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ARHS 673: Seminar on Mexican Manuscript Painting

Research Paper:

Measuring Cultural Interaction and Exchange: Counting and Concepts of Space in Cadastral Registers and Maps in Colonial Mexico, Sixteenth and Early Seventeenth Centuries

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Having made her way from the chinampa town of Xochimilco, doña Josepha Cortés Cerón y Alvarado appeared before a Mexico City judge on February 12, 1686, clutching papers for a lawsuit.\(^1\) Descended from elite Nahuas who traced their lineage to Acamapichtli, the Mexica forebear of Moctezuma Xocoyotzin (r. 1502-1520), doña Josepha sought to inherit her ancestors’ cacicazgo (estate). Her papers included wills, certificates attesting to noble status, a genealogy, and pictorial manuscripts of houses and patrimonial lands. These pictorial sources contained images with Nahuatl glyphs that manifested a distinctly indigenous character and outlook, expressing a common visual language comprehensible to many in central Mexico. The case of doña Josepha reveals the declining fortunes and status of an elite Nahua family, the inheritance being claimed by “the bastard daughter of the artisan nephew of the late tlatoani [ruler],” as historian Sarah Cline has written.\(^2\) As with the fate of the family, the cadastral sources (see figures 1-5) suggest a trajectory of decline for indigenous pictorial traditions. Yet in both these processes of waning fortunes, there are complexities and ambiguities that frustrate a simple tale of declension.\(^3\)

The sources reveal that within the overall decline of pictorial traditions varying rates of change accompanied certain types of glyphic representation. Some but not all of the pictorial language endured into the seventeenth century, demonstrating that certain Nahua ways of conceiving of and representing the world around them found expression for longer than others. Earlier generations of art historians including John Glass and Donald Robertson described the abrupt demise of Native manuscript art. Glass argued that manuscript painting “quickly degenerated or came to an abrupt halt,”\(^4\) while Robertson similarly wrote of “the speed with which exotic civilizations crumbled under
the impact of European culture." By contrast, art historian Elizabeth Hill Boone identifies a cultural orientation around visual ways of thinking that proved useful for both Spaniards and Nahuas during the early colonial period. She has demonstrated that "the indigenous tradition of manuscript painting and pictorial documentation continued strongly for three generations after the conquest, until almost 1600." 

Colonial era cadastral registers (showing or recording property boundaries), maps, and land like those of Xochimilco (see also figures 6 and 7) have attracted comparatively little attention among historians and art historians. Presumably their neglect arises from their lack of artistic sophistication vis-à-vis cartographic histories and divinatory codices. These latter pictorial manuscripts manifested greater complexity than did cadastral records, attracting attention from scholars interested in Mesoamerican mathematics, astronomical and calendrical systems. Such scholarship has rarely extended into studies of spatial concepts and systems of measurements.

As historians have observed, colonial era cadastral records form part of the corpus of pictorial manuscripts known as economic or practical documents. This paper will examine these sources during the first century of Spanish colonial rule. Pictorial representations of lands and information in cadastral records about measurements uncover an alternative perspective into the process and timing of cultural interaction and exchange among Nahuas and Spaniards. Change transpired within the context of a long held tradition of recording information about land graphically.

This tradition produced the cadastral records considered in this paper. These sources constituted a distinct genre of Native manuscript painting, identifiable because their provenance and use was closely associated with the Spanish colonial administration.
Unlike tribute and census records, cadastral registers presented physical space in ways that could, in part, be measured. While constituting a distinct documentary genre, their form—with glyphic presentations of information, and not just of measurements—shares broad commonalities with other types of pictorial sources. Classifications of documents according to function, for instance by John Glass, or by artistic school, by Donald Robertson, have contributed immeasurably to scholarship on Native manuscript painting, but they do not sufficiently consider the wide and general use of certain glyphs, including those representing measurements, that transcend the boundaries established by classifications.

An examination of measurements and glyphic content of cadastral records demonstrates their similarity with other pictorial manuscripts. Taken together, these manuscripts act as manifestations of the colonial era visual thinking observed by Elizabeth Boone. This suggests that the impulse among historians to contend with pictorial sources, according to discrete classificatory schemes, masks the use, among Nahuas, of a general visual vocabulary to describe and present the landscape. The commonalities among a variety of economic manuscripts and with maps are displayed in the use of glyphs. These constituted a common visual vocabulary, or language, giving expression to the visual thinking Boone describes. The presence of measurements demonstrates that cadastral and by extension other sources, rather than originating solely in the prerogatives of Spanish colonial rule, also found a format and means for expressing aspects of Nahua culture that lasted well into the colonial era. Glyphs for measurements may have been used beyond the second decade of the seventeenth century, in part, because of their long-lasting utility and application. Glass writes, “In civil and
economic matters Indians and Spaniards alike found that maps, tribute registers, cadastral and census documents derived from native traditions met a common need.\textsuperscript{13}

