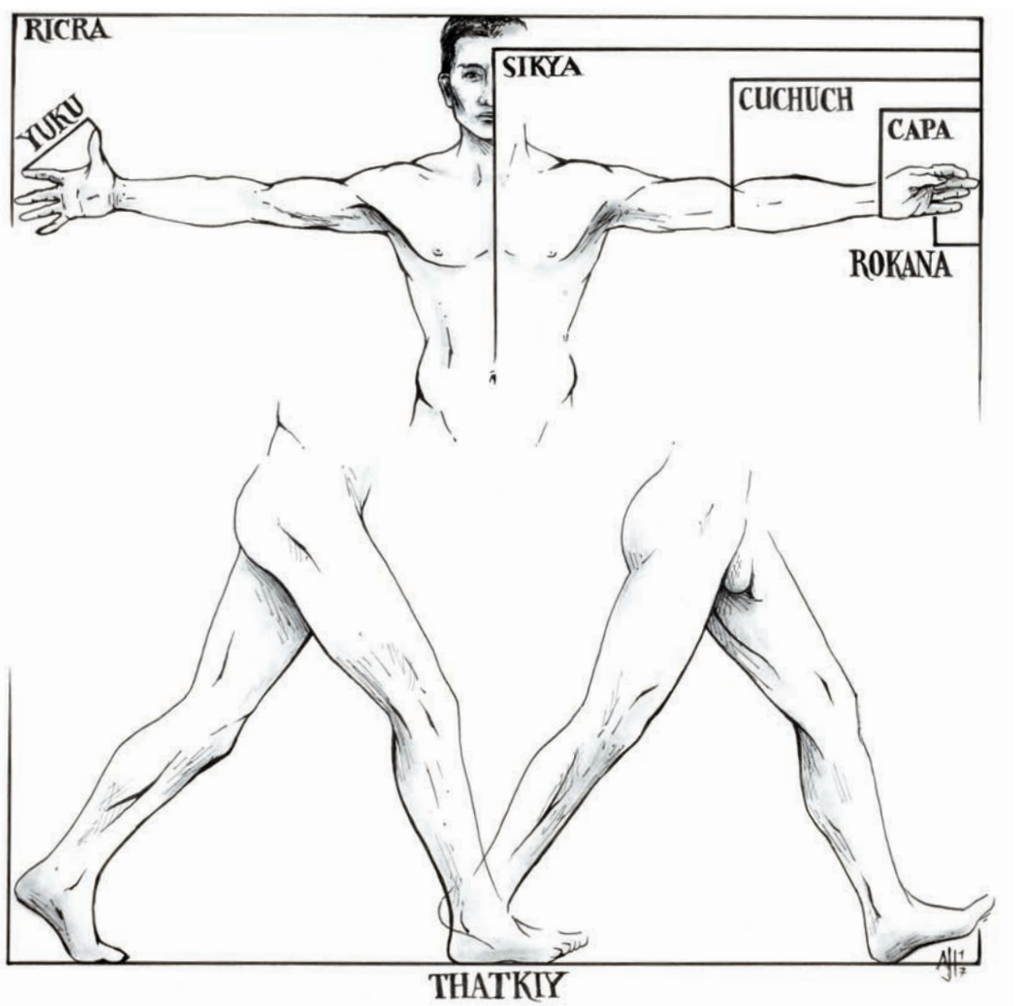

FIGURE 23. Inca units of measurement derived from the human body

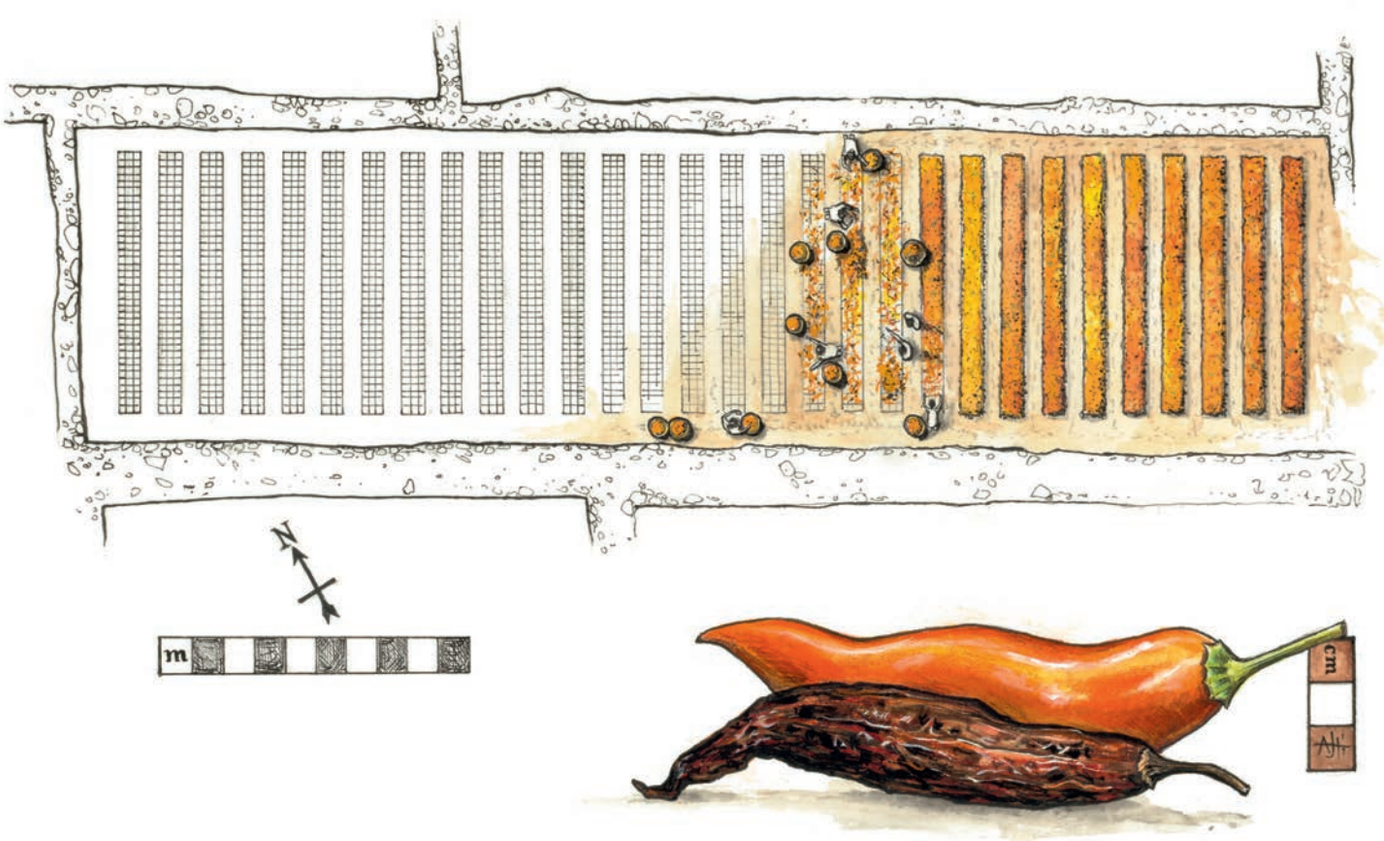

FIGURE 24. The floor of a storehouse at Incahuasi was impressed with extensive grids *(left)*. Workers likely spread harvests of sun-dried foodstuffs like peppers across these grids to measure their quantities by area *(right)*.

be easily converted into the others, such as meters into centimeters. But perhaps most importantly, the smallest unit appears to have been some 7 or 8 cm long. It is therefore possible that many Inca reduced-scale objects were smaller than their units of measurement—leaving them unmeasurable. Thus, the metric measurements presented in this text, often with the precision of millimeters, dramatically misrepresent the ways Incas would have conceptualized the dimensions of these objects and are only meant to inform modern readers.

The Incas measured longer distances with units also derived from the body, such as the *thatkiy* or pace, which anthropologist John Rowe determined to be two steps. The thatkiy and the ricra may not have been significantly different in length (see FIG. 20), but remained distinct units because of the way the human body was employed to take the measurement. Six thousand thatkiys equaled a *tupu*, which were used to delineate "milestones" along Inca roads. The tupu also somehow measured area, but its size was inconstant. It amounted to the quantity of land needed to agriculturally support two people for one year. Understandably, this measure would have varied from one region to another depending on the fertility of the soil and the length of the growing season. Like the quipu knot tied to denote 1, the tupu emphasizes the importance of relationality in Inca thought. According to the chronicler Padre Bernabé Cobo, the Incas did not have a system for measuring liquid volumes.[121] While they used a pan balance, or *aysana*, they do not seem to have had a standard system of weights.

