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Aggregating Histories of Writing and Urbanization

Shannon Mattern

Abstract For millennia, mud and its geologic analogues have bound together our media, urban, architectural, and environmental histories. Some of the first writing surfaces, clay and stone, were the same materials used to construct ancient city walls and buildings, whose facades also frequently served as substrates for written texts. The formal properties of those scripts—the shapes they took on their clay or, eventually, parchment and paper foundations—were also in some cases reflected in urban form: how the city molded itself from the materials of the landscape. And those written documents have always been central to our cities' operation: their trade, accountancy, governance, and culture. In examining the place of mud in the *Kulturrechniken* of city-making and record-keeping, we see that urban and administrative culture are both utterly dependent on geological resources. Aggregating these often separate historical lineages has the potential to enrich the disparate disciplinary knowledges that are bound together here, but there's more at stake than historiography. These public squares, city walls, building facades, urban archives, and sandy stores where earthen materials and writing intersect are the humble city sites where politics play out at myriad scales—where the entanglement of global and local political-economic forces enter people's lives through the material, the geological, and the aesthetic.

Keywords architecture, geology, materiality, urbanization, writing

Over sixty-five hundred years ago, not far from where the radicals of Islamic State recently bulldozed ancient mud-brick temples and shrines, sledge-hammering stone statues,

burning haram (un-Islamic) manuscripts, and smuggling clay cuneiform tablets and mosaics for sale on the black market, a civilization was born—a civilization built upon many of those very same humble materials: mud, stone, and clay.¹ Small farming villages in the fertile Mesopotamian region had made way for what are widely regarded as the first cities, Eridu and Uruk—settlements whose proximity to the Euphrates River made possible the production of a reliable agricultural surplus. In Uruk, those bountiful grains fed a large population—up to eighty thousand at the city’s peak, around 2900 BCE—who had learned to build mud-brick temples and a mosaic-adorned ziggurat, craft stone sculptures and clay pottery, pursue a wide variety of professions, and design complex political and administrative structures to manage their affairs. All of that administration required a system for keeping records.

Bureaucracy, many believe, begat writing (Goody 1986; Houston 2004; Innis [1950] 2007, 1951; Mumford 1961; Schmandt-Besserat 1992; Woods 2010: 33–34). The origins of our written languages, our chirographic cultures, are rooted not in noble literary traditions but in accountancy (although it was the *Epic of Gilgamesh*, which survived on a set of clay tablets, that tells us much of what we know about Uruk’s mythical history). “It has been suggested,” economist Harold Innis ([1950] 2007: 46) writes, “that writing was invented in Sumer to keep tallies and to make lists and hence was an outgrowth of mathematics. The earliest [records] include large numbers of legal contracts, deeds of sale, and land transfers, and reflect a secular and utilitarian interest.” Yet all this proto-paperwork was part of a larger constellation of developments that extended beyond the merely managerial. As Innis explains, “the development of

writing, mathematics, the standardization of weights and measures, and adjustments of the calendar were a part of an urban revolution” (55)—a new way of living with others, a new way of organizing and inhabiting space.

It so happened that Uruk’s urban revolution was fortified by the most archaic of natural resources: mud. The Tigris and Euphrates rivers not only created the opportunity for excess crops but also offered, due to their regular flooding, plenty of alluvial clay—unconsolidated silt, sand, clay, and gravel, mixed in with organic matter and deposited on the riverbanks. That fine-grained clay was blended with chaff from the threshing floor, formed into molds, and dried in the sun, yielding the mud-bricks that constructed most of ancient Mesopotamia’s buildings and city walls. Those bricks were typically “faced” with a thick coating of mud and then sometimes gaudily painted (Oppenheim 1977: 325); or the clay was fashioned into multiform tokens that were used for accounting and into the clay envelopes that organized them (Schmandt-Besserat 1992); or it was strained and shaped into tablets, on which a reed stylus then impressed a wedge-shaped cuneiform script—or a hard-stone cylinder seal rolled out an impression, a script, or a figurative scene, which served as a form of notarization for its “author”—after which the tablet was sun- or kiln-baked, or recycled (Collon 2005; Kilgour 1998: 16; Woods 2010). These alluvial documents constituted the new urban register, and they serve us today as a valuable archaeological archive (see Wengrow 1998).

Many historians date the birth of writing to the early fourth millennium BCE. We have access to writing’s history largely because of the material properties of the historical record, of writing itself.

Olof Pedersén and his colleagues (2010: 132) note that “it is a great advantage to archaeologists when texts are written on clay tablets.” Clay, as Innis would say, is a time-biased medium: it has permanence; it both cultivates lasting civilizations and sticks around to make itself available for historical study.² Of course, early writing and proto-writing appeared on a variety of substrates: stone walls, shards of bone or wood, wax tablets, cloth, metal—some of which are similarly durable. Yet the materiality of the archaeological record has implications that extend beyond the mere availability of artifacts; the forms of those artifacts inform their historical interpretation because they also shaped the civilizations that used them.³ As Innis, Lewis Mumford, Denise Schmandt-Besserat, and a host of other historians, anthropologists, and archaeologists argue, a civilization’s prevailing media formats cultivate its habits of mind, its economy, its modes of governance, its culture.

Urban and architectural history are likewise informed by the materiality of their historical records. Some early construction used stone: consider the Megalithic Temples of Malta and even Uruk’s own Stone Temple, built of limestone and bitumen on a rammed-earth podium. But as archaeologist Seton Lloyd acknowledges, “The raw material that epitomized Mesopotamian civilization was clay” (quoted in Kilgour 1998: 16). For millennia, clay and mud have together accounted for a significant proportion of the earth’s built environment: wattle-and-daub structures (woven sticks or reeds coated with mud), cob houses (chunks of clay tempered with straw, manure, or sand and then stacked and smoothed into walls), adobe bricks (tempered bricks, sun-dried, stacked and mortared), rammed-earth buildings (sand, gravel, and clay compressed into a molded

wall), and fired-brick structures span the globe and the ages (Staubach 2005: 114).

Those ancient architectures serve as more than archaeological remains; they’re often historical texts, too. As we will see later, civilizations the world over—in Mesopotamia, ancient Rome, Mesomerica, Fatimid-era Cairo, present-day Calcutta—have written on their material environments, as well (through architectural inscriptions or epigraphy, for example), which provides another set of historical writings for future archaeologists to consult. These various recorded formats—tablets containing urban administrative records and the material city itself as a written text—are often entangled, which complicates archaeologists’ attempts at periodization and historical dating. Christopher Woods (2010: 34), in his history of writing in the ancient Middle East, acknowledges that most Mesopotamian tablets were found in “rubbish heaps,” in no clear historical strata: “The sun-hardened clay tablets, having obviously outlived their usefulness, were used along with other waste, such as potsherds, clay sealings, and broken mud-bricks, as fill in leveling the foundation of new constructions.” Writing thus served as a literal foundation for urban development.

