De cuenca a valle: Cartografía, el a priori cosmo-geográfico y el pasado lacustre de la Ciudad de México

From Basin to Valley: Cartography, the Cosmo-geographic A Priori and the Lacustrine Past of Mexico City

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Introduction

In his speculative account of the technogenesis elaborated in the third part of *On The Mode of Existence of Technical Objects*, Gilbert Simondon writes about the 'reticulation' of the natural world—its cosmological structuration according to geographical singularities or 'key-points' (*points clefs*)—as prefiguring what would later become technics.[1] Yuk Hui frames this reticulation as a cosmo-geographic *a priori* in which technical objects came to be inscribed and which determined the relationship between nature and technology.[2] With modernity, technology became detached from this cosmo-geographic a priori, eschewing a possible rooting in and inflection by geographical structures, and instead embarked on a development of its own inner logic, often to the detriment of the natural world. However, rather than investigating this historical process of detachment and its spread through the global hegemony of Western cosmotechnics, in this essay, I will focus on a specific domain of technics that arguably holds a particular relationship with the cosmo-geographic a priori: that of mapping and cartography. I will focus on the gradual introduction of Western cartographical techniques as a by-product of the colonisation of America and the role these played in the imposition of new spatial codes based on the naturalization of abstract, geometrical and isotropic space. Looking at this historical phenomenon through the lens of the concept of cosmo-geographic a priori, we can ask a broad and speculative question: How might this rationalization of space and its eventual establishment as the only accurate way of representing territory—to the detriment of indigenous territorial and spatial imaginations—be related to the suppression of technodiversity in colonial America? To approach this wide-ranging question in a more concrete and circumscribed manner, I will focus on the role that the geometric rationalization of space might have played in the urban development of Tenochtitlan after 1521 and in the transformation of the relationship (both

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1   Gilbert Simondon, *On the Mode of Existence of Technical Objects*, trans. Cécile Malaspina and John Rogove (Minneapolis: Univocal, 2017), 173–246.
2   Yuk Hui, *The Question Concerning Technology in China: An Essay in Cosmotechnics* (Falmouth: Urbanomic, 2016), 18–19.

geographical and cosmological) that this city held with its lacustrine environment.

Cartography and Colonialism

In the past couple of decades, several authors have highlighted one aspect of the colonisation of America which had been hitherto ignored: the long-lasting implications that colonisation had for the understanding, rationalising and inhabiting of territoriality in the so-called New World. The 1492 encounter, these theorists argue, signified the beginning of a complex confrontation between divergent—perhaps even incommensurable—territorial imaginations that would unfold through the span of several centuries and which would have important consequences for the way in which social relationships were defined and populations were to be organised. In *The Darker Side of the Renaissance*, Walter Mignolo conceptualises this confrontation through the distinction between two different rationalisations of space: 'ethnic' and 'geometrical'.[3] The former is understood as a rationalisation where a centre is "attached to an observer placed at the centre of a community or of a locus of power" and in which territorial imagination is closely tied to local cosmologies. The latter, on the other hand, deploys geometric instruments to foster the idea of a "universal, objective and nonethnic observer", a scientific rendering of territory purportedly detached from the physical location and cosmology of a given community.[4] As Ricardo Padrón argues, "the modern map does not just grid the world, it puts it on display for consumption by an onlooker who has been abstracted from the world he or she inhabits, who has been raised to a commanding height."[5] This confrontation, however, should not be thought of as the straightforward clash between an Amerindian ethnic rationalisation versus a European geometric rationalisation. Mignolo's whole argument hinges on the thesis that the colonisation of America coincided historically with a moment where ethnic rationalisations of space were being replaced by geometrical ones on both sides of the Atlantic. The difference lies, according to him, in that European colonial powers inconspicuously retained their ordering of territory according to their own ethnic centres (Spain, Rome), while simultaneously deploying this purportedly neutral and objective geometric rationalisation to suppress the territorial imaginations of colonised cultures (Mexica, Andean). [6]

The use of modern cartographic techniques and geometric projections in the kind of mapmaking that

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3   Walter Mignolo, *The Darker Side of the Renaissance: Literacy, Territoriality and Colonization* (Ann Arbor: University of Michigan Press, 1995), 219–259.

4   Mignolo, *The Darker Side of the Renaissance*, 233.

5   Ricardo Padrón, "Mapping Plus Ultra: Cartography, Space and Hispanic Modernity," *Representations* 79 (2002): 45.

6   Mignolo, *The Darker Side of the Renaissance*, 243.

emerged in the 16th century played a crucial part in this process of spatial colonisation. According to cartography historian David Woodward, the cartographic rationalisation of space propelled the idea of a world ''over which systematic dominance was possible and provided a powerful framework for political expansion and control.''[7] Several scholars have even argued that the measuring and rationalisation of space by drafting a geometrical grid over the globe was central to the birth of modernity as a whole. Geometric projections were instrumental for the management of increasing amounts of geographical information which was needed for the processes of territorial control and spatial colonization enacted by Europeans. This, in turn, had negative consequences for Amerindian forms of territorial imagination. As Padrón argues: "With the increasing availability and authority of the map, as we have come to know it, the territorial imaginations of colonial others increasingly began to experience the ideological colonization of the order of abstraction, and eventually fell out of public discourse almost entirely."[8] It is thus a process which compounds a literal as well as a figurative colonisation of space: a colonisation of ways of thinking about the world as much as a physical colonisation of territory.

fig.1 Nuremberg Map of Tenochtitlan (1524)

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7   David Woodward, "Maps and the Rationalization of Geographic Space," in *1492: Art in the Age of Exploration*, ed. Jay A. Levenson (New Haven: Yale University Press, 1991), 84.

