Beyond Imported Magic

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Beyond Imported Magic

Essays on Science, Technology, and Society in Latin America

edited by Eden Medina, Ivan da Costa Marques, and Christina Holmes
with a foreword by Marcos Cueto

1 Introduction: Beyond Imported Magic

Eden Medina, Ivan da Costa Marques, and Christina Holmes

The essays in this collection employ critical frameworks from science and technology studies (STS) to formulate new ideas and knowledge about how Latin American peoples, countries, cultures, and environments create, adapt, and use science and technology. Two key themes run through the volume. First, its essays go beyond viewing science and technology in Latin America as imported from somewhere else and instead explore alternative views of how scientific ideas and technologies are created, move, change, and adapt. This may include travel from South to North; among Latin American regions, nations, and communities; and between different areas of the global South. Second, these essays examine the specificities of Latin American experiences to understand science and technology more broadly. They thereby augment our understanding of such categories as *global South*, *postcolonial*, and *developing* and reveal new dimensions of the relationships among science, technology, politics, and power.

The chapters in this book share a common goal of furthering conversations between scholars in the North and the South who study science and technology in Latin America. Although some Latin American academics find it necessary to access English-language scholarship published in the North, it is less common for academics in North America and Europe to seek out the Spanish- and Portuguese-language literature published by Latin American scholars. Consequently, the work of Latin American scholars who normally publish in those languages may not reach as large an audience, as English often functions as an unofficial lingua franca. Although this is typical of the unequal power relationships that influence global linguistic practices as well as technoscientific ones (Mar-Molinero 2006; Spivak 1987; Wright 2004), we hope that this collection will catalyze new conversations across continents and languages.

Moving beyond Imported Magic

In the 1970s, students in the engineering school of the Universidade Federal do Rio de Janeiro, Brazil, referred to computers as a form of "imported magic." This phrase, which came to be used even among members of the Brazilian technical elite, cast

computer technology as highly effective, universal, sometimes mysterious, and always as coming from somewhere else (Marques 2005). Indeed, there is a widely held perception that science and technology necessarily come to Latin America from elsewhere, a notion fostered by ideas of modernization and development that originated outside Latin America and encouraged the transfer and diffusion of machinery and knowledge from more industrialized nations to less industrialized ones (Basalla 1967; Rostow 1991).[1] Such ideas have held considerable sway, shaped understandings of how science and technology should move, and guided decades of development policies. They have also propagated value systems that relegate Latin American nations to secondary or peripheral status. These perceptions endure, as seen in Latin American press coverage of Apple iPads, Nokia telephones, and forms of social media such as Facebook or Twitter that assumes that all design decisions about and the supply of such increasingly vital technology will come from elsewhere.[2] These perceptions also appear in government programs intended to replicate in Latin America imagined ideas about how US cultures of innovation and scientific expertise work.[3] Such views emphasize the transfer of supposedly superior technologies and ideas from North to South and do not acknowledge that innovation, invention, and discovery take many forms, occur in multiple contexts, and travel in many directions, nor do they acknowledge that diverse communities use scientific ideas and technologies in different ways. Framing science and technology as forms of imported magic overlooks processes of reinvention, adaptation, and use. It may also suggest that innovations such as a scientific way of thinking or an industrial technology should be adopted uniformly, rapidly, and unmediated, without considering the potentially negative or mixed effects of epistemic and technological change. All the essays in this volume contest this simplistic notion of a unidirectional movement of science and technology from the supposed center in the North to the assumed periphery in the South. The essayists' emphasis on science and technology, moreover, challenges past portrayals of Latin American life, which have stressed the magical, the exotic, and the primitive (Moya 2011). These elements, present, for example, in literary studies of magical realism, have drawn attention to important forms of Latin American culture. However, emphasizing them has also furthered the conceptual separation of the region from the West and, by extension, from science and technology.[4]

The essays' serious engagement with science and technology in Latin American contexts shines a light on this less studied aspect of Latin American life while illustrating the limitations of common diffusion narratives.[5] Such narratives give institutions and individuals in the most industrialized regions of the world disproportionate credit for scientific and technological creation, erasing the contributions of all other participants in this process and presenting those in other areas of the world, such as Latin America, as passive recipients or followers. The essays here offer alternative

narratives that move the story of invention and innovation southward; study forms of local innovation and use; analyze the circulation of ideas, people, and artifacts in local and global networks; and investigate the creation of hybrid technologies and forms of knowledge production. Take, for example, the case of Argentine prosecutors who in 1892 used a bloody fingerprint left at a violent crime scene to secure the world's first criminal conviction based on fingerprint evidence, a form of forensic evidence with an accompanying science of dactyloscopy that would not appear in London or Paris courts for another decade. By the end of the nineteenth century, Argentina had become a center of advanced research on criminology, and ideas about fingerprint science traveled regularly across the Atlantic. Yet as Julia Rodriguez demonstrates in this volume, the early adoption and acceptance of this new science in the Argentine courts was rooted in the specificities of Argentine history, including the desire by the Argentine government to control its growing immigrant population. This example, like many provided in this volume, turns this idea of imported magic on its head.

A second example is the Soviet Union's 1963 donation of a factory to Cuba to produce large concrete panels for Soviet-style standardized housing, a supposedly humanitarian act also intended to further Soviet influence in Latin America during the Cold War. The story, however, looks quite different from the Cuban perspective. Modifications made by Cuban engineers to accommodate the Caribbean climate not only traveled back to the Soviet Union and shaped construction there but also created a local aesthetic that defined the architectural landscape of the Cuban revolution (Palmarola and Alonso, this volume). The story of the concrete panel factory is therefore more than a story of imported magic and Soviet hegemony. It is also a story of Cuban innovation, aesthetics, and resilience.