For millennia, mud and its geologic analogues have bound together our media, urban, architectural, and environmental histories. Some of the first writing surfaces, clay and stone, were the same materials used to construct ancient city walls and buildings, whose facades also frequently served as substrates for written texts. The formal properties of those scripts—the shapes they took on their clay or, eventually, parchment and paper foundations—were also in some cases reflected in urban form: how the city molded itself from the materials of the landscape. And those

written documents have always been central to our cities' operation: their trade, accountancy, governance, and culture.

The long history of mud's applications as both a writing substrate and an architectural medium shows us how we can integrate both the historical and contemporary meanings of the term *Kulturrechnik*, or cultural technique, a framework very much *en vogue* in media theory. As Bernhard Siegert (2015: 9) explains: "The very word *culture*, derived from Latin *colere* and *cultura*, refers to the development and practical usage of means of cultivating and settling the soil with homesteads and cities." Since the late nineteenth century, the term *Kulturrechnik* has been associated with agricultural or rural engineering, although there is, as we've seen and will see, a much deeper history to the practices that the term refers to. And rightly so: as Siegert states, "Cultural techniques are conceived of as operative chains that precede the media concepts they generate" (11; my emphasis). "Starting in the 1970s," he notes, "*Kulturtechniken* or basic skills such as reading, writing, and arithmetic" (10). The blending of these agrarian and literary etymologies, Siegert suggests, enables us to recognize the existence of cultural techniques in realms that extend well beyond the book and culture-with-a-capital-C. Culture, in our case, even extends to techniques of settlement, urban planning and administration, and the practices of everyday urban life. Geoffrey Winthrop-Young (2013: 5) proposes that *Kulturrechnik's* genealogical ties to husbandry permit us to recognize culture as "that which is ameliorated, nurtured, rendered habitable and, as a consequence, structurally opposed to nature, which is seen as actively resistant . . . or indifferent." Yet in examining the place

of mud in the *Kulturrechniken* of city-making and record-keeping, we recognize that urban and administrative culture are utterly dependent on nature, on geological resources. Writing and urbanization are both muddy businesses, and they're messily entwined.

Aggregating these often separate historical lineages has the potential to enrich the disparate disciplinary knowledges that are bound together here. Media scholars, for example, can learn to read their histories in archaeological ruins, and urban historians and archaeologists can better appreciate the centrality of communication and media history to their own fields. Thinking these histories in tandem also reveals the long history and expansive geography of urban mediation (see Mattern 2015b: 96). Particularly in light of recent attempts to understand what kinds of intelligence are embodied in our digital "smart cities," the comparatively "dumb" histories of mud and mark-making demonstrate that calculation, coding, and embedded technologies have long been integral to our cities' infrastructures (see Mattern 2015a).

But there's more at stake than historiography. These public squares, city walls, building facades, urban archives, and sandy stores where earthen materials and writing intersect are the humble city sites where politics play out at myriad scales—where the entanglement of global and local political-economic forces enters people's lives through the material, the geological, and the aesthetic. Building and writing materials extracted locally, or sourced and distributed from afar, converge in our settlements and cities, where designers and laborers, often informed by internationally codified and inscribed protocols and standards, give them urban and architectural form. These same

construction materials then become public media. In their geologic composition—the distinctive hue or texture of the local mud, or the distinctive means by which local laborers pack that mud into bricks—they can embody a characteristically local aesthetic, an architectural or geologic *parlante*. Those mud surfaces, then inscribed, carry messages to local residents and to visitors both friendly and hostile—and their competing, sometimes contested, messages make them targets of destruction or attractive spoils of war. Recent threats to our cultural heritage in the Middle East demonstrate just how volatile inscribed bricks and sculpted mud can be—and just how critical it is that we comprehend, document, and, if possible, conserve these records before their historical voices are erased.

Writing on Stone Cliffs and Mud-Bricks: Landscape and Architectural Inscription

From 500 BCE to 500 CE, the people of the Nazca Desert in southern Peru inscribed into the alluvial landscape massive fifteen- to twenty-mile-long line drawings—of flora, fauna, everyday objects, and geometric forms—by brushing away red pebbles and sand, exposing the lighter-colored ground underneath. Once imagined as a gigantic astronomical calendar, these geoglyphs, the Nazca Lines, are now believed to have been used as part of ritual procession routes or in religious rites (UNESCO 2015). Around the same time that the Nazca began marking the ground, Darius the Great, king of the Persian Empire, oversaw the carving of an illustrated autobiography—inscribed in three cuneiform languages: Old Persian, Elamite, and Babylonian—high on the limestone face of Mount Behistun in Iran.⁴

Later, in the first century CE, the Chinese began carving myriad texts—names of places, people, and deities; records of

public-works projects; civic announcements; prayers, eulogies, and poetry—into granite boulders and cliffs. Through these *moya*, or polished-cliff carvings, art historian Robert Harrist (2008: 15) proposes, “the Chinese have transformed geological formations into landscapes imbued with literary, ideological, and religious significance.” He argues that it is important not only to study these texts in terms of their content and style but also to regard them as “environmental case studies,” as “integral parts of their landscape settings,” as texts addressed to a public readership engaged in “peripatetic reading” (23, 28, 32). The carving and the rock are, like our cuneiform and clay, entangled materially and historiographically: the carvings themselves serve as historical records; they guide visitors’ exploration of the landscape, and as Harrist says, they “embed historical memory in the topography of China” (23). Geoglyphs and *moya* thus also exemplify the muddily mixed genealogies of inscription, landscape, and what Henri Lefebvre (1992) calls “the production of space.”

City walls and building facades, made of clay bricks and sticks and stone, have long served as substrates for inscription, too.⁵ In the fifth or sixth century BCE (or perhaps even centuries earlier, according to some scholars), the Olmecs, Zapotecs, and Mayans in Mesoamerica began carving scripts into their monumental sculptures and buildings; these architectural inscriptions constitute some of the earliest-known examples of Mesoamerican writing. Around the same time in Greece, Innis ([1950] 2007: 90) reports, “the laws of Draco and Solon were written on *stelae* of wood or stone and laws were regularly recorded on the walls of public buildings or on separate *stelae* in a public place.” Thus, “with the use of writing”—and the city’s

surfaces themselves as a medium—"the judicial order became a public document, definite and ascertainable."