8   Padrón, "Mapping Plus Ultra," 55.

Within the traditional historical narrative, it is said that scientific and objective modern cartographical techniques replaced premodern forms of territorial representation that were still too closely tied to culture-specific cosmologies; an evolutionary account that supports the historical hegemonization of scientific cartography and lays its claim as the sole form of mapmaking capable of producing true and objectively accurate representations of territory. One upshot of an account such as Mignolo's is that it goes against the grain of this narrative, acknowledging the historical contingency of modern cartography and allowing us to understand it as yet another form of cosmography, rather than as the neutral and objective 'view from nowhere' that it deemed itself to be. Furthermore, this account resonates with recent scholarship that has attempted to reconceptualize maps in general as objects that reflect culturally and historically specific concerns and values and that contribute to the transformation of the spaces which they represent: it is argued that "by being drawn from within yet simultaneously conditioning our spatial cognition, maps both influence and reveal our reality."[9] In their preface to the monumental multivolume work titled *The History of Cartography,* J.B. Harley and Woodward offer a broad redefinition of maps as "graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world."[10] Such a redefinition frees the idea of mapmaking from referring exclusively to those representations produced with modern cartographic techniques, opening it up to acknowledge other forms of graphic representation that embody different forms of 'spatiality' and that inscribe themselves as alternative cosmographic techniques.[11]

It is worth restating that we should avoid framing matters in the form of a binary opposition or clash between Amerindian-ethnic and European-geometric territorial imaginations; a neat compartmentalization that eschews the actual historical complexity of these developments. When it comes to the European side of the equation, it is important to avoid the temptation to attribute retroactively an overarching unity to cartographic techniques during the process of colonisation. Mignolo's account mentions, for example, that the emergence of scientific cartography during the Renaissance also implies a gradual transformation of pre-existing ethnic rationalisations of space in European cultures. To this, we should add the fact that the initial deployment of cartographic representations in the colonial world coexisted with previous forms of mapmaking. Some of the earliest colonial maps were created with the aid of indigenous mapmaking traditions: scholars have argued, for instance, that the famous Nuremberg map of Tenochtitlan (fig.1), which accompanied the 1524 publication of Cortés's first-hand account of his incursion into the city, was most likely inspired by a map that Moctezuma himself commissioned

9   Karl Offen and Jordana Dym, eds., Mapping Latin America: A Cartographic Reader (Chicago: The University of Chicago Press, 2011), 6.

10   David Woodward and J.B. Harley, eds., *The History of Cartography Volume One: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean* (Chicago: The University of Chicago Press, 1987), xvi.

11   Padrón, "Mapping Plus Ultra," 43.

for the Spanish conqueror.[12] Likewise, it is known that several of the maps made for the *Relaciones Geográficas* of the 1580's—the first systematic attempt to chart Spain's overseas possessions—were not made by trained surveyors (*agrimensores*) but rather by local government officials with the aid of indigenous painters, a syncretism of techniques that resulted in hybrid spatial representations.[13] In other words, it would be hasty to assume that colonisers arrived to the New World wielding fully developed cartographical tools, ready to replace previous forms of the rationalisation of space with an already naturalised understanding of space as a desymbolised, abstract extension. Padrón points out that "the early modern revolution in mapping and spatiality should be treated as an emergent trend located in a particular sector of the culture a class of technical specialists—rather than as a widespread phenomenon involving the culture as a whole."[14] He draws from several examples to argue that the spatial imagination of early Spanish colonisers (most of which were not engineers or professional cosmographers) was still closely tied to the itineraries of late medieval travel, showing how several maps of the time exhibit a hybrid condition which often combined the older linear spatiality of nautical charts and itinerary maps— "way-finding maps that primarily serve the purpose of 'getting there', rather than of conceptualizing space or figuring geographical knowledge"[15]—with the emerging sense of space as isotropic planar extension. Furthermore, he points out that, while Iberia under the reign of Phillip II (a ruler who was passionate about geography and cartography) spearheaded the cartographic revolution during the first half of the 16th century, it soon fell behind its Protestant neighbours during the next century and a half. It would not be until the 18th century, "when a fully modern spatiality held sway in the north, and a French dynasty had come to power in Madrid, that Spain would make a concerted effort to modernize its maps and its cartographic institutions."[16]

This is all to emphasize that the transformation of territorial imagination and the establishment of modern cartographic mapping as the hegemonic form of spatial representation on both sides of the Atlantic was a complex and gradual process that depended on a range of factors, from the crucial availability of technologies of reproduction and dissemination to the varying degrees of institutional support from governments, universities and colonial institutions. I will not attempt to trace this history in any more detail here, a task that demands the nuance and archival dexterity proper to historians.

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12   Barbara Mundy, supports this thesis with a detailed analysis of several aspects of the map which, according to her, can only be explained if they are seen as (often erroneous) translations of symbolic Mexica elements to the pictorial language of Europeans. See, Barbara Mundy, "Mapping the Aztec Capital: The 1524 Nuremberg Map of Tenochtitlan, Its Sources and Meanings," *Imago Mundi* 50 (1998), 11–33.

13   Barbara E. Mundy, "Hybrid Space," in *Mapping Latin America: A Cartographic Reader*, ed. Karl Offen and Jordana Dym (Chicago: The University of Chicago Press, 2011), 51–55.

14   Padrón, "Mapping Plus Ultra," 35.

15   Padrón, "Mapping Plus Ultra,"42.

16   Padrón, "Mapping Plus Ultra," 54.

Instead, we will now shift into a more philosophical and speculative register to inquire about the relationship that mapmaking—understood in its broad sense as geocosmography—might hold with technological development and technical thinking more broadly.