Barbara Mundy in \textit{The Mapping of New Spain} has charted the process of cultural change in the ways Nahuas conceived of and represented space and landscapes.\textsuperscript{14} Mundy concentrated on the maps of the \textit{relaciones geográficas}, a corpus of materials commissioned by the Spanish crown. Mundy described the blending of Native and Spanish cartographic traditions in these maps. Mundy notes that the Nahuas based their traditions on understandings of space through social relationships while Spaniards in the sixteenth century increasingly generated maps oriented in geometric terms. Yet Nahuas economic manuscripts like cadastral records, which Mundy does not examine, exhibit similar geometric presentations of land and probably did so prior to contact with Spaniards.\textsuperscript{15} Because measurements underpin and make possible geometric spatial relationships, economic manuscripts can reveal a broader application of Mundy’s observations, demonstrating connections between cartographic styles and administrative records of lands and properties. The format and content of these latter records became incorporated into mapping traditions, serving simultaneously as a means for change to take place and as an expression and hallmark of that change.

Practical manuscripts like tribute and land registers reflected well-established traditions of record keeping which had previously found application in the Aztec imperial state. Nahuas employed standardized measures and systems for counting prior to the arrival of Spaniards. They made frequent use of defined measurements, as attested by their expression in wills and the dictionaries of Franciscans like fray Alonso de Molina.\textsuperscript{16} Nahuas used regular measurements, the standard unit being the \textit{quahuitl}, meaning tree,
wood, stick or staff, according to linguist Francis Karttunen.\(^\text{17}\) Quahuitl units were equivalent in length to approximately 2.5 meters, although this varied according to region (figure 8). This unit could be divided into fractions, shown by glyphs for arrows (cenmitl), hearts (cenyollotli), and hands (cenmatl). Barbara Williams has remarked that hearts represented the distance from the chest to the hand while the cenmatl referred to the distance from the elbow to the hand.\(^\text{18}\)

Nahua units of measurement remained in consistent use for much of the colonial era. In a 1737 will from Tepetenchi, Xochimilco, testator Antonio Juan referred to land in quahuitl units.\(^\text{19}\) Nahuas did come to adopt Spanish loanwords, and with them measuring systems, as shown in the testament of don Nicolas de Silva from 1736 in which he bequeathed to relatives “a piece of land at Tlillan where a fanega of grain can be sown.”\(^\text{20}\)

As this demonstrates, Spaniards imported their own vocabulary for measurements. They employed comparable ways of recording distances and spatial relationships, common ones being known as brazas and varas. Spaniards also used methods of recording measurements similar to Nahuas although their units differed in size. Both quahuitl and the Spanish term vara referred to a staff of office and a unit of measure—the vara amounting to approximately thirty-three inches.\(^\text{21}\) Measurements\(^\text{\Lambda}\) for instance leguas (leagues) remained vague and inexact, much as Nahua equivalents based on the human body did. Ambiguously, the Spanish term fanega translated to the amount of “tilled ground as was necessary to sow” a certain amount of wheat, using a weight also known as a fanega.\(^\text{22}\)

As historian Richard Kagan has noted, Spanish and Nahua methods of taking measurements and their application in economic and political affairs demonstrated
remarkable similarities. As with Spanish cartographers and surveyors, Nahua used tlatamachuani or tlapouhqui who made cadastral maps and surveys. Tlacuiloque (painters of books) recorded the information pictorially. The Mestizo chronicler Fernando de Alva Ixtlixochitl wrote that tlacuiloque specialized in “paintings of districts, boundaries and borders of cities, provinces, towns and villages as well as the parceling out and distribution of land.”23 Spanish chroniclers, including Alonso de Zorita and fray Juan de Torquemada mentioned Nahua records of land in ways that indicate familiarity with them.24 Thus while the arrival of Spaniards in Mexico involved an encounter across cultural differences, the world of measurements may not have proved mutually unintelligible.