The "epigraphic habit" captivated ancient Greece and the Roman empire (MacMullen 1982).⁶ "The Romans seemed to inscribe onto and into everything," according to classicist Christopher Johanson (pers. comm., February 26, 2013). Around the forum, an ancient inhabitant or visitor could find "the written word covering every surface of every major monument." These building facades and walls, doorways and courtyards—of fired brick or terracotta, concrete (whose content of volcanic sand, pozzolana, has accounted for its longevity), tufa (a volcanic stone), limestone, or marble—were not designed to be used as substrates for writing, but through the Romans' social practices, "the fabric of the city" ultimately served to record major laws, achievements, and legal transactions, as well as jokes, jabs, and private confessions (Petrucci 1993: 1).⁷

Through the work of its official and amateur authors, who came from all parts of (literate) society, the city was "informally archiving itself on its skin," Johanson says.⁸ Archaeologist Louise Revell (2009: 3–4) suggests that the writings played an integral part of political processes and religious services and thus were bound up in the social practice of "what it was to be Roman." Such processes and rituals of course involved various forms of mediation—public address, sculpture, and other modes of pageantry. Thus, the scripts were, like Harrist's *moya*, embedded in their environments, cross-referenced with other messages relayed by other media formats, and read by moving, sensing, often celebrating bodies.

The Arabic world has been similarly rich with epigraphy. "In a largely aniconic artist culture"—that is, one that

forbids the creation of images of sentient beings—Yasser Tabbaa (2001: 54) explains, "public inscriptions were by necessity one of the primary visual means of political and religious expression and one of the few ways for a dynasty to distinguish its reign from that of its predecessor."⁹ In the tenth through the twelfth centuries CE, the Fatimids of Cairo, known for the splendor of their art and architecture, displayed official writing on the exteriors of their minarets and other public structures. As in Greece and Rome, architecture functioned here as an infrastructure for communicating territorial claims and codifying beliefs. While places like the mosque of al-Hakim also featured prominent Arabic writing *inside*—writing intended for the worshipping community—art historian Irene Bierman (1998: 4) contends that "the act of putting writing in Arabic, in several places at pedestrian level, and in large scale letters on the minarets of the mosque . . . itself located outside the royal city of Cairo, made that writing viewable by all who passed that public space." These exterior scripts—sometimes in Greek, sometimes in Arabic—were occasionally placed on gateways and city thresholds, too, and were intended to publicly herald both territorial claims and allegiance to a particular linguistic culture and ideology.

The specific aesthetic properties of those "public texts"—their "color, materiality, and form," their floriated Kufic script, and their occasional use of gold or glass mosaic—also played a key role in how and what they communicated: power, opulence, and, as other scholars have argued, confused political goals (Bierman 1998: 20). Tabbaa (1999: 182) notes in his review of Bierman's work that the ornate Fatimid script was "deliberately ambiguous. . . . This simultaneity of visibility and

incomprehension, of inclusiveness and exclusiveness”—of making proclamations public, but incomprehensible—“underlies the intentions of a dynasty that always seemed divided between its messianic purposes and its encrypted messages” (see also Blair 1992, 1998).

Writings on these landscapes and landforms, and on the mud and stone walls of these cities, all carry public messages to their inhabitants and visitors. But in different contexts, they serve different purposes: directing ritual, marking territory, proclaiming power, echoing history, evoking spiritual values, announcing laws, accommodating dissent, perhaps even provoking disorientation and confusion—and in all cases negotiating, materially and textually, between local and global political concerns.

Writing Cities into Being: The Scripts of Urban Planning and Administration

Written charters and drawn plans have brought cities into being, and scrivener documents have kept them in order. Angel Rama, in his posthumously published *The Lettered City*, explains how Iberian colonialists employed a combined strategy involving both writing and urbanization to impose a new order on the New World. In his introduction to the book, John Charles Chasteen fleshes out the many ways in which inscription and city-building converged: “The Iberian monarchs created precocious urban networks, carefully planned with pen and paper, their geometrical layout standardized by detailed written instructions. New cities housed both the institutions of state power and the writers who dealt in edicts, memoranda, reports, and all the official correspondence that held the empire together” (Rama 1996: vii). These written documents, and the educated *letrados* who created and

archived them, enabled the Spanish and Portuguese conquerors to impose an ambitious, rational, systematic plan on existing indigenous settlements and, more rarely, in brand new towns. While the conquerors and their subjects stripped the landscape of its gold and silver, they also (re)molded its mud into grids of adobe-walled structures set around central plazas dominated by a church.

Rama (1996: 19, 24) focuses on the *letrados*’ administrative authority—their ability to “manipulate writing in largely illiterate societies” in order to “evangeliz[e] and oversee the transculturation of an indigenous population numbering in the millions.” And part of that evangelizing, Rama argues, involved conveying an urban imaginary, marshaling “diagrams that translated the [political] will into graphic terms”—typically, orderly checkerboard grids—that were intended, in turn, to inspire a translation into material terms.¹⁰ Conqueror and conquered alike were to imagine transforming those paper-based urban visions into stone and adobe realities. Again, politics were to take material form in the architectural and aesthetic.

Yet the grid plan already was a material reality in many indigenous Mesoamerican settlements. Not only was plaza-centered urban design present in pre-Columbian settlements, but the Spaniards, impressed by the grandeur and order of New World cities, may have even imported their urban-planning ideas back to the Old World and employed them in the redesign of Spanish cities under Philip II (Low 1995; Azevedo-Salomao and Ettinger-McEnulty 2005).¹¹ Anthropologists have also taken issue with Rama’s claim that the conquerors were entering a New World devoid of its own literate culture. Anthropologist Frank Solomon and

sociolinguist Mercedes Niño-Murcia argue that new colonial literacies, “sponsored by church and by state, were not expanding into a graphic void. For when Spaniards brought the alphabet, they brought it to a society which already had its own advanced resources for recording information” (Solomon and Niño-Murcia 2011: 10). As discussed earlier, various ancient Mesoamerican civilizations had developed scripts. Some indigenous populations, like those that Solomon and Niño-Murcia studied in Peru, continued (and continue to this day) to use the ancient medium of the *khipu*, or knot-cord, to monitor taxes and military operations and to track census records, genealogies, and agricultural calendars, and many villages developed vibrant (and remarkably exhaustive) local cultures of handwritten record-keeping.¹²

While the colonialists’ grand urban plans may have duplicated forms that already existed in indigenous settlements, they did promise to refashion those existing restructures, to reconstitute them within a new ideological framework. Hernán Cortés, for example, remade the sacred central plaza of the Great Temple of Tenochtitlán into a new Spanish American plaza and cathedral. In many existing settlements, an urban plan and orientation that once reflected cosmological principles now symbolized rational order and the power of a new god. Cathedrals were sited alongside, or atop, temples and other pre-Columbian structures. Sites and streets took on new names: many that had reflected local geographic features, architectural forms, or agricultural concerns were re-Christened in Spanish, forcing indigenous readers “to pay more heed to the European-framed models conveyed graphically in written documentation” (Rappaport and Cummins 2012: 232). In some cases, colonial influence was

more subtle: as anthropologist Setha Low (1995) explains, colonial power made itself palpable in construction techniques and masonry. Ideology was made manifest in the way mud was shaped into bricks. And indigenous laborers molded those bricks and forcibly remodeled their own homes, through labor with profound symbolic significance.