The Cosmo-geographic A Priori

In the third part of *On The Mode of Existence of Technical Objects*, Simondon embarks on a highly speculative anthropological inquiry into the essence and genesis of technicity. This inquiry is brought forth under the argument that, in order to understand technics in its function as a form of mediation between the human and the world, it is insufficient to start from already constituted technical objects. According to Simondon, "objects appear at a certain moment, but technicity precedes them and goes beyond them; technical objects result from an objectivation of technicity; they are produced by it, but technicity does not exhaust itself in the objects and is not entirely contained within them."[17] In short, the use of technical objects expresses an underlying technicity, the genesis of which ought to be investigated—an inquiry into technogenesis. Deploying his theory of individuation in tandem with an analogy idiosyncratically taken from Gestalt psychology, the figure/ground schema, Simondon theorises how technicity might have emerged from a previous relation between human and world, which he terms the 'magical phase'.[18] This phase is depicted by Simondon as an "original mode of being in the world"[19] characterized by a 'primeval unity' between the human and the world, a mode of existence previous to the distinction between subject and object and, more generally, previous to the splitting between human and world: "magical unity is the relation of the vital connection between man and the world, defining a universe that is at once subjective and objective prior to any distinction between the object and the subject, and consequently prior to any appearance of the separate object [...] Man finds himself linked to a universe experienced as a milieu."[20]

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17   Simondon, *On the Mode of Existence of Technical Objects*, 176.
18   Simondon takes the notion of "phase" (and "phase shift") from its meaning in physics, and it is crucial in understanding the kind of motion implied by his theory of individuation. "By phase, we mean not a temporal moment replaced by another, but an aspect that results from a splitting in two of being and in opposition to another aspect; this sense of the word phase is inspired by the notion of a phase ratio in physics; one cannot conceive of a phase except in relation to another or to several other phases; in a system of phases there is a relation of equilibrium and of reciprocal tensions; it is the actual system of all phases taken together that is the complete reality, not each phase in itself; a phase is only a phase in relation to others." Simondon, 173.
19   Simondon, *On the Mode of Existence of Technical* Objects, 174.
20   Simondon, *On the Mode of Existence of Technical* Objects, 176.

This hypothetical magical phase can be thought of as a transitional moment in the process of anthropogenesis, where a proto-human related to its milieu in a way more akin to Von Uexküll's organism immersed in an *umwelt* than to Heidegger's *Dasein*, faced with its ecstatic relation to the uncanny openness of the world. However, for this proto-human the world is not a mere nexus of physical stimuli devoid of meaning and symbolic structure.[21] This mode of being in the world is mediated by a structure constituted by "the birth of a network of privileged points of exchange between the being and the milieu."[22] For Simondon, the magical universe is structured through a reticulation of 'key-points' (*points-clefs*). These key-points are spatial and temporal, they are privileged places and moments which reticulate the world: the peak of a mountain, the centre of a lake, the clearing in a dense forest, the setting of the sun or the passing of the seasons. These concrete geographical and temporal singularities distinguish themselves from the world without detaching themselves from it, presenting an articulation where 'figure' and 'ground' are indissociable from each other.[23] It is with the splitting of this primeval unity that a 'dephasing' of these two aspects of reality occurs, giving rise to two distinct forms of mediation between the human and the world: technics and religion. Technicity concerns itself with the figural or the singular in a way that finds its roots in the reticulation of key-points, except that now these are objectified and detached from a ground: "they become instrumental, mobile, capable of efficacy in any place and in any moment whatsoever: as a figure, the key-points, detached from the ground whose key they were, become technical objects, transportable and abstracted from the milieu."[24] Religion, on the other hand, implies the dimension of ground, it inherits the sense of totality, a 'wholeness' and cosmic structure that transcends the concrete and the singular. After this dephasing, although figural technicity and grounding religion are two aspects of one and the same reality, they are no longer intrinsically tied together. This is the point where, according to Simondon, technical objects as we know them properly emerge: "The availability of the technical thing consists in being liberated from the enslavement to the ground of the world."[25]

We should be wary of reading Simondon's account at face value, that is, as postulating a factual chronological unfolding of events. Rather, his speculative account is inscribed within a tradition of

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21   Simondon sees "the magical mode of existence as the pre-technical and pre-religious mode, and so as immediately above the relationship that is simply between the living thing and its milieu." Simondon, *On the Mode of Existence of Technical* Objects, 169.

22   Simondon, *On the Mode of Existence of Technical Objects*, 177.

23   "These places and these moments keep hold of, concentrate, and express the forces contained in the ground (*fond*) of reality that supports them. These points and these moments are not separate realities; they draw their force from the ground they dominate; but they localize and focalize the attitude of the living vis-à-vis its milieu." Simondon, 178.

24   Simondon, *On the Mode of Existence of Technical Objects*, 181.

25   Simondon, *On the Mode of Existence of Technical Objects*, 183.

philosophical anthropology, which one can trace all the way back to Rousseau, and which recurs to a mythical-transcendental argument (with its appeal to the archetypal story of the 'fall' or 'lost unity') in order to develop a speculative theory of anthropogenesis. Delving deeper into the structure and philosophical implications of this kind of argument is something that I will not attempt to do here.[26] What is important are the two connected lines of thought that stem from this. Firstly, the way in which Simondon theorizes the essence of technicity as being characterised by a figurality which mobilizes objectivized key-points that can be detached from a broader sense of ground or cosmic order. As it was mentioned, after the dephasing of the magical unity, there ceases to be any intrinsic relation between technics and cosmological order, which in turn makes it possible for different degrees of detachment to take place; different degrees in which technical activities can be grounded (or not) in the structure of the world: from artifacts used in religious rituals and an observation post built on an elevated place, to the completely detached and desymbolized tools of modern industry. Modern technology takes the form of a technocracy or *groundless technics*,[27] which embarks on a development of its own inner logic, often to the detriment of natural and social realities. Secondly, this diagnosis leads Simondon to try to think beyond groundless technics and towards the possibility of regrounding technical practice and thought, of reapproaching figure and ground: "Any mode of thought or any mode of existence engendered by technicity would need to be complemented and balanced out by another mode of thought or existence coming from the religious world."[28] Simondon's purpose with this is to think how culture could reconnect technics with nature, solving the modern antagonism between these two domains of reality.[29] He writes:

> The technical object, placed into the middle of a body of actions and reactions whose interplay is predicted and can be calculated, is no longer that object separated from the world, [...] the figure-ground relation, broken by technical objectification, is once again found within

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26   In his own reinvention of philosophical anthropology developed in *Technics and Time I*, Bernard Stiegler has emphasized the necessarily mythical character of this transcendental account of anthropogenesis and has argued that it ought to be supplemented with an empirical account of the history of technics. Stemming from his reading of Leroi-Gourhan, he argues against the idea of a pre-technical human and in favour of the co-invention of human and tool; an aporetic situation which nonetheless produces an "illusion of succession". Bernard Stiegler, *Technics and Time 1: The Fault of Epimetheus*, trans. Richard Beardsworth (Stanford: Stanford University Press, 1998), 142. Also see: Bernard Michael Lewis, "Of a Mythical Philosophical Anthropology: The Transcendental and the Empirical in Technics and Time," in *Stiegler and Technics*, ed. Christina Howells and Gerald Moore (Edinburgh: Edinburgh University Press, 2013), 53–68.