Through such cases, we see the benefits of adopting a more global view of science and technology that includes Latin America. Understanding the interrelationships among different communities and different parts of the world, however, requires broadening the study of the history and social aspects of science and technology to include scholarship on and by academics around the globe. It may entail encouraging STS and its constituent fields to look for producers or users of science and technology in places less conventional than, say, in the lab or among elites. The contributors to this book bring together literatures from varied fields and geographical areas to draw attention to a wide range of actors in the production of science and technology, including forms of invisible labor, neoliberal policies, and law, as well as the contributions of indigenous peoples, educators, children, activists, women, hackers, and shop floor workers.

In so doing, this book builds on and contributes to important previous work in the area of postcolonial science studies (e.g., Harding 2008; Harding 2011; Anderson 2002; Anderson 2009; Anderson and Adams 2008). As Anderson writes, in the context of science studies the term *postcolonial* "refers both to new configurations of

technoscience and the critical modes of analysis that identify them" (2002, 643). These modes include studying the situated nature of technoscience; the connection and reconfiguration of the local and the global; the coproduction of identities, technologies, and cultural formations; and the transnational movement of people, practices, and technologies. Previous work in this area has raised questions about the role of science and technology outside elite institutions and pushed members of the STS community to look beyond US and European scientific discoveries and inventions. Indeed, Anderson (2008) has shown that cultural exchange can lead to discoveries, as seen in the case of the kuru brain disease and the discovery of prions. Other scholars, such as Harding, have harnessed feminist and postcolonial perspectives on science to highlight their shared interests in inequality, subjectivity, power, and the experiences of those whom Harding calls "modernity's Others" (Harding 2008). Many of the contributors extend concepts from the literature of postcolonial science studies and insights from feminist scholarship to generate new insights about the experience of science and technology in Latin America.

At the same time, it is important to note that the applicability of the postcolonial studies label to Latin America is a subject of ongoing debate. Postcolonial studies emerged largely from Western academic institutions, especially in the United States, where it gained currency in the 1980s, and is often used to refer to the study of people and places that were formerly under the control of a foreign power. The field has focused primarily on issues of personal, cultural, and political identities and possibilities in both colonized and decolonized environments. Postcolonial studies surely shares many concerns that are central to Latin American studies, including studies of empire and its legacy, the exertion of imperial power through representations of knowledge and culture, and the economic exploitation of land, natural resources, and peoples. Indeed, many members of the Latin American studies community have productively engaged with the concepts, findings, and frameworks of postcolonial studies (e.g., Seed 1991; Mignolo 1993; Vidal 1993; Adorno 1993; Moraña, Dussel, and Jáuregui 2008).

Nonetheless, as Fernando Coronil notes, "there is no corpus of work on Latin America commonly recognized as 'postcolonial'" (Coronil 2008, 396). Latin America, a region characterized by colonial ties to Spain and Portugal and comprising nations that typically gained independence in the first part of the nineteenth century, does not fit the historical mold of much of the postcolonial literature.[6] For this reason some scholars of Latin America have argued that the term *postcolonial* unnecessarily homogenizes experiences of colonization and decolonization (Adorno 1993; Klor de Alva 1992; Klor de Alva 1995; Moya 2011).[7] Adorno, for example, writes that while the sweeping expanse of colonial and postcolonial discourse may allow us to bring together the Indians of South Asia and the *indios* of Latin America, doing so "risks offering too much too easily and at too great a cost" (Adorno 1993, 141).

Europe's colonization of Latin America differs significantly from its colonization of Asia or Africa. It begins in 1492 with the arrival of Columbus in the New World, more than three centuries before the expansion of British colonial rule in India or the establishment of French colonial rule in Algeria, and four centuries before Belgium's colonial rule in the Congo. Latin American nations were also among the first to achieve independence from their colonizers and become modern nation-states. As Moya writes, "Spanish and Portuguese colonialism in the Americas began much earlier than other European colonial incursions elsewhere, lasted much longer, ended a century and a half earlier, and left a much deeper impact" (Moya 2011, 5). This can be seen in the overwhelming dominance of the colonial languages (Spanish and Portuguese) and the pervasive presence of the colonizing religion (Roman Catholicism). Colonization, moreover, altered the region at a microscopic level—70 to 90 percent of the indigenous population in the Americas succumbed to imported diseases such as smallpox, measles, and plague, a level of mass extermination that has not been seen since.

Additionally, the Spanish and Portuguese crowns created centralized, hierarchical systems of viceroyalties to manage their empires across the Atlantic; these systems differed in notable ways from British practices of colonial management in the north. Brazil even became the seat of the Portuguese crown in 1808 and thus served as the governing center of the Portuguese kingdom. Spanish and Portuguese colonization of the Americas, moreover, has been linked to the origins of European modernity in the sixteenth century. Latin America provided not only the other that Europeans could use to measure their achievements; it also provided a source of extractable resources that helped Europe gain a competitive edge at the beginnings of global capitalism. Europe, for example, paid for almost all its imports with silver mined from such places as Potosí in Bolivia. Overall, Latin America produced approximately 85 percent of the world's silver between 1500 and 1800 (Pomeranz 2000, 159). The colonies also contributed to European knowledge of the world through the collection of flora and fauna and the mapping of uncharted territories. This, in turn, allowed Spain to exert power over knowledge production by means of its supposed discovery and subsequent naming of plants and places (Cañizares-Esguerra 2001; Cañizares-Esguerra 2006).