Yet even if the New World was no *tabula rasa*, and those colonial urban imaginaries couldn’t be translated “verbatim” into brick, the written plan still served its political function. The ideal-city plan, Rama (1996: 9) says, has the “rhetorical capacity . . . to impose hierarchical order on spiraling empires.” On the city’s “physical plane,” we might be lost amid its muddy “multiplicity and fragmentation”—the juxtaposition of temples and cathedrals, the confusion of cosmic orientations and rational grids. But we can rely on the *letrados* to provide signs—in handwritten documents; or, more recently, in printed guidebooks or street signs; or, today, via Google maps—to “organize and interpret” the mess, “rendering the city meaningful as an idealized order” (Rama 1996: 27). It is worth noting, though, that well into the age of print, native writing—particularly writing *on* the landscape—continued to play a key role in rural villagers’ territorial markings: “Possession to territory was . . . inscribed on paper, on the land itself,” through the digging of *zanjas*, or boundary ditches, or through census takers’ chalk marks on building facades (Solomon and Niño-Murcia 2011: 10, 33).¹³

Rama specifies that the written plans for the ideal city “transposed” not into a concrete construction, not into “the fabric of the living city,” but merely into a compelling urban imaginary. Meanwhile, anthropologist Brinkley Messick (1993) argues that we can find concrete historical

parallels between writing and urban form: script made manifest in brick. He examines the history of Islamic architectural inscriptions and their formal parallels in the very “articulation” of urban space.¹⁴ Messick discusses so-called Arabic spiral texts, in which the writing rotates in a spiral shape, entwining form and content, and argues that “this poetics of written space then can be extended to general domains of spatial organization: towns, architecture, and the space of the state” (231). He contrasts the “curvilinear urban script” of the Yemeni town of Ibb (“a labyrinth of closely packed multistoried houses on narrow and winding alleys and culs-de-sac,” with plenty of “residual, irregular spaces”) with the zoned, planned-out newer regions, characterized by “relatively straight-line, wide thoroughfares with some space left between the buildings” (246–47). This “new separation and precedence of urban form over urban content” and the parallel evolution in urban form, he argues, “is analogous to the changeover from spiral texts to their straightened successors.” Whether we can claim a causal relationship is perhaps beside the point; what we see here is a morphological resonance between writing, an integral political-economic and cultural media infrastructure, and the shape of the city itself.

Many design historians have made similar claims about the media of design (from verbal instructions to blueprints to parametric tools) and the character of the architectural drawing or drawn urban plan, both of which are thought to shape the designer’s proposed plans—and, eventually, the resulting concrete constructions. Scholars have researched the impact of graph paper and photography and 3-D modeling on design practice; particular architects’ penchants for sketching in

charcoal or watercolor or on napkins; the history and epistemology of various projections in architectural drawing; and so forth (see, for instance, the work of the Instruments Project [Instruments Project 2016]). Despite the prevalence of such research, Bernhard Siegert calls for an end to “expressions” about design “that do little more than reinscribe the ideology of the artist’s [he uses “artist” and “architect” interchangeably] imaginary agency,” that imagine architecture as “some ineffable act of creation” (2015: 122, 123). Siegert exhorts design theorists and historians to recognize “design as a cultural technique.” Yet they already do, whether they use Siegert’s particular terminology or not. They already attend to the “material cultures, practices, and workshop conditions” of design; they examine its historical “technologies, materialities, codes, and visualization strategies”—the means by which they make the material aesthetic and political. Drawing, in particular—in graphite or ink on parchment or paper or screen—is widely recognized as a historical and political practice that is central to the identity of the architect; as Reyner Banham (1990) proclaimed: “Being unable to think without drawing became the mark of one truly socialized into the profession of architecture.”

“The architects of the ancient world,” architectural historian Mario Carpo (2001: 19) suggests, “would have drawn up their actual project designs only at the building site and while the works were in full swing. The drawings that they made were working plans, often done at full scale.” In other words, they were written directly on the building site. Sometimes those plans were inscribed at smaller scale onto the lower walls of the under-construction buildings themselves or onto clay tablets (Haselberger 1985; Millard 1987: 109–11).

Thus, in our ancient cities, the writing of architectural and urban plans—if they were written out at all—and the realization of those plans most likely happened simultaneously and in the same medium. Other genres of architectural thought—rules, theory, standards, and so on—likewise took form on different media substrates: manuscripts, printed books, oral address. These formats of communication shaped the advice authors dispensed, which in turn shaped the built environment their readers created.¹⁵ Clay tablet or scroll shaped architectural thought, which in turn informed the arrangement of bricks and stones. These texts thus mediated the translation of mud and stone into urban form, a form that both embodied an ideology and created a platform for a society to perform its politics.

Urban Writing Cultures: Circulating Texts

In Rama's lettered cities, colonial-era *letrados* generated and circulated texts to broadcast and legitimate the colonial order. Meanwhile, in Peruvian villages, by the seventeenth century, "some kurakas (Andean nobles) and Andean commoners close to the scribal establishment could emulate the [colonialists'] ponderous legalistic prose that spoke to power" (Solomon and Niño-Murcia 2011: 9). They generated a vibrant culture of literacy—both through programs sanctioned by the state and the church and, informally, through their own kinship organizations and communities. Many of the Spanish-language writings they produced were collaborative and palimpsestic documents containing transcriptions of legal briefs interwoven from different periods of time, translating not only one language into another but also the spoken word into written form; native dictation or testimony was sometimes filtered through a mestizo interpreter and

recorded by Spanish notaries (Rappaport and Cummins 2012: 118).

Solomon and Niño-Murcia (2011) write that today, "modern campesinos bring to the bureaucratic-legalistic style of writing a devotion and enthusiasm that startle outsiders" (2), and that households "cherish their goatskin-wrapped packets of titles and lawsuits as vital endowments" (24). Information regarded as vital to the community is typically preserved in manuscript form, not in print, and "letters that matter often appear as art: as epigraphy, as embroidery, and as carvings" (36). The most critical texts thus materialize in stone, mud, and thread. While record-keeping was intended to keep social order in the Iberian colonies, the villagers of Tupicocha see their own self-directed record-keeping "as the very linchpin of communal life," the "very heart of the social contract," as well as a means of ensuring "equitable treatment by outside authorities," like state organizations and NGOs (25).