27   Ben Janssen, "Contemporary Magic: On Yuk Hui's Cosmotechnics" (Masters Thesis, Nijmegen, Radbound University, 2019), 36.

28   Simondon, *On the Mode of Existence of Technical Objects*, 170.

29   Yuk Hui, "On Cosmotechnics: For a Renewed Relation between Technology and Nature in the Anthropocene," *Techné* 21, no. 2–3 (2017): 14.

general technology; because of this, the technical object is invented according to the milieu into which it must be integrated, and the particular technical schema reflects and integrates the characteristics of the natural world; technical thought extends itself by incorporating the demands and the mode of being of the milieu associated with the technical individual.[30]

More recently, Hui has taken these ideas as the starting point to elaborate his own concept of cosmotechnics. The main tenet of his philosophy is the idea that technics is always already *cosmo*technics, which is to say that different cultures present various cosmological settings that influence the way technical thinking and practice takes place.[31] Echoing Simondon, he argues that the bifurcation of technicity and religion becomes more acute with the onset of Western modernity, "an indication of the total detachment of technics from cosmology and the disappearance of any overt conception of a cosmotechnics."[32] Pointing out the disappearance of any *overt* cosmotechnics does not mean that the modern technology does not imply a cosmotechnics in and of itself. The 'cosmology of the moderns'[33] is couched on the bifurcation between nature and culture, as well as in the scientific understanding of the former as a dull and intrinsically meaningless affair, leading to its technical 'enframing' as an exploitable standing-reserve.[34] In this context, globalisation and modernisation can be understood as processes of technological homogenisation, wherein the hegemony of Western technology is established throughout the globe to the detriment of other forms of cosmotechnics. In short, it implies a gradual suppression of technodiversity. With this in mind, Hui also develops Simondon's Gestaltian attempt to reunite figure and ground—or, in other words, to reground technics—taking it towards new directions. Although he approves of the attempt to reconnect technics with nature in what he terms a *techno-geographic milieu*, in Hui's reading, such an attempt can still risk presupposing the modern scientific postulation of a single universal nature—understood as matter in movement governed by meaningless physical laws—as the defacto cosmology, which would limit the possibility of a rapprochement of technics and nature to the purview of a technological development in sync with the causality of geographical structures and dynamics. Laudable (and necessary) as this purpose might be in light of our current ecological crisis, it also forecloses the possibility of other non-Western cosmologies—in which grounding structures might not be exclusively limited to geography—might serve as grounds for alternative and divergent technological trajectories. Hui argues that technology "must be interrogated in relation to a larger

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30 Simondon, *On the Mode of Existence of Technical Objects*, 227.
31 Hui, *The Question Concerning Technology in China*, 19.
32 Hui, *The Question Concerning Technology in* China, 21.
33 Didier Debaise, *Nature as Event: The Lure of the Possible*, trans. Michael Halewood (Durham: Duke University Press, 2017).
34 Martin Heidegger, "The Question Concerning Technology," in *Basic Writings* (New York: Harper Collins, 1993), 307–42.

configuration, a 'cosmology' proper to the culture from which it emerged"[35] and suggests a regrounding of technology in "various cosmic realities" in order to "provide new frameworks for future technological developments" alternative to the hegemonic Western paradigm.[36] This is why Hui writes about the *cosmo-geographic apriori* of technics, using this term to refer to a reticulation of the world according to key-points that might exceed the strict realm of geography so as to include the symbolic tissue of myths and cosmologies.[37] The cosmo-geographic a priori varies from one culture to another,[38] allowing for the construction of various forms of techno-geographic milieus which include considerations that go beyond the homogeneity of modern ecological thought with its idea of 'green technologies', pointing instead towards those issues pertaining to politxical ecology and cosmopolitics which Isabelle Stengers and others have written about.[39]

To go back to the topic of cartography and colonialism, what I want to explore here is the possible relationship between mapmaking and the cosmo-geographic a priori. As mentioned above, the reconceptualization of maps as "graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world"[40] allows us to displace the hegemony of modern cartography as the only legitimate form of graphic territorial representation, while at the same time highlighting the cosmographic dimension of mapmaking practices in general. Mapmaking is a technology that has served a cosmographic function in several cultures, including Western modernity. Take for example the nested rectangles of old Chinese maps that were tied to the territorial imagination

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35   Hui, *The Question Concerning Technology in China*, 18–19.

36   Yuk Hui, *Recursivity and Contingency* (London: Rowman & Littlefield, 2019), 277–78.

37   Janssen, "Contemporary Magic," 52.

38   Perhaps a brief terminological clarification is in order at this point. In its philosophical usage, the notion of *a priori* refers to something that antecedes experience and the domain of the empirical, and which, for this same reason, can be considered as necessary and universal. It is in this sense that the Kantian transcendental subject is an a priori subject: a universal subjective structure previous to all experience, and functioning as the conditions of possibility of the latter. This is why it might seem contradictory to talk about an a priori capable of variation according to empirical conditions. However, to shed some light on this question it is useful to point out that one of the most notable (and polemical) features of Bernard Stiegler's project (from which Hui himself draws upon to an important extent) is precisely his postulation of the empirical-transcendental (or cuasi-transcendental) character of technology: technics, in spite of belonging to the domain of the empirical, is at the same time constitutive of experience and temporality—this is why Stiegler's argument unfolds simultaneously in the domain of the empirical-historical and the phenomenological. One could argue that the cosmo-geographical a priori is situated in this same realm of the cuasi-transcendental, anteceding (both logically as well as chronologically) technics as such.