Scholars of Latin America such as Mignolo (2000), Moraña, Dussel, and Jáuregui (2008), and Klor de Alva (1995) have called for greater recognition of colonial difference and greater attention to the historical specificities of how nations fit within the "world-system of colonial domination" (Moraña, Dussel, and Jáuregui 2008, 6). These scholars also reject the idea that the region has undone colonial relationships or moved beyond them, as the term *post*colonial might suggest. Instead, they argue that colonialism has changed over time as power has shifted from European colonizers to creole elites to those with connections to the metropolitan centers and global markets. Indeed, this shift in power from European colonizers to creole elites in the period

following independence is yet another distinguishing factor of the Latin American colonial experience (Klor de Alva 1995). Thus, even as this book aims to foster conversation among the literatures of STS, Latin American studies, and postcolonial studies, it acknowledges these ongoing discussions within the Latin American studies community.

Through this volume we hope to enrich understandings of colonial and postcolonial science and technology by making Latin American history more visible within the field of STS. Many of the contributors to these pages use science and technology to illustrate how structures of power have shaped both knowledge production and material life in Latin America from its colonial past to its neoliberal present. In doing so, they explore how science and technology have played a role in perpetuating structural inequalities among nations and facilitating the spread of European, US, or Soviet ideas of modernity, even as the legacies of such ideas mutate when they are reused (Kowal, Radin, and Reardon 2013). At the same time, as the essays that follow demonstrate, Latin America provides scholars a space to study alternative epistemologies that challenge Western "scientific" ways of knowing or call into question science and technology policies that travel from North to South but are ill suited to Latin American realities or socially unjust. This book therefore also aims to offer science and technology as a lens through which to better understand Latin America's history, its connections to other parts of the world, and its ongoing struggle for intellectual, technological, and economic sovereignty.

STS in Latin America

Latin America is a region with a distinctive geography and history that have shaped its collective experience with science and technology. This includes a colonial history predominantly tied to the Iberian Peninsula, economies of colonial extraction that were later replaced by conditions of economic dependency on more industrialized nations, a history of centrality in economic globalization and understandings of modernity, and sustained US intervention in its political and economic life during the nineteenth and twentieth centuries. Scholars such as Saldaña (2006) have identified further commonalities within this area that pertain to the development of Latin American scientific and technological capabilities. For example, characteristic geographical features such as the Amazonian basin, Mesoamerican lowlands, and highlands in Mexico and the Andean cordillera, and the flora, fauna, and mineral deposits within the region, have contributed to the rise of particular areas of science and engineering expertise (e.g., mining, botany, zoology). In more recent times, the idea of Latin America as a region has led to the growth of networks of scientific collaboration and exchange, including the formation of professional societies or conferences such as the Latin American Conference on Informatics (CLEI). Regional analysis allows for

researchers working in different disciplines to enter into conversation with one another and produce comparative knowledge about this part of the world.

However, although Latin America has a strong regional identity, it is not a self-contained, bounded unit but rather an open one, linked to global flows of labor, capital, and cultural hybridization. Thus, the regional focus of the book is intended as a basis for future transdisciplinary conversations using science and technology as a way to probe the global reality that is Latin America, past and present.[8]

That said, we do not mean to overlook the tremendous diversity of histories, cultures, and languages within the region. Although Spanish and Portuguese are the dominant languages in Latin America today, they are but two of many languages spoken historically in this part of the world. It is estimated that immediately before Columbus arrived in the New World, approximately 350 distinct languages were spoken in the areas that became known as Mexico and Central America and that 1,450 distinct languages were spoken in the areas that became known as South America (Sherzer 1991). African languages and cultures also arrived in Latin America with the transatlantic slave trade, which peaked in the eighteenth century.

We further recognize that while the term *Latin American* conveys a shared identity, it is politically fraught and always has been. The label was arguably first imposed on the region in 1836 in the writings of the French intellectual Michel Chevalier, who divided Europe into Latin (Roman) Europe and Teutonic (German) Europe and argued that such divisions carried over to the New World (Mignolo 2005). The French later used this construction of *Latinidad* to promote the linguistic root of Latin shared by Spanish, Portuguese, and French and thereby justify France's greater influence in the region, including its invasion of Mexico in 1862 and Napoleon III's installation of Maximilian as the short-lived emperor of Mexico (Chasteen 2001). Mignolo and others have also argued that the term *Latin America* is a geohistoric category that has since become naturalized and that the idea of Latin America has historically served as a necessary other for European modernity, claiming that "the Americas exist today only as a consequence of European colonial expansion and the narrative of that expansion from the European perspective" (Mignolo 2005, xi). More recently, Gobat (2013) has argued that Central and South Americans invoked the term *Latin America* in the mid-nineteenth century as a way to unify the region in protest against US expansion and European intervention. He notes that the term *Latin* also emphasized the region's connection to France, which was then viewed as one of the most modern European nations (in contrast to Spain), and provided the basis for a regional claim to whiteness. Sorensen, in contrast, has dated the construction of Latin American identity to the cultural and political imagination of the 1960s; "only then," she writes, "did a transnational cultural identity become rooted in the hemispheric imagination" (Sorensen 2007, 1). Thus, Latin America has historically functioned as a political category and contested form of regional identity. This book acknowledges this history but uses the

term in a different way. It uses *Latin America* to refer to nations in the Americas that are south of the United States and where Spanish and Portuguese are predominantly spoken, including areas of the Caribbean. We opted to use *Latin America* instead of *Ibero-America* because it is familiar to a broader readership.