Manuscripts have proven similarly central to the cultural identity of Timbuktu, in Mali (Gwin 2011, 2013; Hammer 2006, 2014; Harding 2013). These vellum and parchment documents—primarily in Arabic, but also in a few African languages—were created between the thirteenth and seventeenth centuries, when Timbuktu was an intellectual, spiritual, and cultural center and a hub for the trade of salt, gold, cattle, grain—and manuscripts. The several-hundred-thousand-item historical collection, containing both materials imported from elsewhere in the Islamic world and those copied locally, included texts on a wide variety of topics: poetry, music, African history, Islam, medicine, science and mathematics, and so forth. As the city developed its library, its leaders also commissioned mosques, including the magnificent Djingareyber, Sankoré,

and Sidi Yahia mosques, which served as centers for Islamic scholarship, and which, like much of the city's architecture, were constructed from *banco*, a mixture of mud and straw, on a timber frame.

When the Moroccan army invaded in 1591, its soldiers looted the libraries and carried its preeminent scholars off to Marrakesh. Yet many of Timbuktu's manuscripts survived—secreted away in private homes (many families later established their own private libraries), hidden in trunks or caves, or buried in the sand (over the years, some items have been carted or sold off to foreign museums or libraries, too). This literate history has also remained a popular secret: "Even most Malians have known nothing about the writings, believing that the sole repositories of the region's history and culture were itinerant musician-entertainers-oral historians known as *griots*," reported the *Smithsonian Magazine's* Joshua Hammer in 2006. Musician Toumani Diabate, who claims a fifty-two-generation-long griot heritage, told Hammer: "We have no written history" (Hammer 2006). That written history has been strategically concealed repeatedly throughout Mali's history, each time a city or village's written culture has been threatened by colonial invasion, flood, fire, or by tribal or radical Islamist insurgency.

Yet over the past several decades, archaeologists and archivists have begun to call attention to the documents and focus on their preservation. Much of this work has been centered at the Ahmed Baba Institute, which in 1964, with support from several other Islamic countries and from the United Nations Educational, Scientific, and Cultural Organization (UNESCO), sent its staff across the country in search of the diasporic manuscripts. In 2009, the institute moved into a new home with proper climate control

for preservation of the material documents and with equipment and funding for their digitization. Other private collections have used Western funding (from the Mellon and Ford Foundations, for instance) to construct their own private libraries—the Bibliothèque Mamma Haidara, Bibliothèque al-Wangari, and the Bibliothèque Allimam Ben Essayouti—and initiate their own digitization efforts. Here at these sites, again, local and global politics converge.

Yet digitization is no fail-proof defense.¹⁶ Another attack, this time from Islamist insurgents, occurred in 2012, and the Malians' centuries-old preservation strategy—burying their written heritage in the earth—attracted global media attention. The Tuareg tribe allied with Islamic militants and seized Timbuktu. The jihadists, Hammer (2014) reports, ultimately abandoned the Tuaregs, declared sharia law, and began attacking anything haram: "Eventually the militants set their sights on the city's ultimate symbols of open-mindedness and reasoned discourse: its manuscripts." The dormant network of manuscript-activists sprang to action, smuggling over 350,000 manuscripts—by donkey, by boat, by night, often through jihadist checkpoints—to safety in Bamako. "The people here have long memories," said reporter Sidi Ahmed. "They are used to hiding their manuscripts. They go into the desert and bury them until it is safe" (quoted in Gwin 2013).

Early in 2013, French troops arrived in response to new threats from al-Qaeda (much of what follows is informed by Hammer 2014 and Schultz 2013). Hammer reports that, at that time, the city was preparing for its Maouloud festival, which involves a public reading of some of their most revered manuscripts. The jihadists, faced with both impending French resistance and an impending haram

ritual reading, threatened to destroy the manuscripts as a show of force against the French. On January 25, the jihadists entered the restoration and digitization rooms at the Ahmed Baba Institute and burned 4,202 manuscripts. Despite this great loss, most of Timbuktu's written heritage was preserved—by digitization, yes, but also by mule and mud. The jihadists never ventured into the basement storage, deep in the building's foundation, where they would have found 10,603 restored manuscripts. Thousands of other written documents were shielded, too, behind mud walls or buried in sand, where they have hidden during so many times of trial.

Before we leave Timbuktu, I should note that mud has even more long-standing and widespread applications in preserving the city's cultural heritage. Not only have mud and sand helped to obscure Timbuktu's written artifacts and thereby prevent their destruction but mud has also proven integral to the maintenance of its architecture, which embodies the city's spiritual and cultural heritage. Residents have used *banco* to rebuild, brick by brick, mausoleums destroyed in recent years by al-Qaeda. And since the fourteenth century, Timbuktu's residents have regarded it as their "religious and social obligation" to contribute to maintenance of the city's mud mosques, which are constantly threatened by geological and climatic forces, particularly engulfment by sand (i.e., "desertification") (UNESCO 2007). In 2007, UNESCO reported that at least prior to the mosque's recent formal restoration (funded by the Aga Khan Trust), the community had contributed to a restoration "ritual" at least biennially. After the *banco* was delivered and kneaded, the master mason, "well armed with magic spells, applie[d] the first clods of banco while the others chant[ed] incantations."

Then, both children and adults "formed a chain to pass the banco from hand to hand to the sound of beating drums and flutes" (UNESCO 2007). And by consulting ancient documents, the city's written heritage, they were able to refurbish the western facade of the Djingareyber Mosque's inner courtyard. Again, we see mud and text entwined in urban development and restoration, in the creation and maintenance of urban communities, in the cultivation of distinctive cultural identities, and in international development.

Standardization: Bricks and Concrete

Before bricks were uniformly manufactured, they featured a great deal of local variety, informed by local materials and local masonry customs and the idiosyncrasies of individual masons' work. Some of the oldest dried bricks, made around 7500 BCE from shaped mud, were found in present-day Turkey, and the earliest fired bricks, from around 3000 BCE, were found in Indus Valley, in present-day Pakistan. Yet even in ancient Rome, the manufacture of bricks was standardized—they came in *bessales*, or 1-foot-long modules; *sesquipedales*, 1.5-foot-long; and *bipedales*, 2-feet-long—and they featured stamps identifying the name of the clay field or brickyard (*figlina*) where they originated, the name of its owner, the name of the brick-maker (*offinator*), and the consuls in office during its manufacture (Adam 1999: 293; Anderson 1997; Bodel 1983: 1). As Jean-Pierre Adam explains, "These bricks and their subdivisions are found at absolutely every level of the buildings as well as in walls, frames, arches and lintels, vaults, floors or heating installations." By the nineteenth century, the introduction of wire cutters and dryers, brick-pressing machines and extruders, and other machinery dramatically routinized and

standardized the production of bricks, which are today composed of clay-bearing soil, sand, and lime or concrete.