The well-established Nahua tradition of taking measurements, allied with that of record keeping, proved a considerable benefit for Spaniards seeking to understand their newly conquered territories and people. The commission of the Codex Mendoza—a manuscript combining historical account, tribute information, and an ethnographic chronicle of everyday life—by the Spanish King Charles V in 1541 reflected the utility of Nahua traditions of record keeping.25 According to historians James Lockhart and Charles Gibson, preconquest practices of recording measurements continued, albeit in mildly modified form, during Spanish colonial rule. Gibson notes that confusion could arise in attempts by Nahuas to comprehend measurements in Spanish terms (and vice-versa).26

In writing about Spanish usurpation of territory in the colonial era, Gibson remarked upon the tradition of Nahuas to prize and guard their lands, fully cognizant of the dangers of alienation, which had been a “standard feature of Indian life” since the late
Aztec period. In this context, systems of record keeping originating in preconquest times continued through the sixteenth and seventeenth centuries. Regarding the process by which Spanish authorities issued viceregal land grants to Native communities, Gibson writes:

After a gobernador [governor] and his officers had entered a petition, the viceroy ordered the corregidor [Spanish officer in charge of a district] to make a survey. The Indians of the town were notified of the pending survey on a Sunday or fiesta day following religious services. Announcements were duly read, recorded, and witnessed. The corregidor, the Indian officers, an interpreter, and a number of other Indians traversed the area in question and made a record of its measurements and topographical features.

According to Lockhart, such practices amounted to an extension and revision of pre-existing Nahua traditions that continued to find expression in the colonial era through the presence and use of *tlalhuehueteque* ("land-elders"), altepetl officials charged with maintaining records. Having traversed lands, tlacuiloque recorded measurements on cadastral registers. Essential information, common to all forms of land records, identified the location of the land, often described in the general terms of *altepetl* (ethnic state), the owner of the land, information about the size of the holdings, and, in some instance, field shapes. This information found expression in glyphs and as the colonial period wore on, through alphabetic script.

Howard Cline, Barbara Williams, H. R. Harvey, and Jerome Offner have examined such sources as the *Códice de Santa María Asunción*, the *Oztoticpac Lands Map* (figures 9-10), and the *Codex Vergara*, which all contain glyphic forms of written language. These scholars have offered excellent analyses of individual sources, identifying glyphic content and explaining the visual language and writing conventions employed by their Nahua authors (figures 8, 11, 12). Glyphs provide a wealth of data,
ranging from measurements to what Williams describes as sociological information, which consists, for instance, of glyphs depicting people, either as householders in censuses or elsewhere as owners of land.\textsuperscript{31} Glyphs referring to people express differences according to gender and age, through such communicative devices as hairstyles and the inclusion of torsos.\textsuperscript{32} Other artistic embellishments add further details: wrinkles identify a person as elderly; tears indicate that a person is a widower, and hairstyles also stand for marital status. Of the glyphic language used, Harvey and Williams remark that “the pictorial system expresses the demographic variable of age and sex of individuals, a person’s civil and tribute status, size of nuclear families and households, and household social and economic organization.”\textsuperscript{33}

Other common features of the pictorial system found in colonial era records include footprints, glyphs for houses, names, soils, and what Harvey and Williams term “dimension” glyphs representing measurements. Some of these dimension symbols represent linear units, such as lengths and breadths of parcels of land while others concern the area of that land. Together they reflect two types of land records, the milcocolsi and tlahuelmantli registers. Both measurements, however, employ the same glyph.\textsuperscript{34} These could appear in combinations, too, becoming increasingly complex their meaning, as was often the case with soil and dimension images.

Additional information in these records is presented according to color. Color indicates different patterns of land tenure, for instance, lands associated with nobles, royal palaces, and commoners’ lands. In figure 9 parcels of land with perimeters drawn in red ink identify them as owned by nobles. These conventions appear in some of doña
Juana's documents from Xochimilco (figures 1 and 4), although the entire parcel of land, and not just its perimeter is shaded in different colors.

Certain other glyphs representing quantities, not mentioned by Harvey and Williams, appear in plans of property and land as well as in abundance in a large proportion of tribute records (figure 13). Whereas the measures identified by Harvey and Williams implicitly refer to units of measure, the symbols in figure 13 represent numbers disconnected from quantified units, analogous to the dot counters found in a variety of codices. The glyph resembling a banner, termed pantli in Nahuatl, refers to a full count in the vigesimal system (twenty). The one resembling a pine tree represents the number centzoniti or four hundred (i.e. twenty full counts or twenty multiplied by twenty). This counting system independent of measured units, accounts for the widespread use of these glyphs, particularly when representing large numbers (figures 14-17).

Attention to a small corpus of sources has enabled Williams and Harvey to identify regional differences. An example of this is seen in the Texcocan standard linear unit of measurement. While useful for explaining and understanding specific sources, attention to regional forms obscures the widespread use of a common graphic vocabulary among Nahuas of different altepetl and regions. Although the precise meanings and dimensions of measurements vary, their visual representations through glyphs remain consistent. The limited number of glyphs used in economic manuscripts, especially when compared with divinatory codices of the Borgia Group, may have meant for considerable stability in their use over time. Indeed, their long lasting presence in the documents may have arisen from the possibility that the glyphs provided information construed as
manifestly important. Glyphs representing essential information were less susceptible to redundancy after the arrival of Spaniards.