Although it is not possible within the scope of this introduction to do full justice to the existing interdisciplinary body of STS literature in Latin America, a brief overview of the multiple points of origin and its relationship to the development of related fields such as the history of science provides some useful context.[9] Our overview focuses on the development of STS within Latin America, as this history may be less known to readers of this volume.[10] It shows, moreover, that STS as a field has a diverse history that is interwoven with the historical experiences and intellectual currents found in different parts of the world.

Arellano Hernández and Kreimer (2011) date the precursors of the social studies of science and technology in Latin America to the 1950s, including work by the Brazilian scholar Azevedo (1955), the Cuban scholar López Sánchez (1967), and the Mexican scholar Gortari (1963). These early works limited the scope of inquiry by arguing that Latin America, and by extension Latin Americans, lacked science and attributed this deficiency to the history and culture of the region—perhaps contributing to the articulation of science and technology as forms of imported magic (López Sánchez 1967; Gortari 1963). Azevedo, for example, proposed that Brazil's colonial experience (including the tendency to focus on literary works and subjectivism) and the absence of a Protestant work ethic impeded its level of scientific activity. For this reason, Saldaña describes this early historical work as having "a limited horizon and distorted understanding of scientific activity" (Saldaña 2006, 5).

From the 1950s to the beginning of the 1980s, research on the social dimensions of science and technology did not have a strong institutional presence in Latin American universities or government offices. Instead, it coalesced as a current of thought or movement sometimes referred to as *pensamiento latinoamericano en ciencia, tecnología y sociedad* that connected science and technology to economic and political issues such as development and dependency. Much of this thought grew out of research activities at the Chilean offices of the United Nations Economic Commission on Latin America (ECLA) during the 1960s and 1970s (Arellano Hernández, Arvanitis, and Vinck 2012; Dagnino, Thomas, and Davyt 1996). Among those involved in this research were the ECLA economists Raúl Prebisch and Osvaldo Sunkel, and scientists and technologists such as Jorge Sábato, Amílcar Herrera, Oscar Varsavsky, and Marcel Roche, many of whom became social thinkers and ideologues who connected science, technology, and politics in their writings. It was in this way, according to Vaccarezza, that "Latin American thought on political science and technology was shaped without forming a conscious community identified as STS" (Vaccarezza 2011, 47).

This thinking on Latin American science and technology was influenced by dependency theory, one of the most important Latin American contributions to economic thought.[11] It arose at a moment when economists firmly cast countries as either developed or developing and argued that the unequal power relationship between developed and developing nations was a necessary part of industrialization. Dependency theory challenged the idea that Latin American nations could move from developing to developed by following linear models of innovation that included adopting Western models for scientific practice and industrial technologies for economic growth and increased consumption. Instead, dependency theory framed underdevelopment as necessary for the developed nations to amass their wealth and argued that Latin American nations could not follow the same trajectory as nations such as the United States. The condition of Latin American nations could be improved, however, with increased national autonomy and less reliance on foreign capital, foreign goods, and foreign priorities.

Latin American thought on science and technology during this period similarly argued that Latin Americans should develop science policies and technological practices that reflected the specific conditions of Latin American life. In Cuba, Chile, and elsewhere, this resulted in national policies that viewed science and technology as mechanisms for social change and activities that could be oriented toward addressing national problems (Núñez Jover and López Cerezo 2008; Medina 2011). The ideas of Varsavsky, Herrera, and others were embodied in government reference texts that shaped science policy. In some countries, such as Chile, these ideas merged with platforms for socialist change (Medina 2011) and Marxist critiques of capitalism. But the national programs for science and technology development proposed in these texts also appealed to nationalistic wings of the military, especially in countries such as Brazil and Argentina (Adler 1987; Evans 1995; Marques 2003).

One of the most influential of these early thinkers about the role of science and technology in Latin America was the Argentine mathematician Oscar Varsavsky, who wrote a number of scholarly texts on the structure and practice of Latin American science. In his 1969 *Ciencia, política y cientificismo*, which exemplifies the critical stance he termed *cientificismo*, Varsavsky argued that Argentine scientific practices, norms, and values were following those of larger research centers in Europe and especially the United States, perpetuating a form of scientific colonialism that prioritized foreign business interests and encouraged young scientists to study problems that were of little relevance in their own countries, a phenomenon more recently described as an "internal brain drain" (Polanco 1987). Varsavsky argued that it was both possible and necessary for Latin American countries to develop scientific styles adapted to their own national projects (Núñez Jover 2002; Schoijet 2002). His later works critiqued scientific objectivity, cast science as an ideological extension of existing power relations, and accused it of being overly focused on problems that would not bring about

revolutionary change (Varsavsky 1971). Varsavsky's writings, and those of his contemporaries, connected science and technology to political and economic structures and unequal power relations between Latin America and more industrialized parts of the world.[12] This attention to social justice and public policy remains a hallmark of Latin American STS scholarship, and the acronym STS, or CTS in Spanish and Portuguese, is often used to denote scholarship on the subject of science, technology, and public policy.