The absence of units of volume and weight may make Inca measurements seem primitive; rather, they were highly culturally determined. Recent excavations of a government storehouse at the site of Incahuasi on the south coast of Peru have garnered attention due to the discovery of in situ quipus alongside foodstuffs like black beans, peanuts, and chili peppers.[122] While this may lead to breakthroughs in

FIGURE 25. Peppers drying in the sun on the north coast of Peru

quipu decipherment, what is perhaps more interesting for the present study is that the compound centered around large rooms with floors bearing grids of more than 3,000 squares, each measuring around 23 cm by 23 cm (FIG. 24). Farmers seem to have brought their harvests to the compound and spread them across the grids so their areas could be measured. Although this may seem unusual, it makes a great deal of sense agriculturally: beans, peanuts, and peppers must all be dried in order to be stored. Even now, Andean communities spread out their harvests on the ground so that they can desiccate in the sun (FIG. 25). This same process likely led Inca farmers to quantify such crops by area rather than by volume or mass, a precedent that the Inca state institutionalized. While systems of measurement in themselves might not have been a great theoretical focus for the Incas, conventionalized approaches to quantifying objects allowed for robust accounting practices that were central to Inca administration.

Issues of measurement and quantification also bring to the fore questions of currency, which Inca society—and potentially many of their predecessors—do not seem to have developed. This absence necessarily would have made exchanges of commodities a question of determining equivalencies. A scale bar, part of an

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aysana, from the north coast, conserved in the Berlin Ethnologisches Museum, makes stunningly clear how transactional measurements of equivalent weights could be (PLATE 13). The bar is crowned with two figures, one of whom extends an upward-facing palm, while the other reaches out as if to offer some object or payment—possibly the very thing the scale was used to quantify. Unfortunately, the figure's extended arm is broken at the wrist, making it impossible to know what the hand held. Perhaps because scale balances were a common and important instrument in the ancient Andes, they could also be embodied as reduced-scale objects for ritual purposes.

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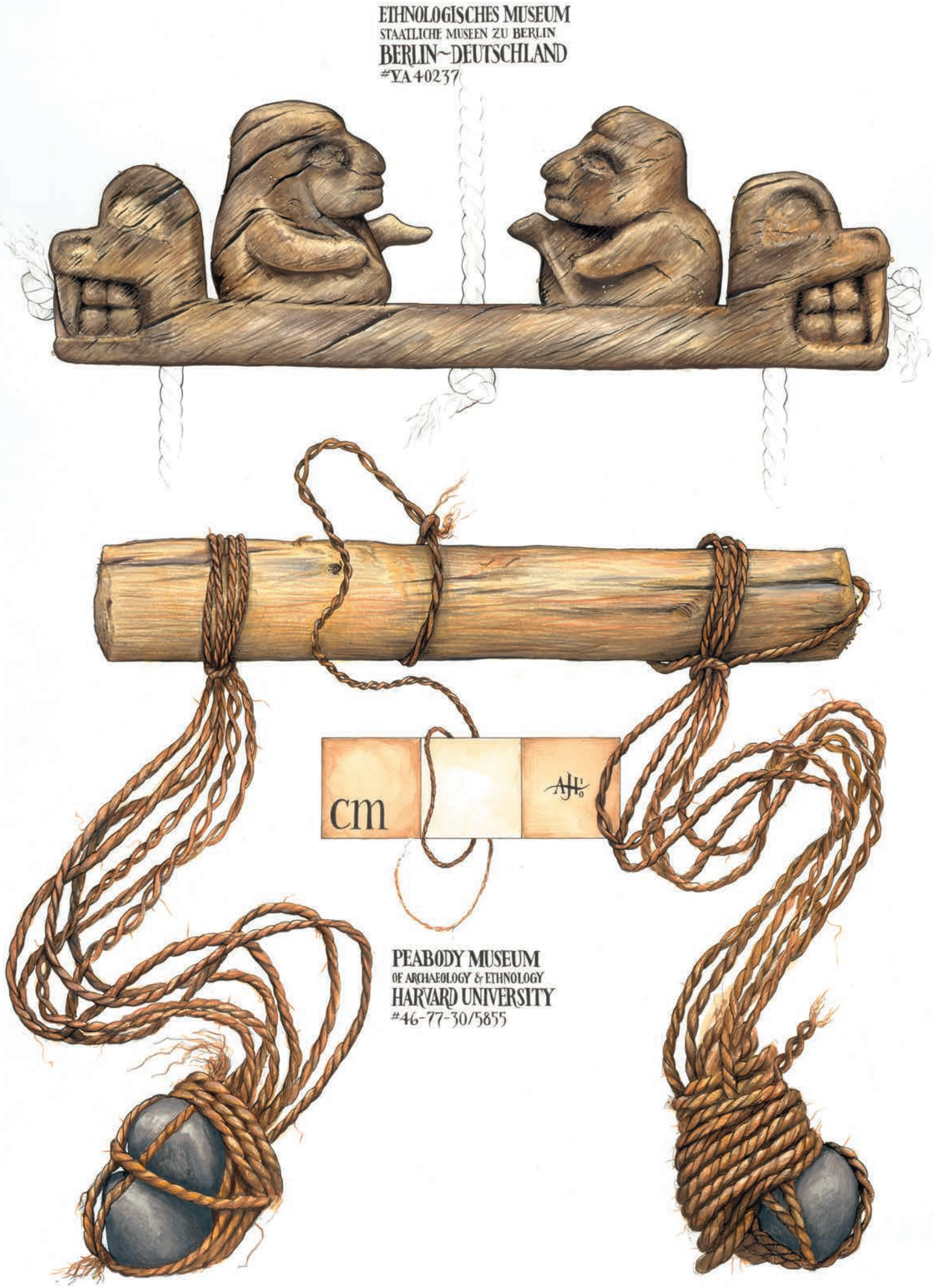
The Harvard Peabody Museum conserves a reduced-scale scale, where each pan