Elizabeth Boone has contended with an array of documentary genres in the colonial period. While writing about classifications of sources, such as “Histories, Genealogies, and Paintings of the Community Lands,” she notes commonalities in style and function that transcend different groupings. There remains among some other scholars a tendency to view each in relative isolation. Still, and as Boone notes, some codices could contain a mixture of economic or practical manuscripts, for instance, census and land plans, as exemplified by the range of materials found in painted testimonies like the Codex Osuna and Codex Kingsborough. Even with great variety in documentary forms, common measurements demonstrate considerable and widespread usage and thus relevance during the first century of Spanish rule.

Many cadastral registers as well as plans of property and land presented information in geometric form from an aerial view. Others proved more abstract. Such is the case of land registers from the Codex Cozcatzin, named after the records of don Luis Cozcatzin, a cacique (local ruler) of Tenochtitlan who brought litigation before the courts in 1572. Here land records appear as akin to a table divided into two cells containing a combination of glyphs and alphabetic script (figure 18). The left-hand cell identifies the altepetl while the other presents information about the owner and his or her parcel of land. Information about land appears in alphabetic script. While such abstract presentations of land remain few in number, their format closely reflect that of annals histories like the Codex Aubin (see figure 19). Indeed, the common presentation of data in a systematic arrangement in rows and columns appear in a variety of documentary
genres, particularly census and tribute records (figures 20-22), albeit with a few
differences in the directions they should be read (figures 21 and 22). Such techniques for
conveying information about land, as well as demography and tribute, continued well into
the colonial period as attested by the Techialoyan *Codex San Francisco Xonacatlan*
(figure 23).

More common than abstract land records structured as tables are the aerial or
vertical elevation views of property and lands (figures 9 and 10). Similarities between the
two structural forms exist, particularly with the placement of location, landowner, and
land, as can be identified through glyphs. Symbols representing people, measurements,
and to a lesser extent, soil types, constitute the visual language that cut across
documentary genres.\(^3^8\) A large part of the corpus of cadastral records and plans of
property are found in litigation presented before Spanish institutions. They may have
been produced specifically for the requirements of the court, especially given the general
resemblance between them (figures 24-39) and with those from Xochimilco (figures 1-7).
Their consistent style and comparative simplicity vis-à-vis divinatory codices and even
other cadastral maps like the *Códice de Santa María Asunción* suggest that notaries and
not llocuioloque created them.\(^3^9\) Other cadastral records such as the *Oztotipac Lands
Map*, the *Códice de Santa María Asunción*, and the *Humboldt Fragments VI* and *VIII*
(figures 40-41) represent patterns of record keeping that arose within and for the internal
needs of communities. These latter sources, while sometimes admitted as evidence in
legal cases, were not expressly manufactured for that purpose and, as such, display more
information and manifest a wider array of glyphic images than do the pictorial records
generated under the auspices of Spanish courts. The comparatively elaborate nature of the
Cóndice de Santa María Asunción stems, in part, from the variety of information it contains; communities would have consulted this codex for information about land holding, tribute, and demography.

Two documentary forms can be discerned among the legal records. Those produced for courts and those generated within communities but submitted to courts shared the same essential visual language. When glyphs for people, places, and measurements appear in these two documentary forms ("legal" and "community"), and indeed, in other pictorial sources, they do not change appreciably in style or meaning. Rather, what differentiates them is the extent of their inclusion or exclusion. Glyphs connoting fractions of units of measure, for instance, are exhibited with less frequency in court documents, presumably because relatively small measurements were of less relevance when questions about the very ownership of that land were at stake.

Commonalities in the use of glyphs for measurements and counters among pictorial manuscripts demonstrate the versatility of Nahua visual language. The Codex Osuna (figure 17) displays counters like those found in the Codex Mendoza along with dot counters. Figures 42 and 43 include both methods of conveying numbers to readers. They also exhibit features from a variety of documentary styles: aerial views of lands; plans of buildings; drawings of other items of property; head glyphs, and lines connecting people showing familial relationships.

Comparisons between different pictorial sources, be they cadastral records, plans, maps, genealogies, listings of properties, tribute records, and censuses, demonstrate the widespread application of a common visual vocabulary. While the form and meaning of this vocabulary remained consistent, changes took place over time in the frequency of
their use. Much as colonial era sources have attracted little comparison across documentary genres, so the practical documents have received little comparative treatment that traces changes in their composition over time. An examination of pictorial sources of properties and lands submitted to the courts reveals a process of change during the period 1540-1616, as shown in table 1.