The 1980s to the second half of the 1990s witnessed a shift in STS research, as well as research in the related field of the history of science, and reflected the growing maturity of both. Beginning in the 1980s, the history of science in Latin America moved away from Eurocentric understandings of science and began to focus on how the specificities of Latin American history created a different context for science, which was often referred to as "science of the periphery." The field also increased its professional identity with the founding of the Sociedad Latinoamericana de Historia de las Ciencias y la Tecnología in 1982 and the creation of its journal *Quipu: Una Revista Latinoamericana de la Historia de las Ciencias y la Tecnología* in 1984. The journal was published in Spanish and based in Mexico from 1984 to 2000 (producing thirteen volumes of three numbers each), with a recent resurgence of the journal and publication of a fourteenth volume in 2012 (Quipu 2012). *Quipu* was a disciplinary landmark for the history of science in Latin America because it opened a space for local historical narratives and abandoned earlier views of Latin America as an empty space for the production of scientific and technological knowledge.

Like the history of science, STS also developed a professional identity during the 1980s. Whereas previous work on science, technology, and society had been conducted primarily by scientists who were reflexive about their practices, the field increasingly became a domain that included social scientists and humanists (sociologists, psychologists, anthropologists, historians, philosophers) who considered STS their specific area of expertise and who gave greater attention to theory. Within Latin America, the pressure to shift from economic models of socialism and developmentalism to those of neoliberalism also affected the content of the field and motivated scholars to abandon such influential frameworks as dependency theory. This included challenging the center-periphery dichotomy and studying how scientific and technological exchanges transcended the rigidity of these categories. As Cueto has noted, although the concept of the periphery that had emerged from dependency theory had been "useful for locating scientific communities that are considered to be on the 'outskirts' of the traditional centers of knowledge," the theory's "lack of temporality, the linearity, [and] the passivity assigned to the periphery" must be rejected by scholars if the field is to continue and mature (Cueto 2006, 231).

Writing in the journal *Social Studies of Science* in 1987, Hebe Vessuri observed that social studies of science were still fragile in Latin America, despite increasing research

activity and a growing number of publications in Spanish and Portuguese. Although she credited the emerging field with fostering a deeper understanding of the role of science and technology in development (which was in keeping with the early interests of the field in the 1960s and 1970s), she also expressed discomfort with the conceptual dependency of Latin American scholarship on intellectual production in the United States and Europe.[13] This concern remains, given that many of the theoretical frameworks found in the STS literature on Latin America have originated in France, Great Britain, or the United States (although, as this book illustrates, theories change as they are invoked in different historical, cultural, and geographical contexts and often become more nuanced in the process).[14]

The field has continued to grow within Latin America since the mid-1990s. For example, the biannual Latin American Conference on the Social Study of Science and Technology (ESOCITE) has held nine meetings in different locations in South America and Mexico since 1994 and attracted an increasing number of participants.[15] Nevertheless, certain areas of Latin America have been more engaged in STS research than others. For example, a historical analysis of participation in STS conferences reveals a strong concentration of scholarship in such countries as Brazil, Argentina, and Mexico; fewer contributions from such nations as Colombia, Costa Rica, and Chile; and a dearth of work from many areas of Central America and the Caribbean (Arellano Hernández 2012).

This growth has led scholars to reflect upon where the field should go in the future. Arellano Hernández and Kreimer (2011), for instance, posit that one of the key contemporary challenges facing the field is to understand how Latin American technoscience functions in the global context. Velho (2011), for her part, argues that a key paradigm of Latin American science studies in the twenty-first century is studying the relationship of science to social good. And Vessuri (2011) situates the future direction of the field in a larger political context to wonder whether the return to power of various leftist governments in Latin America will result in a resurgence of earlier topics of importance, including issues of sovereignty, legitimacy, and power. The essays in this volume also consider other potential directions, such as studying science and technology in transnational frameworks (Mateos and Suárez-Díaz), moving beyond the North-South dichotomy to study exchanges among areas of the global South (Fressoli, Dias, and Thomas), examining forms of internal colonialism (Cukierman), as well as challenging what we view as legitimate innovation and ingenuity (Marques).

The Book's Structure and Conceptual Themes

The rest of this volume is divided into three parts: Latin American Perspectives on Science, Technology, and Society; Local and Global Networks of Innovation; and

Science, Technology, and Latin American Politics. The first part examines the politics of knowledge and representation in specific Latin American contexts and possible frames of analysis for studying science and technology in the region. The second traces the circulation of scientific ideas within community, national, and transnational networks. The final part addresses the mechanisms through which scientific projects and technologies are linked to Latin American politics and political will. This includes how Latin American politics have shaped the historical development of science and technology in the region and how science and technology have shaped the contours of Latin American politics and history.

Part I: Latin American Perspectives on Science, Technology, and Society

The chapters in this part use multiple frames of analysis to help us better understand the development and practice of science and technology in Latin America. Although the authors employ concepts drawn from different analytical frames and geographic regions, all are concerned with the politics of knowledge and representation in and about Latin America. They also examine what is made newly visible by these approaches and illustrate their broader applicability to our understanding of Latin American science and technology.

In the first of these essays, Henrique Cukierman examines a scientific expedition to inland Brazil in 1911–1913 that he ties to nation building and the colonization of both the scientists involved (through their desire to emulate European science) and the residents of an inland northern tropical region of Brazil. Cukierman explores the use, perception, and adaptation of European medical science in inland Brazil and how local material conditions and cultures come into contact with Western science and technology to shape the production of scientific knowledge.