By the 1930s, a German architect named Ernst Neufert sought to further rationalize construction by publishing a set of architectural standards, the *Bauentwurfslehre* (published in English as *Architects' Data*), which remains today a valuable resource. He drew heavily on his teenage experience as a bricklayer. Inspired by the work of Die Brücke (Internationales Institut zur Organisierung der geistigen Arbeit), a Munich-based group dedicated to the organization of intellectual work and the development of standardized formats, he sought to build upon their efforts to normalize paper dimensions. He argued that “standard [paper] formats constitute the basis for the dimensions of furniture used for writing and record keeping. These are also constitutive of the dimensions of spaces” (quoted in Vossoughian 2014: 39). Standardizing these various infrastructures would facilitate the circulation of ideas, promote easy translation between disparate industries, save on storage space, and promote what he called “rapid design.” Notably, Peruvian villagers came to a similar conclusion by the late nineteenth century: standardized uses of paper—particularly, the way that it could allow them to record information in tabular formats and to maintain separate, consistent books for different topics (labor records, marriages, census, etc.)—ultimately demonstrated that paper matched, if not surpassed, the strengths of their *kipus*, which had long served as a tactile form of proto-infographics (Solomon and Niño-Murcia 2011: 83–97).

Neufert saw parallels between the proportions of standardized paper and Renaissance architecture, and he proposed that similar principles could

reform the modern construction industry (Vossoughian 2014: 46). The A0 sheet of paper, one square meter in area, could be proportionally linked to a hypothetical “standard-format brick” via Neufert’s Octametric System, a set of norms based on an eight-part subdivision of the meter. The regularity of the Octametric System would purportedly increase the efficiency and cost-effectiveness of the construction process and would allow builders to use the brick as a unit, an inscription, of measurement: one could count the number of standard-sized bricks to determine a room’s dimensions and then plan for its appointment with standard-sized furniture and appliances. The bricks, architectural historian Nader Vossoughian says, “are thus media—that is, tools of communication—as well as materials, instruments of construction. They are intended as instruments for regulating—and not just building—buildings” (47).

Paper, a substrate for writing, gives shape to bricks and the furnishings in those brick-built rooms. Those bricks, in turn, could be read as measurements of a room’s dimension. And according to Vossoughian, the standardization impulse that links those two forms together—that makes the brick have to conform to the paper’s proportions—also manufactures the need for more writing. “Over the course of the twentieth century,” Vossoughian (2014: 49) writes, “it increased the designer’s dependency on handbooks and manuals, which centralized and homogenized the production of architectural knowledge.” Further, he notes: “It stimulated the spread of design systems, which regulated architectural decision-making across multiple scales. . . . It reimagined the ‘art of building’ (Vitruvius [the first-century BCE Roman architect and engineer]) as a system for organizing

and arranging dimensional norms, which interpolated the architect as a kind of ‘computer’—that is, as someone who calculates, computes, and organizes. Finally, it anticipated the phenomenon of digital design, which replaces the drafting table with the programmable ‘black box.’”

Concrete has had a similarly radical impact on architecture, allowing designers to reimagine the “art of building.” It is liquid, poured rather than installed in units, and chemically active. That liquid metamorphoses into solid form within mere hours of the pour. According to architect Francesca Hughes (2014: 119), concrete’s material properties transformed construction and opened up new possibilities for conceivable designs. Yet this material untamedness also made it a prime target for standards and specifications, for “criteria for performance and written instruments of its own control” (126).¹⁷ “No other construction material’s handling had ever, nor has ever, been so keenly determined,” Hughes argues. “The quantification of every aspect of production, every small move of the laborer’s body prescribed, the degree of vigorousness with which a tester might knead a sample, the pressure with which a cement trowel might be applied to smooth over the top surface of a filled mold—all was set down, dictated *ad absurdum*” (119). Traditionally, the “embedded knowledge” of laborers and foremen, about both material science and quality control, had proven sufficient on the construction job site. With the imposition of standards, however, Hughes says, “such knowledge was effectively lent both form and formality (extracted and written)” (127). Laborers’ intuitive understanding of the material was thus externalized and formalized in writing. That externalization of knowledge paralleled a division of labor: as architectural historian

Adrian Forty (2012: 16) explains, chemists and engineers developed cements; industrialists sought to commercially exploit cement production; and “ordinary builders,” originally aiming to improve on traditional rammed-earth construction, developed, often by trial and error, “the practical application of the material and subsequently the technique of reinforcing it with steel.”

Also like brick, concrete is both modern and premodern, unnatural and natural, in its mix of primordial materials and new techniques and technologies. For millennia, civilizations have been mixing burnt limestone with sand, aggregates and water, and using it as a mortar—but cement, a binding component of concrete, has also occurred geologically for millennia. Natural deposits, where limestone has reacted with oil shale, have been found in Israel. As we discussed earlier, the Romans used pozzolana, volcanic sand, in their cement. Yet this ancient material concrete is also an essential ingredient in Italian architect Antonio Sant-Elia’s (1914) recipe for a futurist architecture of calculation and “audacious temerity,” and it has “contributed to the formation of modern architectural identities in an age of unprecedented urbanization”—with its ubiquitous office slabs and housing blocks—and monotonous suburbanization (Cohen and Moeller 2006: 6). It found high-profile, progressive champions in the likes of Le Corbusier and Louis Kahn. Concrete has also allowed for the creation of new, technically sophisticated forms: shells, extended spans, cantilevers. Still, its “crudeness” and the craft of its production, Forty (2012: 32–33, 34) argues, have also “provided a means of reconnecting with architecture’s supposedly primitive origins in mud.” American architect Paul Rudolph, a noted brutalist (from *béton brut*, meaning “raw

concrete”), reportedly complained that American concrete contractors’ focus on precision gave their work a “thin metallic-like quality.” “Concrete is mud,” he said. “I work with concrete not against it. I like mud” (quoted in Forty 2012: 23).

Concrete also embodies an ambiguous politics. Cement production involves mixing limestone with clay, along with shells, chalk, shale, slate, sand, iron ore, and/or other materials, and baking at high temperatures to produce lumps of “clinker,” which is then ground up and mixed with gypsum and limestone. The process—from burning the lime, to powering the kilns, and ultimately transporting the materials—is a source of significant carbon emissions (Forty 2012: 69–70; Portland Cement Association 2015). In comparison, older building materials and techniques, like rammed earth and mud-brick, require significantly less energy. Yet across a building’s life cycle, concrete, with its high thermal mass, requires relatively little energy for heating and cooling and thus proves quite efficient (Forty 2012: 70–71, 73). Still, as a global commodity like steel or oil, concrete is traded worldwide, often via the thousand-plus ships owned by the massive Germany company HeidelbergCement (see HeidelbergCement 2014; Forty 2012: 101). Despite the standardization of this global product, however, there is still room for local variation: when we mix uniformly produced cement with local labor, steel, and aggregates, concrete can exhibit local variations, inspiring discussion of the material’s potential regional characters—for example, a Japanese or a Swiss concrete (Forty 2012: 103).