holds a fixed quantity of pebbles. The pans are not attached to precise locations on the bar, making clear the device could never actually be used to measure weight.

Quipus, numbers, mathematics, and systems of measurement all bore some relevance to the scaled relationships this work argues were prominent in Inca thought—but they did not define them. Whereas European understandings of scale were contingent upon analogous bodies of knowledge, Incas engaged scale in more symbolic ways. As will be shown, Inca scaled relationships do not generally seem to have been predicated on precise measurements. Measurement may only have been practiced by certain members of Inca society in select contexts. Moreover, specialized means of measurement were developed for particular applications—such as quantifying sun-dried foods—rather than a system that could be universally utilized for all objects. Scaled relationships permeated Inca life more widely. They enacted forms of signification and communication that were more immediate and accessible than quipus. Whereas quipus may only have been created and understood by trained officials, scaled relationships provided a means of nonliterate signification seemingly recognized across the empire. In sum, Inca scale was not a heightened version of the concept as it might have been recognized by European minds but rather bore different intellectual foundations and applications.

As a result, Andean concepts without clear European doppelgängers more fully contextualize Inca scaled thought. The concept of relationality has already been noted a number of times. Of similar importance was duality.[123] Inca society was divided into two moieties, Hanan and Hurin, or "upper" and "lower." The division did not merely organize kin relationships but actually spatially divided the urban landscape of Cuzco into two parts. Other dualistic pairings included Inca conceptions of male and female, the sun and moon, and gold and silver. Even certain objects like *qeros*, a form of toasting cup, were made in pairs. The birth of twins was especially noteworthy and even ominous. Fray Domingo de Santo Tomás, in the first lexicon of the Quechua language, completed in 1560, defined the word *yanantin* as "a pair, two equal things."[124] Ludovico Bertonio, in the first dictionary of the Aymara language, completed in 1612, defined *yanani* as "two partnered things like two shoes, two gloves."[125] Because Spaniards who compiled dictionaries could map these Inca concepts onto Spanish ones, they were identified and defined, and are now familiar to scholars.[126] Inca concepts of scale were not so overtly recognized, and consequently have not been widely explored. Nonetheless, scale and duality share common ground. Scaled relationships are inherently dualistic as a result of the scaled object and its referent. Duality also poses interpretive challenges for scholars. First, there is a perpetual risk of overstating it. Duality can be read into anything that exists more than once and less than thrice. Second and more subtly, because the importance of duality has long been recognized, Inca objects and conceptual structures may have been identified as dualistic without further consideration of their dimensional traits. This leaves open the possibility that objects and practices suspected to be dualistic might actually be scaled relationships.