39   See Isabelle Stengers, "The Challenge of Ontological Politics," in *A World of Many Worlds*, ed. Marisol De la Cadena and Mario Blaser (Durham: Duke University Press, 2018), 83–111.

40   Woodward and Harley, *The History of Cartography Volume One: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, xvi.

of dynastic regimes; the T/O maps of Medieval Christianity that placed Jerusalem at the centre of a disc world; the circular maps made by Chumayel Mayans in the early colonial period, in which the kind of spatial representation introduced by the Spanish was syncretised with their own cyclical conception of time, their communal history and their cosmogenesis narratives[41]; and even modern cartographic maps, which operate under a naturalized understanding of space as abstract isotropic extension. All these maps can be understood as two-dimensional representations of various cosmologies.

Having said this, I would like to venture the thesis that mapmaking can be understood as a domain of technics that holds a particular relationship with the cosmo-geographic a priori. In their cosmographic dimension, maps can be understood as having the capacity to chart the cosmo-geographic a priori in which technical thought and practice unfolds. Furthermore, this technology can, in a recursive (or dialectical) movement of sorts, not only chart cosmic relations but also influence the way in which other technologies are put in motion in light of this. Additionally, if such a thesis holds, it would allow us to place the diffusion of modern cartography in America as one of the various factors that contributed to the suppression of technodiversity during colonial times.

Perhaps as a way of illustrating the influence that territorial representations can have in the unfolding of technical thought and practice, a parallel can be drawn with Henri Lefebvre's theory of the social production of space. Besides the rhythm of daily practices that, according to him, constitute a dimension of space in its own right, Lefebvre also insists that representations of space—which can include both objects as well as 'mental' representations—cannot be treated separately from the way space is lived in general. In his tripartite conceptual schema, representations of space—from the urban planner's scale plan to the Medieval cosmography—contain culturally specific conceptions of space which, along with social practices, inform the way in which built space is lived.[42] Writing about Medieval spatiality, for example, he points out that

> Spatial practice embraced not only the network of local roads close to peasant communities, monasteries and castles, but also the main roads between towns and the great pilgrims' and

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41   Amara L. Solari, "Circles of Creation: The Invention of Maya Cartography in Early Colonial Yucatán," *The Art Bulletin* 92, no. 3 (2010): 154–68.

42   Lefebvre's triad is constituted by "the perceived-conceived-lived," which in spatial terms is translated into "spatial practice, representations of space [and] representational spaces." Henri Lefebvre, *The Production of Space*, trans. Donald Nicholson-Smith (Massachusets: Blackwell, 1991), 40. Although his notion of representations of space includes both objects (actual two-dimensional maps) as well as ideas (or 'mental' representations), we can focus on the former in order to drive our point home.

crusaders' ways. As for representations of space, these were borrowed from Aristotelian and Ptolemaic conceptions, as modified by Christianity: the Earth, the underground 'world', and the luminous Cosmos, Heaven of the just and of the angels, inhabited by God the Father, God the Son, and God the Holy Ghost. [...] Representational [or 'lived'] spaces, for their part, determined the foci of a vicinity: the village church, graveyard, hall and fields, or the square and the belfry. Such spaces were interpretations, sometimes marvellously successful ones, of cosmological representations. Thus the road to Santiago de Compostela was the equivalent, on the earth's surface, of the Way that led from Cancer to Capricorn on the vault of the heavens, a route otherwise known as the Milky Way - a trail of divine sperm where souls are born before following its downward trajectory and falling to earth, there to seek as best they may the path of redemption - namely, the pilgrimage that will bring them to Compostela ('the field of stars').[43]

Drawing a parallel between Lefebvre's schema and the role of Mesoamerican cosmologies in everyday life, Barbara E. Mundy argues that:

Cosmovision served as a guide for action at the same time that action and experience then continued to shape the understanding of the cosmos. Such a model dovetails neatly with the spatial model proposed by Lefebvre, where the sphere of the representation of space, which in the case of Mesoamerica would include cosmovision—a systematic and integrated body of thought—inflects both lived spaces and practice.[44]

Although we might object to her attributing to cosmovision an influencing factor of spatial representation exclusively in (pre-cartographic) Mesoamerican cultures, her account resonates with the dialectical dynamic that, I argue, takes place between mapmaking techniques and the cosmo-geographic a priori. Cosmological frameworks serve as the ground for various technical domains, cosmographical mapmaking among them. The latter in turn can further influence the way in which certain forms of technical thought and practice take place. The commonsensical decision to place an underground oil pipeline along the shortest route (which might incidentally cut through sacred grounds) might depend on the use of cartographic techniques in a different way than, say, the use of another kind of map which incorporates symbolic connotations might aid in deciding the correct placement of a religious building. Arguably, architecture, urbanism and infrastructural engineering are among the technical domains

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43   Lefebvre, 45.
44   Barbara E. Mundy, *The Death of Aztec Tenochtitlan, The Life of Mexico City* (Austin: University of Texas Press, 2015), 29.

most tightly linked to mapmaking practices, their spatial and projective nature making them particularly inclined towards the implementation of spatial representations.

With this in mind, we can go back to the thesis presented above and ask: How might the gradual establishment of the modern rationalization of space and its concomitant cartographical techniques as the only accurate form of territorial representation be related to the suppression of technodiversity in colonial America? To approach this intimidatingly broad question in a more concrete and circumscribed manner, I will now turn to the context of Aztec Tenochtitlan to inquire into the role that the modern rationalization of space might have played in its urban development after 1521 as well as in the radical transformation of the relationship (both geographical and cosmological) that this city held with its lacustrine environment.

