MICHAEL J. BARANY*

Fellow Travelers and Traveling Fellows: The Intercontinental Shaping of Modern Mathematics in Mid-Twentieth Century Latin America

ABSTRACT

The geographic reach and international integration of modern mathematics expanded dramatically in the wake of the Second World War. I examine the political and logistical achievement of intercontinental mathematics in this period by following the travels of José Luis Massera of Uruguay, Leopoldo Nachbin of Brazil, and Laurent Schwartz of France. The interlocking efforts of mathematicians and bureaucrats in universities, governments, philanthropies, and new postwar formations like the United Nations Educational, Scientific and Cultural Organization to build mathematical institutions in Latin America operated with partial information, competing prerogatives, and costly exchanges of materials and personnel, each of which reflected the shifting economic and political constraints of the global Cold War. Drawing primarily on fellowship files and institutional archives, I situate these undertakings in the mechanics and ideals of twentieth-century scientific colonialism, development, and modernization. I explain how the seemingly nontechnical bases for such exchanges

*Princeton University, Program in History of Science, 108 Dickinson Hall, Princeton, NJ 08544. michael@mbarany.com. http://mbarany.com.

The following abbreviations and acronyms are used: AMS, American Mathematical Society Records, Ms. 75, John Hay Library, Brown University, Providence, Rhode Island; FBI, Federal Bureau of Investigation; IAS, Records of the Office of the Director, Shelby White and Leon Levy Archives Center, Institute for Advanced Study, Princeton, New Jersey; ICM, International Congress of Mathematicians; IMPA, Instituto de Matemática Pura e Aplicada, Rio de Janeiro, Brazil; IMU, International Mathematical Union; JLM, Archivo Privado José Luis Massera, Archivo General de la Universidad de la República, Montevideo, Uruguay; MSP, Marshall Stone Papers, A95-32, John Hay Library, Brown University, Providence, Rhode Island; OIAA, Office of Inter-American Affairs; RF, Rockefeller Foundation Archives, Rockefeller Archive Center, Sleepy Hollow, New York; UNESCO, United Nations Educational, Scientific and Cultural Organization (used also to refer to the UNESCO Archive, Paris); UNESDOC, UNESCO online document and publication database.

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related to the specific mathematics being taught and researched by accounting for the particular success of Schwartz's theory of distributions in Latin America, which owed both to circumstantial coincidences and to a mixture of several of the theory's superficial, technical, and conceptual features. My analysis stresses the complex, ambivalent, but nonetheless consequential personal and institutional negotiations underwriting midcentury intercontinental mathematics while pointing to the importance of such phenomena for explaining the form and effects of the period's broader array of global scientific exchanges.

KEY WORDS: postwar mathematics, Cold War science, international exchanges, Latin American mathematics, mathematical institutions, UNESCO, Rockefeller Foundation, theory of distributions

INTRODUCTION

Few endeavors of the human intellect seem to move as freely as mathematics. Mathematical teaching and research are inexpensive in comparison with those of most sciences. Mathematical notions appear to translate easily across idioms and media, unimpeded and undistorted by politics or ideology. When Marshall Stone, the discipline's great globalizer in the first decades after World War 2, made the case in 1947 for a new International Mathematical Union (IMU), he acknowledged that it might have seemed superfluous.[1] "In mathematics," he averred, "in contrast with a number of other fields of science, there is little opportunity for cooperative enterprise." Unlike chemists or physicists (with their own prominent international organizations), Stone's mathematicians had "no serious problems of nomenclature," nor pressing need for special tables, large computation laboratories, or other expensive materials and equipment.[2] The things mathematicians did demand according to Stone—the ability to meet and travel, to publish and to translate new works—only reinforced his image of a transcendent discipline. Mathematics, for him, could be done by so many people in so many places that the sole point of an international organization was to help them to keep up with each other.