Additionally, Inca peoples had very different conceptions of objecthood both from their Spanish conquerors and our own. They believed in a force called *camay*, which anthropologist Frank Salomon has defined as "the energizing of extant matter" or "generative essence."[127] Camay was neither visible nor tangible, but it materially infused substances with being. Objects animated by camay were called *camascas*. Crucially, in Euro-American terms, they could be "animate" organisms

just as easily as "inanimate" rocks. A camasca could change shape or states and yet its camay would endure. A *camayoc*, which might be loosely translated as a "bringer into being," was perhaps the nearest term the Incas had for an artist. Quipu makers, for instance, were called *quipucamayocs*, just as professional weavers of *cumbi* cloth were called *cumbicamayocs*. Camay, however, could originate from another entity called a *camac* or vitalizer. In a number of clear examples, *camacs* seem to have acted as referent objects. The identity of the referent object was conferred upon the scaled object through camay, making camay a critical mechanism in the ways Incas constructed, conveyed, and understood scaled relationships. What is important to understand about camay, however, is that because the concept was so foreign to chroniclers, they did not explicate the issue directly—similarly to scale—but rather only described its effects upon Inca beliefs. Our knowledge of the concept derives largely from the ways Quechua words were recorded in dictionaries and a rare Quechua language document written around 1600, referred to as the Huarochirí manuscript.

Finally, scale draws attention to an issue at the heart of Inca art historical studies: the question of representation. Scholars have regularly characterized Inca art as geometric and abstract. While the material cultures and built environments of Andean civilizations over preceding millennia professed a range of styles from tessellated representations of flora and fauna to naturalistic likenesses of people, Inca art often emphasized shapes, lines, and blocks of color, commonly including mimetic forms in only ancillary ways. Although this may appear to parallel trends toward abstraction in the twentieth-century Euro-American sense of the term, it is necessary to question the descriptive relevance of this adjective. "Geometric," similarly, references a specific Euro-American understanding of space and form whose relevance to the Inca intellectual tradition has already been questioned. These adjectives formally describe Inca objects to modern audiences more familiar with Euro-American art but may significantly mischaracterize them from an Andean perspective. Many Inca scaled objects manifest representational qualities. Often, this is the only reason their relation to a referent object can still be discerned. Other scaled objects do not bear strong mimetic resemblances—Why? Scaled relationships raise questions about the role of mimesis in Inca art, and the ways mimesis was indigenously conceptualized.

In a recent multidisciplinary study of the Incas edited by Izumi Shimada, art historian Thomas Cummins observed:

> The study of Inca art and architecture is still in its infancy. There are studies of disparate media, concepts, forms, and objects, but an integrated investigation has not yet been undertaken. Hence we have recent studies of the *khipu* … metallurgy … architecture … textiles … stonework … and ceramics … , but these studies really have yet to speak to each other and to discuss how such forms and media were understood by the Inca in relation to each other. Rather, study has progressed following Western epistemological divisions and interests that are mainly academic and disciplinary.[128]

Certainly, it is challenging, if not impossible, for a scholar working in the tradition of the European academy to fully step outside its fabric of ideas and terms. The very notion of art and of art historical study, it could and has been argued, is unavoidably

European.[129] Nonetheless, Cummins's call to action is well taken. This study begins with a term—scale—that appears never to have been widely associated with the Incas in colonial sources, and that has consequently not been extensively explored in subsequent scholarship. Through examinations of extant artifacts of diverse media and uses, in addition to a wide range of archaeological sites, as well as critical rereadings of colonial texts, the ensuing verbal and visual analyses argue that scale played a foundational role in Inca thought and expression. In so doing, scale disentangles, realigns, and recenters aspects of Inca culture that may have once seemed like unrelated chords and tangents.

Although only a few previous theoretical studies of art and scale have been undertaken, they have often been organized according to scale's spectrum, particularly with chapters devoted to the concepts of miniatures and "the monumental," given the expectation that each would-be type of object would share a particular cultural symbolism. This approach risks flattening scale's expressive capacity and oversimplifying diversiform ideas and beliefs in the interest of a linear argument. The goal of this study is not to provide singular conclusions of "what scale symbolized" for the Incas, but rather to argue that scale itself was a cognitive orientation and recurring mode of expression. My goal is to emphasize the breadth of contexts in which scale conveyed meaning, and its diversity of audiences, while analyzing the work it performed as a conceptual tool. The chapters are therefore organized according to a different logic of scale: self-similarity. That is, at no matter what scale Inca society is considered, whether the life of an individual and the material culture he or she possessed, the collective experience of the inhabitants of a built environment, or the fundamental ideas that defined the worldview of Inca society, scale remained a prominent structure of Inca thought.

Scale is not only essential for understanding this sophisticated Andean civilization but is also a body of theoretical knowledge that Inca art and culture can offer scholarship at large. Without texts or treatises, few indigenous concepts of the ancient Americas have informed art history as a discipline. Inca scaled relationships offer a potential benchmark for future studies of scale in the material cultures and built environments of other cultures.