Mariano Fressoli, Rafael Dias, and Hernán Thomas highlight the tensions between market logic and local participation in innovation by describing how ideas for technological development and social inclusion that were originally developed in India are being taken up in Latin America and by such global institutions as the World Bank. Combining analyses of cognitive praxis and of the sociotechnical alliances involved in these movements allows the authors to consider how ideas circulate among areas of the global South, their relevance to a new local context (in this case, Latin America), and how these ideas intersect with the market, market thinking, and concerns about the well-being of the poor.

In their investigation, Tania Pérez-Bustos, María Fernanda Olarte Sierra, and Adriana Díaz del Castillo deploy feminist theory on the politics of care to examine how gender figures in the ways various scientific practices and practitioners are made visible or invisible and their value increased or diminished. In particular, they examine how women forensic geneticists in Colombia have framed their work within a broader concern for serving justice. They demonstrate that giving care can be at odds with

academic concerns, such as the desire to publish results, and thus diminish the status of the work but not its technical difficulties.

Ivan da Costa Marques uses the concept of ontological politics to examine various frames of reference used by scientists and activists in Brazil to determine the legitimacy of a local nutritional innovation, *multimistura*. Ontological politics is the sum of choices and decisions made to establish or stabilize what constitutes a reality—a frame of reference for understanding the world. By granting an ontological role to narratives, Marques uses the case of *multimistura* to explore the different worlds that surrounded the development, adoption, and use of this technology, including those of nutritionists, social scientists, and activists/users.

Finally, Michael Lemon and Eden Medina analyze how two different academic communities, Latin American studies and the history of technology, have approached the telling of Latin American history of technology, based on a review of the English-language literature on the history of technology in Latin America in two of the top journals on the history of technology and three of the top journals on Latin America. Through an analysis of the number of articles published, they identify important differences in how each community addresses the topic of technology, and the authors highlight what is made visible and invisible in each field. They conclude by suggesting ways to broaden how scholars in these fields write technology history in the Latin American context.

Part II: Local and Global Networks of Innovation

The essays in this part investigate the flows of technology and scientific knowledge across communities, regions, institutions, and nations, examining the formation of networks of exchange and how ideas and technologies are transformed or contested as they move within these networks. These studies address translations, hybrids, adaptations, and the creation of charismatic objects; uniformly reject the idea that technoscience travels unchanged from a central to a peripheral context; and examine how politics shape the movement, selection, and use of ideas, practices, and artifacts.

Julia Rodriguez's historical study of the development of the science of fingerprinting demonstrates that the system for forensically filing and categorizing fingerprints to allow their easy retrieval for use in criminal cases was first developed in Argentina and then spread to other parts of the world. Yet her story also details the transatlantic exchanges that contributed to both the initial development of forensic fingerprinting, including circulation among members of shared language groups within the scientific community, and the rapid movement of immigrants into Argentina that first prompted the Argentine state to develop new sciences for social control.

Hugo Palmarola and Pedro Ignacio Alonso's essay examines the confluence of science, technology, and ideology in one of the largest social housing projects in

Latin America, the large-concrete-panel housing projects in Cuba. The authors demonstrate that Cuba's imagination of revolutionary change was simultaneously local and imported, arguing that the Cuban slogan "socialism is building" furthered the Cuban political project and that the Cuban government's framing of prefabricated housing paralleled its framing of the Cuban New Man. Large-panel construction, they argue, is a hybrid technology that is both Soviet and Cuban and made possible through local innovation and transnational exchange.

In their chapters Anita Say Chan and Morgan G. Ames study the design, use, and meaning of the XO laptops created by the One Laptop per Child program. Chan first traces the process from the differing perspectives of a programmer affiliated with the program in the United States and an engineer working on the deployment of the laptops in Puno, Peru. Chan delineates two models for laptop design—an engineering-centric vision that minimizes engagement with local users and contexts, and a participative model that accepts input from multiple members of the local community—and argues that the adoption of new technologies necessarily depends on processes of local translation that can open new technological possibilities. Ames describes the appeal of the XO laptop in Paraguay in terms of the concept of the charismatic object, which exerts power not because of what it is but because of what it promises to do. Tracing the everyday challenges related to the use of the XO laptop in the classroom and the networks of NGOs, teachers, and government officials involved in the program, Ames explains why the Paraguayan program has been more successful than most and retains its appeal despite those challenges. Both Chan and Ames describe how the actions and networks of globally dispersed actors, including students, rural teachers, technicians, activists, software programmers, and engineers, create unique sociotechnical ecosystems.

Noela Invernizzi, Matthieu Hubert, and Dominique Vinck study the development of nanoscience policy in Brazil, Mexico, and Argentina to examine how the scientific priorities of nations outside Latin America shape those in Latin America. Acknowledging the strong policy influence of the United States and Europe, they nonetheless challenge the narrative of technological imitation by showing how the distinctive character of national and international scientific networks in different Latin American countries, and the scientific traditions within each country, shape the specific character of these policies despite their common rhetoric. They thus argue that local factors contribute to the ways in which scientific development is materially organized and scientific policies travel and change.