Perhaps place can thus be written in concrete, too. It can speak to class politics, as well: “In global terms,” Forty argues (2012: 40), “reinforced concrete is one of the new ‘technologies of poverty’—in

overall quantity consumed, its use by self-builders in poor countries probably exceeds all other applications. In the shanty towns of the world, its use is characterized by ingenuity rather than innovation: new or even relatively old developments in concrete technology are irrelevant, what matters is the way small amounts of reinforced concrete are made to go a long way.” Outside the shanty towns, those new developments—including the creation of thin, elastic high-performance concrete or the integration of optical fibers to generate a translucent material—have made possible new “forms of expression”: decorative grainy surfaces or the use of photoengraving or digital etching to inscribe imagery or pattern into building skins, allowing, Cohen and Moeller (2006: 6–7) suggest, “for a technologically based *architecture parlante*,” an architecture that speaks its function or identity through form.¹⁸

Writing on Walls: Industrial Materials and Indigenous Inscriptions

Concrete has also historically been used—in unsanctioned practices, peripheral to the world of famous architects and international construction companies—to provide a platform for voices speaking in marginal languages. Concrete facades and walls, those ubiquitous urban partitions and barriers and screens, have given rise to their own epigraphic habit. Of course much has been written about the history of urban graffiti as a marker of territory or a means of reclamation, or of individual or collective expression. Anthropologist Julie Peteet (1996) has studied graffiti on the concrete, cinder-block, brick, and stone walls of the occupied West Bank at the height of the intifada, in the late 1980s and early 1990s. For Palestinians, she argues, that writing has served simultaneously to “affirm

community and resistance, debate tradition, envision competing futures, index historical events and processes, . . . inscribe memory," "provide political commentary," "record events and commemorate martyrdom," and "issue directives both for confronting occupation and transforming oneself in the process" (140–41).¹⁹ These marks—typically created by Palestinians and erased by Israelis—undoubtedly carried very different meanings for each. Yet both groups, as well as those foreign to the region and the conflict, could read the walls "much the way an archaeologist reads stratigraphy—layer by layer," with superimposed texts reflecting the temporality of an unfolding dialogue, or, as Peteet puts it, "victory in an ongoing battle," a "barometer of discontent and resistance" (139, 145). The flat, banal, brutal face of a concrete wall, whose act of dividing and denying served as a profound symbol of deep conflict, seemed to invite agonistic inscription. "The riot of signs on stones, and their erasure," Peteet argues, "signaled a contest over place and its definition. It made the stone walls into encoded tablets, public, didactic, archival, and interventionist spaces of riposte" (148).

Meanwhile, Calcutta hosted a different battle of public lettering—between official and commercial signage and informal wall writing. According to architectural and urban historian Swati Chattopadhyay, the early and mid-twentieth-century city was clad in layers of text. Building facades—in plaster and brick, and more often, by the early twentieth century, concrete—featured their owners' names and building names, dates of construction, street names, and house numbers, all of which were embedded in the buildings' walls, "their permanency staking a claim in the city in the longue durée" (Chattopadhyay 2012: 139; see also Tappin 2002). Businesses also

painted semipermanent signboards on their facades, and "the strip of wall underneath the row of upper-floor windows provided a continuous space for commercial billboards that were mounted on fixed frames" (Chattopadhyay 2012: 139, 141). Informal posters, which advertised films or introduced political candidates, added a fleeting surface-layer of applied text, "changing the materiality of the wall and its claim to obdurate permanence by showing up its susceptibility to resinscription and transformation" (151).

At the very top of this palimpsest, an additional layer of informal wall writing by subaltern and marginalized groups manages to overpower the official and commercial scripts. In the process, Chattopadhyay says, it also challenges the permanence of state and corporate infrastructures.²⁰ Writers often first whitewash the walls to create a fresh space for their inscriptions, many of which then employ visual effects that mimic the shapes and materials of the facade; these writers and their scripts "appropriat[e] the wall by following its geometry of surfaces, solids, and voids," and "resonating" its "patchwork plaster and . . . exposed brickwork" (Chattopadhyay 2012: 152, 155, 158, 161). The wall is thus not simply a blank substrate; its mud and concrete give form to the writing it supports. At the same time, in "talking over" the facade's official scripts—house numbers and commercial billboards—this political wall-writing "express[es] the wall's impermanence and malleability, . . . bring[ing] forth new intentions and forg[ing] new readership and political agency" (162). The banality and brutality of concrete thus offer opportunities, again, for homegrown means of local inscription, for the subaltern to have a voice.

The Mud and the Mark

Mud, that most humble of geological resources, and its material analogues—clay, stone, brick, concrete—have supplied the foundations for our human settlements and forms of symbolic communication. In our mud-brick walls and clay tablets and concrete buildings, we can observe the aggregated histories of communication and urbanization; we see the integration of *Kulturrechniken's* dual lineages of cultivation—engineering the earth and training the mind. Written decrees and urban plans have proven instrumental in marshaling the resources to bring our settlements and cities into existence, molding cities from clay and codes and cables, and in regulating and standardizing the use of those resources. The complexity of urban existence then necessitates the production of more and more written records. We sometimes observe formal parallels between our written texts, our building materials, and our urban morphology, as in Ibb and the colonial New World—and we often find that our cities and our media reflect one another in their operative logics and politics. Our bricks and stones can even speak their own geologic *parlante*, reflecting the distinctive character of a place. And various cultures of writing—like those etching lines into the Peruvian landscape, those carving on stones in China, those collecting manuscripts in the mud-and-timber city of Timbuktu, those generating household bureaucratic archives in post-colonial South America, or those protesting, in spray paint on concrete walls, in Calcutta and the West Bank—have used those bricks and stones as a platform for expression. While their public inscriptions have held different meanings for different populations, those public writers have invariably, through their mark-making, reshaped the cities they lived in and used

their walls and written symbols to negotiate political forces at various scales.