The Draining of the Lakes

When the first Spanish soldiers entered the Valley of Mexico, located at over 2000 meters above sea level, what they encountered was a network of six interconnected lakes which covered around 1,500 of the basin's 8,050 square kilometres during rainy seasons. Besides the various settlements that peppered their shores, on the Western side of Lake Texcoco stood the great city of Tenochtitlan. Founded on a small rocky outcropping in the middle of the shallow lake, the dry land upon which the Aztec capital was built was prepared by generations of Mexicas who scooped up lakebed mud and, basketful after basketful, carried it to higher ground. A city with a population of around 250,000 inhabitants (twice the size of London at that time), connected to its surrounding shores by five radial causeways (*calzadas*), crisscrossed by heavily transited canals and nurtured by a complex network of artificial horticultural beds raised above the surface of the lake, Tenochtitlan's notable relationship with its lacustrine environment was the result of both great feats of state-mandated engineering, as well as of a deep understanding of the environment ingrained over generations. If one traverses the streets of contemporary Mexico City while having this past in mind, the complete absence of any body of water on its surface becomes all the more astounding. Today, what was once the island city of Tenochtitlan is now one of the largest cities in the world, standing on a dried lakebed in a valley which five hundred years ago was, in fact, a basin.

Over the centuries, the stark contrast between the watery Tenochtitlan and the dried-up Mexico City has often led to imaginaries that postulate a quasi-mythical lacustrine paradise of human-nature symbiosis which was to be irrevocably desecrated with the arrival of Europeans: "The Great Tenochtitlan was a city over the water with advanced technologies to control its levels and recycle its waste. This is

how significant the respect for nature was. But with the violent arrival of European culture, the situation changed. The deep knowledge, adequate management and integral dominion that our ancestors had over water: these were never understood by the horseriding men."[45] Even when these idyllic inclinations are tempered, it is generally thought that the ecological crisis in the Valley of Mexico, as historian Alain Musset writes, "started in 1521" when the introduction of Spanish "cultural models" jettisoned the locals' attempts of peaceful coexistence with the lacustrine environment, deciding instead to conquer and drain it as a strategy of social and territorial domination.[46]

Hearkening back to these romantic narratives is not my intention. Much to their dismay, history is more nuanced. As Musset himself recognizes, it would be an illusion to think that we have, on the one hand, an indigenous civilization living in perfect symbiosis with its environment and, on the other, one in constant and irremediable conflict with it. Firstly, one must recognize that the lacustrine environment in which Tenochtitlan stood was all but 'natural' in the common sense of the word: the lacustrine conditions of the Valley of Mexico had been intensively modified by hydraulic engineering projects. From the massive dam built by Nezahualcoyotl in 1449 which managed to separate the sweet waters that trickled down from the western hills from the salty waters that flowed from the eastern lakes, to the various sluices that regulated water levels throughout the year, the survival of the city (and its fragile *chinampas*) in this less-than-ideal setting depended on a system composed by large-scale hydraulic projects built by a strong-handed imperial government. The endorheic dynamics of the enclosed basin were both a blessing (due to its extraordinary productivity and biodiversity) and a curse (due to its proclivity to seasonal flooding) to its inhabitants, and the Mexica civilization relied on both the harnessing and the domination of this environment. Furthermore, there is evidence that points to the fact that the Valley was already under considerable ecological strain before the arrival of the Spanish. The large population living in the basin and the tributary requirements of the Mexica hegemony stimulated overhunting, overfishing and deforestation. As Vera Candiani argues, "the problem seems not to have been with the nature of Aztec and village knowledge of soils, species, and hydrology, which was sophisticated, but with the intensity of its application."[47] However, although both the Mexica and the Spanish struggled in dealing with this natural setting, the difference lies in the solutions to these problems that each of them puts into practice. The stark difference between their respective hydraulic politics marked the

45   Ricardo Legorreta, "Agua de Lluvia, La Llave Del Futuro En El Valle de México," *La Jornada Ecológica*, 1997, 1–12.

46   Alain Musset, "De Tláloc a Hipócrates. El Agua y La Organización Del Espacio En La Cuenca de México (Siglos XVI-XVIII)," in *Tierra, Agua y Bosques: Historia y Medio Ambiente En El México Central*, ed. Alejandro Tortolero VIllaseñor (Guadalajara: Potrerillos Editores, 1996), 127.

47   Vera S. Candiani, *Dreaming of Dry Land: Environmental Transformation in Colonial Mexico City* (Stanford: Stanford University Press, 2014), 25.

evolution of the Valley of Mexico. The Aztec city, despite all, was conceived to live in this lacustrine environment, in sync with the rhythm of the lakes. This was not the case for the Spanish, who struggled against it, often imposing costly and inefficient urban strategies.[48]

fig.2 Map of Santa Cruz (c.1537)

It didn't take long for the Spanish to decide that the draining of the lakes was the most viable option to protect the new colonial capital against seasonal flooding. A combination of factors led to this decision. The political turmoil and sharp demographic decline that ensued from the war waged against the Mexicas implied the loss of indigenous knowledge and a neglect of the complex and interlocking pre-existing hydraulic infrastructure. Upon the dissolution of the government, which organized and maintained the system, and the onset of the first stage of the colonial plunder economy, the coordination necessary to regulate the water levels was neglected. Furthermore, the introduction of the Spanish pastoral economy—extensive grain cultivation and livestock breeding—worsened soil erosion and was based on a strict distinction between water and land (whereas the Mexica capital and its lakeshore hinterlands both depended on seasonal flooding and understood this distinction as a fluid one).[49] Although the absence of any significant water level rise in the first couple of decades probably led the Spanish

48   Alain Musset, "De Tláloc a Hipócrates," 150.
49   Candiani, *Dreaming of Dry Land*, 25.

into a false sense of security, two catastrophic floods in 1555 and then in 1604 brought the issue once again to the fore. As Candiani narrates, while the first flood reignited the attempt to renew Mexica hydraulic infrastructure with the aim of water containment, by the time the second happened, the most popular solutions pointed towards water evacuation. On 28th of November 1607, Viceroy Luis de Velasco himself would remove the first spadesful of dirt at the site where the Real Desagüe de Huehuetoca was to be built—a massive hydraulic project intended to dessicate the lakes, and a drainage endeavour of a scale unheard of since the Romans attempted to do something similar in Lake Fucine in the 1st century BC. This was just the beginning of a drainage project that would span four centuries—recuperated by Porfirio Díaz in the 18th century and then updated with modern technology throughout the 20th—the building of the Real Desagüe would be the "material manifestation of the consolidation of a Hispanic state, capable of picking up where the Mexica-dominated state had left off in terms of vast infrastructural interventions upon nature but with an entirely different strategy."[50]