Over time, certain visual representations of the landscape, for instance, bridges, roads, and water, remain consistent as do the presence of footprints. They incorporate innovations, though, suggesting European influences. For instance, some use brush strokes and watercolors (figure 1), as well as the inclusion of crosses (figures 3 and 29), and, perhaps most notably, alphabetic script. Alphabetic writing, however, as James Lockhart contends, remained largely superfluous in these records, occasionally translating the visual vocabulary employed by Nahuas into cursive form but often presenting alternative information instead.40 The Xochimilcan documents seem to confirm Lockhart’s observation: of the nine documents examined, only two present measurements in both glyphs and alphabetic script (figures 2 and 4) and none present measurements in script instead of glyphs.

Several other features of these sources merit mention. Dots as counters and hands as units of measure appear with regularity while several images appear inconsistently, as is the case of body parts, including hearts and arms as well as a bone and an arrow (figures 35, 37-39). The presence of these glyphs, representing fractions, demonstrates the sporadic need for measuring small amounts. Other items appear only rarely: figure 30 shows objects resembling gourd bowls or copal incense as found in tribute records; and
figure 39 contains discs with a cross in the center, similar to the glyphs found in figures 15 and 16.\footnote{41}

<table>
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<th>Date</th>
<th>Number of sources in sample</th>
<th>Number in which litigants are elites\textsuperscript{42}</th>
<th>Number in which litigants maintain connections with elites\textsuperscript{43}</th>
<th>Number containing glyphs showing measurements</th>
<th>Percentage with measurements</th>
<th>Number with other glyphs\textsuperscript{44}</th>
<th>Percentage with other glyphs</th>
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<td>60</td>
<td>1</td>
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Table 1: Comparison of the incidence of glyphs representing measurements and other information in cadastral records and plans of lands submitted in lawsuits, 1540s-1616.\textsuperscript{46}

Table 1 demonstrates that the overall presence of glyphs in pictorial records diminished over time. Whereas measurements appear in a majority of the sources through the period, the incidence of glyphs representing other information, for instance of a sociological nature, was generally lower; they never appear in more than half of the pictorial sources examined. After the 1560s, the use of sociological glyphs diminishes considerably, presumably reflecting changes in their perceived necessity. Accordingly, during the second half of the sixteenth century, sociological glyphs become increasingly superfluous, perhaps because their information was readily apparent in a legal context.\textsuperscript{47}

The varying rates and extent of decline in this visual language may be explained by the utility of such information in legal settings. Glyphs identifying the owner of a piece of land would be redundant given that lawsuits involved the very people who claimed ownership. By contrast, a pictorial source like the Códice de Santa María Asunción, because it served community needs and was generated outside the prerogatives
of court, contains information about many people in one place, thereby presumably requiring a greater variety and number of glyphs. Sociological glyphs in the legal documents may have found expression in alphabetic writing that was more readily comprehensible to court officials.

Overall, visual markers for measurements remained an integral part of record keeping until the first decades of the seventeenth century, suggesting that they retained their communicative currency longer, though not without some degree of decline. Their enduring presence attests to a lasting need for their inclusion. While cadastral records exhibit changing patterns in the use of graphic language over time, representations of physical space in regular geometric form remain constant. Consistent geometric form relied on measurements, providing another explanation for the enduring presence of measurement glyphs in the sources.

Geometric form acts as a striking feature of the aerial views of land and property. While not drawn to scale, Harvey and Williams have observed that field shapes in micocoli land registers found in the Códice de Santa María Asunción exhibit markedly consistent geometric forms. Tlacuilos, they suggest, sought to show approximate field shape although “angular relationships between sides cannot be read in degrees of arc but only as obtuse or acute angles.” Such was their relative precision that they included what the authors term “cut-outs,” or “negative images of what would be an expected pattern of house lots” (figure 9). Harvey and Williams also remark that, “The cutout areas accommodate the dimensions of Aztec-period Tepetlaoztoc residential floor plans... and also correspond to dimensions of contemporary house lots in the piedmont zone.” The other land register examined by Harvey and Williams, the tlahuelmanti, employs a more
abstract rendering of physical space, in which the tlacuilo used regular, rectangular field shapes irrespective of the situation on the ground. Nevertheless, in comparison with the abstract representations of land found in the tabular records found in the Códice Cozcatzin (figure 18), the tlahuelmantli appears in a format that would have been more immediately recognizable to Spaniards.