For most of its history, however, the sort of theoretical mathematics Stone had in mind—the subject of advanced university study and research, as

1. See Karen H. Parshall, "Marshall Stone and the Internationalization of the American Mathematical Research Community," *Bulletin of the American Mathematical Society* 46, no. 3 (2009): 459–82.

2. Extract of 19 Apr 1947 NRC-CISU minutes enclosed in Fleming to Dresden, 27 Aug 1947, AMS, Box 32, Folder 62.

distinct from the much broader assortment of activities and studies that might be deemed mathematical—has typically been confined to small cohorts of scholars interacting across narrow geographic ranges.[3] Historians have long recognized distinctive approaches to mathematics associated with particular regions, nations, or research schools, which reflect the limited circulation of mathematicians and their work in a variety of contexts. Recent characterizations of the widening reach of mathematics have explored how resources, relationships, and politics have shaped mathematical communities of different sizes and shapes.[4] These join a substantial literature on the history of the international and transnational organization of science.[5] Histories of the international reconfiguration of the sciences in the early Cold War, in particular, have tended to focus on resource-intensive and data-driven disciplines and undertakings whose material exigencies and ambitions often make their geographic and geopolitical scale seem inevitable, even if the

3. Stone's theory-oriented view of the mathematical enterprise was not the only widely held one in this period, but while some mathematicians would have pressed for greater investment in computation and related priorities, few would have objected to his emphasis on communication as the defining problem of international mathematics. See Amy Dahan Dalmedico, "An Image Conflict in Mathematics after 1945," in *Changing Images in Mathematics: From the French Revolution to the New Millennium*, ed. U. Bottazzini and A. Dahan Dalmedico (London: Routledge, 2001), 223–53. There are few systematic demographic (or even prosopographic) studies of mathematicians, possibly because their numbers are comparatively small. Two exceptions are Reviel Netz, "Greek Mathematicians: A Group Picture," in *Science and Mathematics in Ancient Greek Culture*, ed. C. J. Tuplin and T. E. Rihll (Oxford: Oxford University Press, 2002), 196–216; and Judy Green and Jeanne LaDuke, *Pioneering Women in American Mathematics: The Pre-1940 PhDs* (Providence, RI: American Mathematical Society, and London: London Mathematical Society, 2009).

4. See especially Karen H. Parshall and Adrian C. Rice, eds., *Mathematics Unbound: The Evolution of an International Mathematical Research Community, 1800–1945* (Providence, RI: American Mathematical Society, 2002). With the exception of Japan and China, "international mathematics" for the authors in Parshall and Rice's volume means mathematics in a European and later a Euro-American context. On mathematicians' international organization in the twentieth century, see Olli Lehto, *Mathematics Without Borders: A History of the International Mathematical Union* (New York: Springer, 1998). On geography, travel, and local coordination for a single large program of proof, see Alma Steingart, "A Group Theory of Group Theory," *Social Studies of Science* 42, no. 2 (2012): 185–213.

5. Three recent discussions are John Krige and Kai-Henrik Barth, "Introduction: Science, Technology, and International Affairs," *Osiris* 21 (2006): 1–21; Marwa Elshakry, "When Science Became Western: Historiographical Reflections," *Isis* 101, no. 1 (2010): 98–109; and Simone Turchetti, Néstor Herran, and Soraya Boudia, "Introduction: Have We Ever Been 'Transnational'? Towards a History of Science Across and Beyond Borders," *British Journal for the History of Science* 45, no. 3 (2012): 319–36, esp. 331.

messy mechanisms and contingencies of their realization remain significant targets for historical scrutiny.[6]

Mathematical research, by contrast, does not seem to depend intrinsically on large mobilizations of people and materials, nor does it appear in the historiography to be an indispensable adjunct to the well-studied iconic projects of Cold War international technoscience, with the mathematics of computing a partial exception. Yet, in precisely this period, mathematics did become appreciably more global, with its people, documents, and theories appearing to travel ever-greater distances with ever-greater ease. In the wake of the Second World War, mathematicians began to form institutions and research communities that were not just international but intercontinental. Such developments, moreover, were not just window-dressing—lofty talk grafted onto business as usual. Rather, intercontinental mathematics was possible only by virtue of fundamental transformations in mathematicians' studies, travel, and communication. This new scale for professional mathematics, in turn, reshaped the possibilities for mathematics as a discipline and as a body of knowledge.