The story of the draining of the lakes in the Valley of Mexico is a long and complex one, constituted by an innumerable series of technological choices made by a plethora of actors. These choices are constrained by economic, social, physical, technical, and cultural factors, which can often not be explicitly voiced or even cognized by the people involved. As anthropologist Pierre Lemonier argues, the idea of technological choice "emphasizes the sorting out of possibilities on which the development of a technical system is *de facto* based, although usually in an unconscious and unintentional way."[51] Any reading that takes one of these factors as the only relevant one risks the result of a skewed or incomplete account that eschews historical complexity in favour or explanatory simplicity. Thus, although in what follows I will briefly sketch—in very broad strokes—some of the cosmological factors that might have influenced these choices, this by no means implies that cultural factors are to be seen as more relevant or causally determinant than strictly social factors that are tied to dynamics such as economic motivations and class interests.[52]

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50   Candiani, *Dreaming of Dry Land*, 47.

51   Pierre Lemonnier, *Technological Choices: Transformation in Material Cultures since the Neolithic* (London: Routledge, 1993), 7.

52   Candiani's phenomenal *Dreaming of Dry Land* is written precisely from this latter standpoint. In her account she questions the assumptions that have characterized the writing about the drainage projects since the 18th century. According to her, a grand narrative has been woven where flooding is presented as a 'universal' problem and drainage as a 'public good'. Contrary to this, she contends that the idea to dry the lake throughout the centuries has been peddled by the urban-centric elites in turn, who have put their economic interests before those of the other classes, the countryside and of the environment more generally. Furthermore, she argues that the Desagüe has much to say about the process of colonisation more generally, and it can be seen as exemplifying the process of colonisation and the early stages capitalism: "Wherever communal modes of production and social reproduction held sway and began to be challenged by the imposition of private-property relations and the rule of mercantile capital, the processes and dy-

Firstly, it is important to mention how, besides the important agricultural, transport and defence advantages that the harnessing of the lacustrine environment implied for the Mexica civilization, the significance of water in their cosmology meant that these concrete benefits were inextricably laced within a mythical tapestry. This is due to what is known as *teotl*, a central concept of Mexica cosmology (often compared to Polynesian *mana*) which expressed an understanding of natural phenomena as a manifestation of the sacred—the world as hierophany. Thus, water and the lacustrine environment assumed a different meaning for the Mexica, being associated with two divinities. Whereas the rainfall, storm and mountain water were associated with the god Tlaloc (to whom one of the two temples in the Templo Mayor belonged) streams and lakes were associated with the goddess Chalchiuhtlicue. The Mexica lived "in an environment of lightning, thunder, drops of rain, and flows of streams. The idea of teotl held that the world around was animated by divine forces. As such, all these elements were alive, and provided another cosmic model, for the watery environment of Tenochtitlan."[53] The cosmic importance of water was further crystallized in the concept of *altepetl,* "one of the key nexus of Mexica [and Mesoamerican] spatial thought" which was "both an ideal physical and an ideal political space."[54] A diphrasism composed by *atl* ('water') and *tepetl* ('hill'), the concept of *altepetl* designated both the basic form of affiliation within a collective and the ideal environment where this collective was to flourish. Hence, *altepetl* could be said to refer not so much to a space but, rather, to a *place.* These terms are entangled but not synonymous. For many scholars, the notion of place implies an analytical shift "from abstract forms of representation to comprehending human experience, collective memory, and emotional bonds—often with the nonhuman world. Places are, thus, locations imbued with meanings [...] Just as spaces and places are outcomes of social and environmental interactions over time, so, too, do maps record and reveal the significance of these relationships."[55]

Before the arrival of the Spanish, the Mexica had developed a tradition of mapmaking that was unparalleled elsewhere in the New World and which had evolved independently from its European, Asian and

namics seen working overtime in the Desagüe district are to be found as well, entirely distinct in their specifics but recognizable in their overall outlines. [...] As demonstrated by the story presented in this book, the locally contingent ways in which this occurred are seen with exceptional clarity when one examines its operation in marshy landscapes, like the Valley of Mexico, where the literally fluid nature of the relationship between water and land was an obstacle to the penetration of private property and capitalist social forms and modes of production and actually quite favourable to autonomous and communal forms." Candiani, *Dreaming of Dry Land*, 12.

53   Mundy, *The Death of Aztec Tenochtitlan, The Life of Mexico City*, 41.

54   Mundy, *The Death of Aztec Tenochtitlan*, 30.

55   Karl Offen and Jordana Dym, eds., Mapping Latin America: A Cartographic Reader (Chicago: The University of Chicago Press, 2011), 7.

African counterparts. One of its main characteristics was its seamless fusion with their logographic writing, which meant that "writing and mapmaking [...] rested on the same graphic substrate, employing the same pictorial conventions."[56] Mundy identifies four categories—which can often intermingle—of Mesoamerican maps: terrestrial maps with a historical narrative ('cartographic histories'), terrestrial maps without a narrative (city plans and property plans, cosmographical and celestial maps.[57] Although there are no maps of Tenochtitlan that survived the conquest, there are a few remaining examples from the 16th century where the interlaced practical and symbolic significance of water for the Mexica *altepetl* can be appreciated. One example is the impressive Map of Santa Cruz (fig.2), which is said to have been drawn by native artists in the Franciscan monastery in Tlatelolco. Measuring thirty-one by forty-five inches, the map depicts, in painstaking detail, the water systems of the valley as they were operating before the conquest: from the various streams and rivers that flowed into the lakes to the networks of canals and dikes that constituted the hydraulic infrastructure of the Mexica capital. Additionally, a gradient of pigments was used to colour the different qualities of the water, using a greenish colour to represent the salty waters of lake Texcoco and a lighter blue to represent the fresh water that the massive Nezahualcoyotl dam had permitted the separation of, and which was crucial for the *chinampa*-based horticulture that sustained the city.