The Códice Cozcatzin presents land through two different and distinct communicative means. In addition to the table-like land register, the reader encounters a map of Xochimilco (figure 44). The map represents a blend of two Nahua traditions of depicting geographical space. The overall view of the city appears not in terms of its physical reality, reflecting a close approximation of its actual layout, but rather through an understanding of space in terms of social relationships. Thus, the city's three subdivisions, or tlaxilacalli, of Tepetechi, Tecpan, and Olac predominate in the scene, presented through the visual language of lineages of tlatoque and their palaces. Other communities, presumably barrios (wards) are indicated by the presence of churches. The map presents chinampas (aquatic gardens), the rectangular plots of land in the shaded area at the bottom of the map, in ways reminiscent of tlahuelmantli. They resemble less abstract depictions than found elsewhere in the Códice Cozcatzin and instead, the map shows regular, rectangular plots more redolent of field shapes. Therefore the Códice Cozcatzin contains three traditions of representing space: that of the abstract land register, and in the map of Xochimilco, geometric field shapes of chinampas (reminiscent of tlahuelmantli) and space defined by social relationships. This last presentation of geographical space in terms of social relationships is a hallmark of the many maps
examined by Barbara Mundy (and is evident in a map contained in the *Codex Kingsborough*, figure 45).

The use of glyphs as a visual vocabulary and the rendering of physical space into geometric form enable us to observe unfolding processes of cultural interaction and exchange among Nahuas and Spaniards. As Barbara Mundy has observed, Nahua cartographic histories and maps rarely employed geometry or measurements. Dana Liebsohn has similarly remarked that features like buildings in Native maps (in her case, from Oaxaca) appear as though they “hover in an indeterminate space.”49 Nahuas conceived of maps, Mundy observes, as being “structured by social relationships.”50

Mundy has persuasively explained that in the sixteenth century, Spaniards had begun to draw from Ptolemaic and Euclidian ideas about geometry, albeit imperfectly, to conceive of the physical relations between places—relations that could be understood in the language of measurements. Such concerns had also motivated Europeans engaged in overseas navigation.51 Thus by the time the King Philip II commissioned the *relaciones geográficas* in 1578, the author, cosmographer Juan López de Velasco, requested information about distances (and depths of bays) in twelve of the survey’s fifty items.52 As Barbara Mundy’s examination of the survey reveals, Spaniards brought with them to New Spain a cultural orientation about the ways in which landscapes, and features that appeared in them, should be represented in visual terms.

Cadastral and tribute records, among others, provide a counterpoint to Mundy’s discussion of maps. That Nahuas used standardized measurements indicates that colonial era cadastral sources drew from their own traditions that extended back prior to the arrival of Spaniards. Nahua traditions of record keeping, as concerned measurements
were not entirely dissimilar to equivalent practices among Spaniards. The image in figure 46, known as the Plano de Magüey, resembles a map although in fact it served as a tribute record, albeit one including plots of land. The parallel between the presentations of space in geometric terms finds analogy in the compatibility of Nahua and Spanish traditions of taking measurements as an integral part of record keeping. Perhaps these two similar traditions were in some way intertwined, for the rendering of space into geometric form requires the use, or understanding of measurements, as archaeologists have demonstrated.53

In coming to terms with the conventions of cartography employed by Spaniards, Nahuas seem to have found recourse to their own traditions of recording field shapes in their cadastral registers. The presence of geometric space in the maps indicates the blending not only of Spanish and Nahua culture but also the transference of characteristics from Nahua cadastral records to their maps, as is readily apparent in figures 47-49, maps of the relaciones geográficas. Furthermore, city blocks grids included in maps resembled field shapes in cadastral records. Also, the placement of buildings within these blocks finds analogy with the measurements in the Humboldt Fragment VIII (figure 41, compare with figure 45). Accordingly, the process of cultural change, as manifested in map making, did not necessarily have to involve the adoption of a foreign cultural import, namely the incipient Spanish tendency toward rendering of space in geometric form. Rather, it may have involved the adaptation and translation of Nahua cadastral records into the new colonial modus operandi of making maps. By 1616, the Tamazolco Map from Tlaxcala relies almost entirely upon the geometric ordering of space in cartographic form (figure 50). This suggests that Nahua cadastral traditions and
Spanish cartographic preferences blended and found a complement to each other during the seventeenth century, perhaps marking the accomplishment of a hybrid style.

Doña Josepha Cortés Cerón y Alvarado’s papers reveal changes in the use of a graphic vocabulary that gave expression to visual ways of thinking. While constituting a distinct genre of manuscript painting, cadastral records also conform, in their graphic language and structure, to a broader range of economic and other painted manuscripts. Changes during the sixteenth century involved a varied decline between dimension and sociological glyphs, the latter finding less frequent expression and faster obsolescence. The utility of glyphic language to convey important information in legal settings accounts, in part, for varying rates of decline. Glyphs for measurements, as a readily comprehensible and succinct form of expression, retained a communicative currency longer than did sociological glyphs. Their inclusion in economic manuscripts continued at least until the second decade of the seventeenth century. Nahua traditions of recording measurements were not entirely dissimilar to Spanish equivalents. Nahua cadastral records of land enabled and underpinned the presentation of geometric space. They reveal alternative perspectives into ways in which indigenous mapping adjusted after the arrival of Spaniards. Moreover, they played an integral part in the process of change, serving as a means for adapting cultural traditions to serve new needs and as an emblem of cultural change.
Figures