Amy Cox Hall details the origins of the first photo of Machu Picchu that appeared in *National Geographic* and that has since become one of the most iconic depictions of Peru. The photograph was taken as part of an anthropological expedition sponsored by Yale University during a period in which the camera was viewed as a scientific instrument that could capture objective data. Cox Hall, however, details how the use

of the camera during the expedition was a negotiated and disciplined practice. Presenting Machu Picchu as a lost civilization that had been found again by the expedition involved a particular configuration of human and nonhuman actors and practices that presumably stabilized the facts created by the expedition. Borrowing a term from Ames, Cox Hall suggests that cameras and their photographs thereby also served as charismatic objects as well as inscription devices.

Part III: Science, Technology, and Latin American Politics

The chapters in this part examine more closely the relationship of science, technology, and politics in Latin American settings, including how the coproduction of technology and politics shapes bureaucratic decision making and how science and technology have been used to achieve specific political ends. They also include analyses of the ways in which international relations have shaped the character of national research programs and how technologies can interrupt or change legal practices, regulations, and classification systems and intersect with such state structures as policy making and legislation.

Three accounts in this part deal with cases of nuclear power. Jonathan Hagood uses the history of nuclear energy in Argentina to challenge overly simple and often decontextualized understandings of technological success and failure in Latin American contexts. Examining how the political world of 1950s Argentina made it possible for Argentine president Juan Péron and the German émigré scientist Ronald Richter to envision creating a "bottle of atomic energy," Hagood argues that although these efforts are often viewed as a failure (or an example of a president's being duped by a savvy scientist), the project helped Péron achieve his short-term political goals and thus can be seen as a political, if not technological, success.

Gisela Mateos and Edna Suárez-Díaz use a transnational framework to study the history of Mexican nuclearity during the Cold War. As they show, the development of national nuclear capabilities required the international circulation of physicists, nuclear materials, standards, and practices. Yet the authors further argue that the history of the Mexican nuclear program cannot be understood outside the context of Mexican political history in the twentieth century, as Mexico's dual goals of political independence and national scientific capability resulted in a nuclear program that was dedicated exclusively to peaceful applications—such as energy—and eschewed the building of bombs.

Manuel Tironi and Javiera Barandiarán examine Chilean energy policy in the context of neoliberalism, which they argue functions as a "political technology"—a form of applied knowledge that can be used in pragmatic and intentional ways to transform the state and society. To demonstrate how neoliberalism and its use as a political technology have changed over time, they examine two cases. The first is the dismantling of Chilean nuclear energy policy in the 1970s, when the Chilean

government's instantiation of the neoliberal model devalued the expertise of Chilean nuclear engineers while giving greater power to Chilean economists. The second case examines the more recent hydropower generation to argue that although current forms of neoliberalism permit multiple and noneconomic forms of expertise to contribute to environmental regulations, they do so only in ways that do not threaten the structure of the neoliberal state.

Shifting topics, Ana Delgado and Israel Rodríguez-Giralt detail the attempts of Brazilian peasant movements to include creole seeds in the national agrarian insurance system. Creole seeds, which have been developed, adapted, or produced by farmers and landless and indigenous peoples in situ over long periods of time using local methods and management systems, are by definition not standardized. Yet if they cannot be standardized or classified, they cannot be entered into the national registry, which provides insurance in times of crop failure. The authors draw on Moreira's discussion of interferences, or copresences through which the social is reenacted, to describe how creole seeds disrupt what is considered a legally valid entity in the Brazilian context.

Finally, João Biehl examines how "right-to-health" legislation in Brazil is changing the relationship among technology, medicine, and the law. Right-to-health legislation requires the state to pay for health care in the form of certain pharmaceuticals, which has spurred a phenomenon referred to as the "judicialization of health." Biehl chronicles how some Brazilian poor have turned to suing the government to claim their right to access newer medical technologies, often expensive proprietary pharmaceuticals that otherwise would be beyond their reach. This in turn shifts public understanding of the state's role in health care toward the acquisition of and payment for pharmaceutical treatments that are often manufactured by multinational pharmaceutical companies. Biehl examines the practices of citizenship and governance that are emerging from these struggles and how the market, acting through the acquisition of pharmaceuticals, is influencing the way Brazilians understand their relationship with the state.

Collectively, then, this book features a range of voices from Latin American, US, and European institutions. Although we cannot hope to cover the geographic, cultural, and historical richness of Latin America in a single volume, our intention is to provide a snapshot of some of the promising, provocative, and groundbreaking research taking place in this growing field and to suggest areas for future work and interdisciplinary engagement. As such, the collection deepens our knowledge of Latin American experiences, extends the geography of science and technology and makes it more inclusive, and provides new conceptual approaches for STS-related research. Freed from the framework of imported magic, Latin American science and technology, as well as their study, take on new relevance in how we understand the history of the region and its global connectedness, diverse practices of knowledge production, and the many forms of innovation that create and maintain our worlds.

Notes

All translations in this chapter from Spanish and Portuguese sources were made by the authors.

1. One of the more frequently cited models of scientific diffusion is George Basalla's (1967), which tracked the spread of modern science from a handful of European countries to the rest of the world through military conquest, colonization, missionary work, and political and commercial relationships. Rostow's theory of economic growth (1991), which charted the progression of societies from traditional to modern, with modernity defined as an industrial economy and the mass consumption of high-value goods, also exerted considerable influence in Latin America and guided decades of foreign aid policies, Latin American economic planning, and discourse regarding development (Escobar 1994). Rostow and Basalla have rightly been criticized for idealizing the historical experiences of the United States and Western Europe and for insisting on the global imposition of these experiences.