Another example is the famous folio 2r of the Codex Mendoza (fig.3). Created by native scribes one generation after the conquest, it is a portrayal of the founding of Tenochtitlan which, rather than attempting to accurately document the physical layout of the city and its network of canals (which can be glimpsed in a map such as the so-called Plano de Papel de Maguey), it displays "the *idea* of Tenochtitlan, wherein the intermeshing of city and cosmic model are made manifest."[58] The image shows a small island where the eagle of Huitzilopochtli is perched on a nopal cactus with a serpent on its beak—the divine signal to the Mexica that their city should be founded on that spot. Around this sight one can see the ten tribal leaders of the Mexica who would make this happen. This scene is surrounded by a rectangular band of turquoise water (representing the lakes) and is crossed by similarly coloured stripes (representing the canals), thus dividing the space into four triangles—a quadripartite scheme with cosmic significance for the Mexica, applied in political, urban and architectural arrangements. The presence of water on this foundational scene is highly symbolic, being tied to the myth of Anahuac, the 'Place Surrounded by Waters' which is held to be the template of their ancestral home of Aztlan as well as for the newly born Tenochtitlan. Thus, this map can be read as showing the founding of the Mexica

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56   Barbara E. Mundy, "Mesoamerican Cartography," in *The History of Cartography Volume Two, Book Three: Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies*, ed. David Woodward and Michael Lewis (Chicago: The University of Chicago Press, 1998), 198.

57   Mundy, *The Death of Aztec Tenochtitlan*, 187.

58   Barbara E. Mundy, "Mapping the Aztec Capital," 14.

capital "stripped down to its bare symbolic essentials, a hieroglyph"[59] with a mythical hydrology figuring prominently in it, inextricable from the city itself.

Once the home of an amphibian culture that had managed the impressive feat of effectively harnessing an otherwise inhospitable lacustrine environment, in today's Mexico City, rainfall is ejected through immense civil works, rivers have been turned into underground sewage and, around 40% of drinking water has to be brought in from hundreds of kilometres away while the rest is pumped from the remaining aquifers (which contributes to a yearly sinking of up to forty centimetres in certain zones of the city). Around 15% of its population (mostly those inhabiting the periphery) suffer from chronic water shortages—a number that is bound to rise in the following decades. Ironically enough, the city still suffers from seasonal flooding in the summer months, just as it did five hundred years ago.

fig.3 Folio 2r of the Codex Mendoza (c.1541)

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59   Mundy, *The Death of Aztec Tenochtitlan*, 18.

Alan Díaz Alva

Conclusion

Numberless technical choices have driven Mexico City to stand today at the brink of environmental and social catastrophe which, as it was argued above, have been constrained by a wide range of factors. Reading this unfolding of events with the concept of the cosmo-geographic apriori as a backdrop, my intention has been to highlight the cosmological dimension that plays a part in steering these technical choices. Furthermore, by establishing a link between the cosmo-geographic a priori and mapping practices, I have attempted to provide the framing for what remain as (still) open ended questions: how might the hegemonization of modern cartographic techniques—with the naturalization of geometric and isotropic space they imply—have influenced the post-conquest transformation of the relationship (both geographical and cosmological) that Mexico City has with its lacustrine environment? Considering the influence that territorial representations can have in the unfolding of technical thought and practice, to what degree might the usage of spatial representations that eschewed the previous cosmic significance of the lacustrine environment have contributed to foreclosing the possibility of imagining technical alternatives to desiccation?

Faced with the gargantuan challenges that lie over the horizon, such speculative questions might seem inconsequential when these rather pressing matters ought to be addressed pragmatically and functionally through effective public policy, urban development guidelines and (yet more) large scale infrastructural projects. Nevertheless, if we take the idea of cosmotechnics seriously, we cannot ignore the ways in which these technical choices can be "enabled and constrained by particular cosmologies, which go beyond mere functionality or utility."[60] Likewise, it might seem that looking back to the lacustrine past for answers expresses a melancholic attachment to an irretrievable hydrological past, a yearning for a long lost amphibian utopia and, perhaps, even another case of a form of theorizing that is couched in the romanticization of a non-Western culture and the attempt to rekindle the belief in indigenous cosmologies. However, it is paramount to point out that cosmotechnical thinking is not based on preservationist and restorationist tendencies. As Hui argues, "The restoration of 'indigenous natures' itself has to first be questioned, not because it doesn't exist but because it is situated in a new epoch and is transformed to the extent that there is hardly any way to go back and restore it."[61] Cosmotechnical thinking is predicated on the conviction that the re-appropriation of metaphysical and cosmological categories of the past can reground, and thus transform, technical thought and practice. "To return to ancient categories […] is by no means to return to them as 'truth' or as 'explanation'."[62] Rather, traditional cosmologies can be reinterpreted and transformed, which amounts to mobilizing them in the search for

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60   Yuk Hui, *Fragmentar El Futuro: Ensayos Sobre Tecnodiversidad* (Buenos Aires: Caja Negra, 2020), 44.
61   Hui, *Fragmentar El Futuro*, 56.
62   Hui, *The Question Concerning Technology in China: An Essay in Cosmotechnics*, 52.

new technological relations with the world and to foster a future technodiversity. Perhaps the technical choices that lie in the future of Mexico City could look for new ways of cosmo-geographic grounding in order to bring forth alternatives to the dire prospects mentioned above. What can Mesoamerican cosmotechnics teach us in this respect? Is it possible to reappropriate Mexica cosmological categories such as *teotl* or *altepetl*? Can different forms of territorial imagination and their corresponding mapping practices contribute towards this purpose?

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