Figure 1: Xochimilco \textsuperscript{54}

Figure 2: Xochimilco \textsuperscript{55}
Figure 3: Xochimilco

Figure 4: Xochimilco
Figure 5: Xochimilco

Figure 6: Xochimilco
Figure 7: Xochimilco

- household head, male
- household head, female
- old age
- widower
- ethnic group, economic status?
- milpocalli field
- soils, e.g., tepetate, clay

milpocalli measurements
- 1 quahuitl: 2.5 m
- 5 quahuitl: 12.5 m
- 20 quahuitl: 50 m
- cémntl: 1.5 m
- ceayollotl: .9 m
- cémmatl: .5 m

- color: blue—water
- red—nobles’ property

land transfer: name

This are the landholdings of household X

Figure 8: Barbara J. Williams, “Hieroglyphic Conventions Depicting Cadastral Data in the Codex Vergara and the Códice de Santa María Asunción.”
Figure 9: Tlanchiuca Milcocoli Land Register, from the Códice de Santa María Asunción.
Figure 10: Detail from the Oztoticpac Lands Map\textsuperscript{63}
Linear Measurements in Tlalquahuitl

a standard Texcocan linear unit, equal to 2.5 m

● 20  5  1  tlalquahuitl

Fractional Linear Units Expressed as Monads

Ø  heart  0.9 m  cenyollotl
↑  arrow  1.5 m  cemmitl
→  hand  1.7 m  cemmatl

Figure 11: Harvey and Williams, "Linear Dimension Glyphs in the Códice de Santa María Asunción."\(^{64}\)

Figure 12: Harvey and Williams, "Soil Glyph variants in the Códice de Santa María de Asunción."\(^{65}\)
Figure 13: Quantity glyphs from the Codex Mendoza

Figure 14: Codex Xiquilimilco Temoaya
Figure 15: Coyoacan

Figure 16: Trozo de Azcapotzalco
Figure 17: Codex Osuna

Figure 18: Codex Cozcatzin
Figure 19: Codex Aubin, f.44v-45.\textsuperscript{72}

Figure 20: Cuauhtepuztitla Census, f. 3, Códice de Santa María Asunción.\textsuperscript{73}
Figure 21: Tepotzotlan Codex, f. 1. ⁷⁴

Figure 22: Codex Kingsborough, f. 4. ⁷⁵

Figure 23: Codex San Francisco Xonacatlan ⁷⁶
Figure 24: Documentos Nauas

Figure 25: Documentos Nauas

Figure 26: Documentos Nauas

Figure 27: Documentos Nauas
Figure 28: Documentos Nauas

Figure 29: Documentos Nauas

Figure 30: Documentos Nauas

Figure 31: Documentos Nauas
Figure 36: Documentos Nauas

Figure 37: Documentos Nauas

Figure 38: Documentos Nauas

Figure 39: Documentos Nauas
Figure 40: Humboldt Fragment VI.\textsuperscript{93}

Figure 41: Humboldt Fragment VIII.\textsuperscript{94}
Figure 42: Xochimilco

Figure 43: Genealogy of Miguel Damían
Figure 44: Códice Cozcatzin Map of Xochimilco

Figure 45: Codex Kingsborough Map (Tepetlaoztoc)
Figure 46: Plano de Maguey

Figure 47: Map from the Relación de Zempoala
Figure 48: Relación Map of Ameca

Figure 49: Relación Map of Texupa
Endnotes

1 Archivo General de la Nación, Mexico City (henceforth referred to as AGN), Ramo Vínculos y Mayorazgos, vol. 279, expediente 1.
5 Robertson, Mexican Manuscript Painting of the Early Colonial Period, 1.
8 Glass categorized colonial era documents as economic; Boone calls them practical documents, referring to their utilitarian value, “to explain their social and administrative niches and the documentary needs they served.” Boone, “Pictorial Documents and Visual Thinking in Postconquest Mexico,” 150; Glass, “A Survey of Native Middle American Pictorial Manuscripts,” 36-37.
12 John Glass, for instance, wrote, “There is little doubt that the manuscript and writing systems of Central Mexico continued to develop under European influence at least until the last quarter of the 16th century.” Glass, “A Survey of Native Middle American Pictorial Manuscripts,” 4.
13 Ibid, 3, 36.
15 The tradition of making land records seems well established given its general consistency in form over time and in its broad comparability with other pictorial manuscripts.
19 AGN Ramo Civil, vol. 1230, exp. 7, f. 2-2v.
20 Excerpted in James Lockhart, Nahua as Written: Lessons in Older Written Nahua, with Copious Examples and Texts (Stanford: Stanford University Press and UCLA Latin American Center Publications, 2001), 137.
24 Ibid, 48-49.
26 He writes, “Measurements were vague and even vague (‘400 braças o mas y se de 800 braças’), and varas and brazas were confused.” Gibson, The Aztecs Under Spanish Rule, 266.
27 Ibid, 271.
28 Ibid, 262.