Writing and urbanization are entangled materially, politically, economically, culturally, and historiographically. And as we've witnessed in the recent destruction of many treasures of the world's cultural heritage in the Middle East, those most humble geologic resources—when molded into bricks and texts, into monuments and manuals for living—are powerful emblems of, and lightning rods for, cultural politics. Wind, rain, and sand will continue to take their toll on these geological media—our ancient monuments and cliff-carvings—thus gradually diminishing the archive from which we can write and experience our shared histories. But an even more potent corrosive force, it seems, is the hubristic destruction inherent in a radical form of *Kulturrechniken*. The media of sledgehammers and bulldozers and dynamite are equally powerful “symbolic operators,” as Siegert might call them—not through their cultivation and inscription of meaning but through their erasure.

Notes

1. Images illustrating the article, prepared for a May 2016 talk at the University of Amsterdam, are available in Mattern 2016.
2. The materiality of the historical record conditions the possibilities of historiography. As Innis ([1950] 2007: 29) noted:

The significance of a basic medium to its civilization is difficult to appraise since the means of appraisal are influenced by the media, and indeed the fact of appraisal appears to be peculiar to certain types of media. A change in the type of medium implies a change in the type of appraisal and hence makes it difficult for one civilization to understand another. The difficulty is enhanced by the character

- of the material, particularly its relative permanence. Pirenne has commented on the irony of history in which as a result of the character of the material much is preserved when little is written and little is preserved when much is written. Papyrus has practically disappeared whereas clay and stone have remained largely intact, but clay and stone as permanent material are used for limited purposes and studies of the periods in which they predominate will be influenced by that fact.
3. In a 1975 report by the National Academy of Sciences, a group of materials scientists and engineers wondered about the cultural and methodological implications of materials development: How might the materials used to produce historical records inform the nature of writing, and thereby shape a culture's language and their "mode of thought"? How did the angular script necessitated by the reed stylus and clay tablet shape Sumerian thought? "The differences between the cuneiform and hieroglyphic culture," which used a more flexible medium, papyrus, "were made dependent on the differences in materials available, quite as much as were the mud-brick and stone architecture of their respective regions" (National Academy of Sciences 1975: 1–14).
 4. Johanna Drucker (2010: 139) says that inscriptions such as these, as well as similar inscriptions on the limestone palace walls at Babylon and the tomb paintings of ancient Egyptian monarchs, constitute spaces in which "authority is constituted through spatial signs." She explains: "These monuments are frontal in their mode of address: flat surfaces large in scale and authoritative in intention and effect. They dwarf their viewers and often, as at Behistun, are placed in a position so difficult to access that they appear to have been produced by a superhuman force. . . . The speaking subject of monumental spaces entertains no dialogue with the spoken subject."
 5. Malcolm McCullough (2013: 140), in his study of "ambient," or environmental, communication, notes that "buildings were the first communication medium" and that "too few histories of information acknowledge this architectural power; too few histories of information are environmental."
 6. Much of this passage on epigraphy is drawn from my "Deep Time of Media Infrastructure" (Mattern 2015). Malcolm McCullough (2013: 118–21) also acknowledges epigraphy as a form of environmental communication in his *Ambient Commons*.
 7. For more on the material properties of public lettering and their modes of address, see Drucker 1998, 2010.
 8. Jane Webster (2008: 118) concurs that "individuals at all levels of Roman society"—including slaves—made literary and (non-linguistic) figural inscriptions, both *dipinti* (painted) and *graffiti* (carved). See also Keegan 2014 and Mouritsen 2011: 127–35.
 9. As Laura U. Marks (2010) notes, however, some Islamic art traditions, particularly Persian paintings and carpets, did allow for the representation of animals or human figures.
 10. See also Bernhard Siegert's "(Not) in Place: The Grid, or, Cultural Techniques of Ruling Spaces," in Siegert 2015 (97–120).
 11. Archaeologist Timothy Pugh has recently discovered that the Maya site of Nixtun-Ch'ich' in Petén, Guatemala, inhabited from 600 to 300 BCE, was organized in accordance with a clear grid structure (Jarus 2015).
 12. Rama (1996: 24) also acknowledges that during the nineteenth century, the graphic universe, the "universe of signs," expanded dramatically beyond the "mute text": "[Neo-] Baroque discourse bloomed with a profusion of emblems, hieroglyphs, apologues, and ciphers, all commonly incorporated into theatrical displays along with painting, sculpture, music, dance, and decorative use of colors. . . . The best examples of this discourse are obviously not the mute texts that we have conserved but in these ephemeral festivals of the arts, best represented by the triumphal arches that commemorated great events."
 13. Rappaport and Cummins (2012: 121) note that these territorial claims were also performed: landholders "rolled on the ground, tearing up

- bits of turf to symbolize the act of claiming possession.”
14. Much of this passage on Islamic spiral texts and urban form is drawn from my “Deep Time of Media Infrastructure” (Mattern 2015b).
 15. Vitruvius, the first-century BCE architect and engineer, wrote his *De architectura*, the only surviving architectural treatise from antiquity, on a scroll. As Carpo (2001: 13) explains, the materiality of his writing informed the advice he dispensed to fellow architects: “Vitruvian architectural theory did not escape either in its form or content from the conditions of use inherent in the manuscript medium.” He couldn’t rely on the accurate reproduction of any illustrations he might choose to include in his text, and furthermore, “there were in his day . . . so many ignorant architects that Vitruvius preferred to be obscure rather than teach ‘to the multitudes of those who do not understand’” (17).
 16. Consider also various cultural organizations’ use of 3-D modeling and image databases to “preserve” those heritage sites destroyed or threatened by ISIS (Farrell 2015).
 17. “That an epistemological trend—such as increasing precision, quantification, or standardization—might be directly accelerated by the physical characteristic of certain materials is telling. It reveals the possibility that such a trend might directly stem from a deep-seated fear of instability of form and matter relations, an instability most embodied in a material that has both liquid and chemically active properties” (Hughes 2014: 126).
 18. On *architecture parlante*, see Harries 1998 (70–72) and Forty 2000. For concrete inscriptions, see the work of Herzog & de Meuron and Wiel Arets.
 19. I transformed the verbs in this passage from past to present tense. For more on the wall as a writing substrate, see Parikka 2014.
 20. As part of the recent interest in “making the invisible visible,” or paying attention to hidden infrastructures, various artists and designers and advocacy groups have also sought to interpret official markers of infrastructure’s presence—particularly those spray-painted inscriptions on the streets and sidewalks that identify the location of electric wiring, communications and gas lines, and sewers. That marking system emerged when, in June 1976, a Los Angeles construction crew working on a road-widening project cut through an oil pipeline that was much nearer the surface than they had anticipated. The resulting explosion caused much destruction and resulted in nine deaths. In response, California instituted its DigAlert spray-paint utility marking system, with electric lines identified in red, sewers in green, communication lines in orange, and gas lines in yellow (American National Standard 1991; DigAlert 2015; Harrison 2014; LAOneCall 2015; Stamp 2013; Twilley 2011).

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