I here account for the political and logistical achievement of such intercontinental mathematics in the mid-twentieth century by examining the postwar emergence of certain South American venues as important sites of elite mathematical research and training. This transformation in the geography of elite mathematics emerged from a confluence of coordinated efforts tied to universities, governments, philanthropies, and international organizations in North and South America and Europe. These institutions' shifting relationships, constrained resources, and partial access to information reinforced their

6. See, e.g., John Krige and Kai-Henrik Barth, eds., *Global Power Knowledge: Science and Technology in International Affairs, Osiris 21* (Chicago: University of Chicago Press, 2006), especially Alexis De Greiff, "The Politics of Noncooperation: The Boycott of the International Centre for Theoretical Physics," *Osiris* 21 (2006): 86–109, and Clark A. Miller, "'An Effective Instrument of Peace': Scientific Cooperation as an Instrument of U.S. Foreign Policy, 1938–1950," *Osiris* 21 (2006): 133–60; John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe* (Cambridge, MA: MIT Press, 2006); Paul Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, MA: MIT Press, 2010); Gabrielle Hecht, ed., *Entangled Geographies: Empire and Technopolitics in the Global Cold War* (Cambridge, MA: MIT Press, 2011), especially Donna Mehos and Suzanne Moon, "The Uses of Portability: Circulating Experts in the Technopolitics of Cold War and Decolonization," 43–74. Historians of theoretical physics and other theoretical sciences offer a closer comparison to mathematicians' situation, albeit reflecting somewhat different relationships to state interests and infrastructures; e.g., David Kaiser, *Drawing Theories Apart: the Dispersion of Feynman Diagrams in Postwar Physics* (Chicago: University of Chicago Press, 2005).

mutual dependence while complicating many aspects of their cooperation. I follow the course and effects of their efforts through the travels of three men, widely counted among their respective countries' leading young mathematicians in the late 1940s and 1950s: José Luis Massera of Uruguay, Leopoldo Nachbin of Brazil, and Laurent Schwartz of France. These mathematicians, two of whom (Massera and Schwartz) played leading roles in regional communist politics in the immediate aftermath of the Second World War, participated in a burgeoning international system of scientific and cultural exchange where one's politics—as well as one's age, gender, religion, and other markers of identity—could significantly shape where one traveled and what one did.

The varying goals and politics associated with scientific internationalism in this period are only part of this story. To appreciate the full scope and consequences of the transformation of mid-twentieth century mathematics, one must stress the distinction between internationalism as a project and international mathematics as a situated historical achievement. Mathematicians' will to share their enterprise across continents was hardly enough. Rather, a full account requires situating mathematics in the ample historiographies of scientific colonialism, development, and modernization from which it has been largely absent.[7] The features that make mathematics distinctive among the postwar sciences help to qualify and reorient prevailing understandings of the