31 Williams “Mexican Pictorial Cadastral Registers,” 105.
32 Williams and Harvey, The Códice de Santa María Asunción, 21.
33 Ibid., 22.
34 Ibid, 26-29, and Williams “Mexican Pictorial Cadastral Registers,” 105-107 and 114-117.
36 Ibid, 165-172.
37 Ana Rita Valero de García Lascurain and Rafael Tena, Códice Cozcuztin (México and Puebla: Instituto Nacional de Antropología e Historia and Benemérita Universidad Autónoma de Puebla, 1994).
38 Not all glyphs appear in all economic manuscripts, though, partly because of the provenance of the documents and the different purposes they served.
39 In terms of their authorship they might be seen as resembling foundational plans of cities, as described by Richard Kagan, Urban Images of the Hispanic World, 121.
40 Lockhart, The Nahuaas After the Conquest, 143.
42 Either as Nahua elites—pipiltin (nobles), tlatoque (rulers), or people holding office (alcaldes, alguaciles, among others)—or Spaniards, as indicated, for both, in the presence of such titles as don or doña, among other indicators, or as can be determined from accompanying litigation records.
43 As indicated by the presence of witnesses in legal cases, among other references in the documentary record, excluding those officials who presided over the cases.
44 Excluding footprints.
45 Although one has a cross and two contain images of plants although these do not seem to have other meanings invested in them.
46 Based on pictorial sources and accompanying legal records pertaining to figures 1-7 and 42-43 (from Xochimilco), and figures 24-39 (from Mexico City). These sources have been selected because they constitute a part of a broader set of legal and administrative records that provide context and background.
47 Whereas art historians have demonstrated that pictorial evidence in literate and cartographic histories conferred authority and legitimacy upon local elites, such was not the case in pictorial records presented in court. No correlation between elites involved in the legal cases, who could have afforded added details and embellishments, and the incidence of glyphs can be detected.
49 Williams and Harvey, The Códice de Santa María Asunción, 29.
51 Mundy, The Mapping of New Spain, xvi.
52 See, for example, the chapters “A New Sky and New Stars”: Arabic and Hebrew Science, Portuguese Seamanship, and the Discovery of America and “Sailing in the Wake of the Portuguese” in Patricia Seed, Ceremonies of Possession in Europe’s Conquest of the New World, 1492-1640 (New York: Cambridge University Press, 1995), 100-178.
53 Items forty two and three request the following information: “What are the ports and landings along the coast? Make a map showing their shape and layout as can be drawn on a sheet of paper, in which form and proportion can be seen. What is their size and capacity? Note their approximate width and length in leagues and paces, as well as can be determined.” See, Appendix B, Mundy, The Mapping of New Spain, 227-230.

[references for figures]
54 AGN Ramo Vínculos y Mayorazgos, vol. 279, exp. 1, f. 36.
55 Ibid, f. 78.
Ibid, f. 36v.
Ibid, f. 53.
AGN Ramo Tierras, vol. 1525, exp. 5, f. 3.
Ibid, exp. 2753, f. 2.
Williams, "Mexican Pictorial Cadastral Registers," 106.
Williams and Harvey, The Códice De Santa Maria Asunción, 310.
Ibid, 28.
Williams and Harvey, The Códice De Santa Maria Asunción, 26.
Ibid, 31-32.
Berdan and Anawalt, The Essential Codex Mendoza, f. 37r.
Codex Xiquilimalco Temocaya. Rare Books Collection, Latin American Library, Tulane University, New Orleans.
Pintura de los tributos de Coyoacan, Handbook of Middle American Indians, vol. 14, no page number given.
Ibid.
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Ana Rita Valero de García Lascuráin and Rafael Tena, trans. and eds., Códice Cozcacatzin (México: Instituto Nacional de Antropología e Historia, Benemérita Universidad Autónoma de Puebla, 1994).
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Brotherston, Painted Books from Mexico, 59.
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Ibid, 90.
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Ibid, 298.
Ibid, 186.
Ibid, 145.
Ibid, 163.
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______ “The Lands and Political Organization of a Rural Tlaxilacalli in Tepetlaoztoc, c. A.D. 1540,” in Harvey, ed., Land and Politics in the Valley of Mexico, 187-208