2. For example, in 2012 *O Globo*, a daily newspaper in Rio de Janeiro, published an article on trends in cell phone manufacturing that lamented the decline in "the techno-diversity" of cell phone models while also praising a new Nokia model and expressing disappointment that this new phone "has no foreseen date of arrival in Brazil." Instead of arguing that Brazilian technologists should change cell phone design, the underlying assumption of the article is that technology necessarily comes from somewhere else (Rónai 2012).

3. Start Up Chile, for example, is a program run by the Chilean government to replicate in Chile the start-up culture of Silicon Valley and increase Chilean economic competitiveness. The Brazilian government is also trying to place 100,000 Brazilian students and researchers in top universities worldwide as part of its Science without Borders Program, based on the premise that training Brazilian students and researchers abroad in science, engineering, and innovation and having them subsequently return to Brazil will provide a mechanism to import knowledge and expertise and strengthen the Brazilian economy. We point to these programs not as a criticism, but rather to demonstrate the enduring belief that science and technology are only and should only be imported to Latin America from elsewhere.

4. This does not mean that we wish to establish a dichotomy with magic on one side and science and technology on the other. Indeed, technoscientific objects can take on some of the mysterious connotations of magic in the sense that magic represents an emotion-laden experience of the unknown. Furthermore, as this book shows, literary works such as Gabriel García Márquez's *One Hundred Years of Solitude* can suggest new and productive directions for the study of technology history (Lemon and Medina, this volume). Our point, rather, is that scholarly attention to the magical has propagated a particular image of the region that is not associated with scientific practice or technological creation.

5. Indeed, the analyses developed in this book illuminate the limitations of diffusion narratives in national and international contexts outside of Latin America. *Diffusion* can often be used interchangeably with *technology transfer*, although the two terms are sometimes distinguished by the movement they describe. *Technology transfer* is often used to describe the movement of a technology from one country to another, whereas *diffusion* is used to describe movement within

a community (Staudenmaier 1989). We do not draw this distinction here, and our assessment of diffusion would apply to many discussions of technology transfer.

6. Perhaps this is why it has been noticeably absent from major works of postcolonial scholarship. For example, Ashcroft, Griffiths, and Tiffin's 1989 *The Empire Writes Back*, an important early book on postcolonial theory, did not include the Latin American experience, with the exception of the Caribbean. The second edition of the book, however, recognized the omission of "the oldest, and second largest and most complex modern European empire—that of Spain" and suggested that the distinct character of coloniality in Latin America "may fundamentally change our view of the post-colonial" (Ashcroft, Griffiths, and Tiffin 2002, 202). Although the authors did not include additional material on Latin America in the text, their comments support our contention that broadening what is considered postcolonial to account for Latin American experiences is imperative.

7. This argument does not imply that the analytic frameworks of postcolonialism are not relevant, but rather that they have not been sufficiently expanded to include the Latin American context.

8. Drawing from the transnational turn in historical scholarship, we know that we cannot understand the histories of colonizing nations without understanding those of the colonized and vice versa. Nor can we understand the centers of scientific and technological production without understanding processes of imports and exports, particularly asymmetries in resource exchanges (e.g., in raw materials, geographically specific knowledge, the external and internal brain drain of Latin American technical experts), and the ways that ideas, artifacts, and techniques travel. This is even truer today, as contemporary science and industrial production become increasingly globalized and distributed, a phenomenon made possible by the increasing speed of transportation and communication and the resulting time-space compression (Harvey 1990; Harvey 2000). The presence of Latin America in the social studies of science makes visible the inseparability of the histories of various regions and demonstrates how the production of colonialism, modernity, and Western hegemony is intertwined with the production of technoscience.

9. While the history of science can be considered a constituent or related field of science and technology studies, the two fields have different historical paths of development in the Latin American context and overlap only occasionally. One goal of this book is to increase the degree of conversation among these epistemic communities.

10. This review, for instance, does not detail the rich and growing literature on the history and social study of science and technology being written by scholars outside Latin America (e.g., Soto Laveaga 2009; Rodriguez 2006; Wolfe 2010; Gallo 2005; Grandin 2009; Hayden 2003; Chan 2013; and Takhteyev 2012), nor does it trace the development of all the varied areas of the field within Latin America.

11. For example, Herrera's views on Latin American science and technology were intellectually tied to the work on dependency theory coming out of ECLA (the United Nations Economic Commission on Latin America) during the 1960s and 1970s. His 1970 *Latin America: Science and Technology in the Development of Society* was edited by the ECLA economists Fernando Henrique

Cardoso, Aníbal Pinto, and Osvaldo Sunkel, leading figures in the development of dependency analysis.

12. For example, Herrera (1971) argued that actual scientific practice was based on the implicit policies of elites whose interests were often aligned with foreign powers. Roche (1972) extended the framework of dependency theory to science and technology research and worried that the increasing levels of foreign investment in Latin American manufacturing and the importation of capital technologies from elsewhere would have long-term effects on the development of Latin American science and technology research capabilities.

13. This evocative observation extends Xavier Polanco's 1987 critique of internal brain drain to the production of STS scholars and STS scholarship.

14. For example, Varsavsky and his contemporaries are relatively absent in the bibliographies of present-day ESOCITE papers, while distinguished STS scholars from the United States and Europe appear frequently (Silva and Marques 2012).

15. For example, for the 2008 ESOCITE meeting in Rio de Janeiro, scholars submitted 470 extended abstracts; 313 abstracts were selected, and 228 complete texts were distributed in 43 sessions (available at http://www.necso.ufrj.br/esocite2008/index.html).

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