7. E.g., Marcos Cueto, ed., *Missionaries of Science: The Rockefeller Foundation and Latin America* (Bloomington: Indiana University Press, 1994); Arturo Escobar, *Encountering Development: The Making and Unmaking of the Third World* (Princeton, NJ: Princeton University Press, 1995); Michael Adas, "Review: A Field Matures: Technology, Science, and Western Colonialism," *Technology and Culture* 38, no. 2 (1997): 478–87; James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998); Gyan Prakash, *Another Reason: Science and the Imagination of Modern India* (Princeton, NJ: Princeton University Press, 1999); Roy MacLeod, ed., *Nature and Empire: Science and the Colonial Enterprise, Osiris 15* (Chicago: University of Chicago Press, 2000); Warwick Anderson, "Introduction: Postcolonial Technoscience," *Social Studies of Science* 32, no. 5–6 (2002): 643–58; David C. Engerman, Nils Gilman, Mark H. Haefele, and Michael E. Latham, eds., *Staging Growth: Modernization, Development, and the Global Cold War* (Amherst: University of Massachusetts Press, 2003); Odd Arne Westad, *The Global Cold War: Third World Interventions and the Making of Our Times* (Cambridge: Cambridge University Press, 2005); David Ekbladh, *The Great American Mission: Modernization and the Construction of an American World Order* (Princeton, NJ: Princeton University Press, 2010); Michael E. Latham, *The Right Kind of Revolution: Modernization, Development, and U.S. Foreign Policy from the Cold War to the Present* (Ithaca, NY: Cornell University Press, 2011). A critical touchpoint for many historians of science is the Rostovian diffusionist model of George Basalla, "The Spread of Western Science," *Science* 156, no. 3775 (5 May 1967): 611–22. Scholars have emphasized the complex, interest-laden relations and rationales underwriting modern scientific institutions across the globe while situating accounts

methods and motives of Cold War actors in Latin America and beyond. Modern mathematics was not seen as a means to feed the masses, eradicate disease, or reform developing markets. Nor was it commonly represented as a paragon of cultural achievement or a beacon of political rectitude. Its presence and features across a variety of Cold War programs thus illuminate what their participants valued, assumed, and accomplished in ways that might otherwise be obscured by attention to higher-profile programmatic interests.

Mathematicians and their institutional supporters, in particular, depended far more on the assessment and circulation of people than of data, specimens, equipment, or even books and periodicals (although these latter were certainly important). For them, Cold War science was especially personal. Agents of the philanthropies, governments, and nongovernmental organizations that facilitated intercontinental mathematics were rarely connoisseurs of its forbiddingly abstract formalisms. Instead, they spurred the production and circulation of advanced mathematics by becoming connoisseurs of the producers and circulators themselves. Mathematicians' new and transformed cooperative enterprises in the period following Stone's remark reveal the far-reaching consequences of the deeply personal work that went into making a supposedly universal discipline span the globe.

COLONIAL MATHEMATICS

Addressing the mathematicians of forty-one nations at the opening of the 1950 International Congress of Mathematicians (ICM) in Cambridge, Massachusetts, the Congress's president Oswald Veblen referred to the interwar twilight of the "colonial period" of American mathematics.[8] The "coming of age of mathematics in the United States," as Veblen put it, was evident in the Americans' increasing intellectual autonomy, their increasing contributions of "important discoveries," their cultivation of new approaches, and their exchanges of overseas students and researchers "more and more on terms of

like Basalla's in the same intellectual, economic, and political contexts within which those institutions operated.

8. Oswald Veblen, "Opening Address of Professor Oswald Veblen," included in J. R. Kline, "Secretary's Report," in *Proceedings of the International Congress of Mathematicians, Cambridge, Massachusetts, U.S.A. 1950*, ed. Lawrence M. Graves, Paul A. Smith, Einar Hille, and Oscar Zariski (Providence, RI: American Mathematical Society, 1952), 121–45, on 124–25, quote on 124. For attendance figures, see Kline, "Secretary's Report," 135. Where the meaning is unambiguous, I will follow actors' use of the term "American" to refer to those based in the United States.

equality."[9] American mathematicians of Veblen's generation frequently credited their formation as an elite scholarly community to their apprenticeship in German institutions in the late nineteenth and early twentieth centuries, when Americans regularly completed their advanced mathematical training in German universities.[10] Veblen's Institute for Advanced Study in Princeton, New Jersey, founded in 1930, was routinely cast as an American replacement for the stimulation and formation Americans had found in Germany a "generation ago," before the Great War's turmoil and the ensuing disintegration of taken-for-granted international ties.[11] A later generation of mathematicians arriving from Germany between the World Wars brought more recent experiences of treasured German institutions to American shores.[12] Veblen's contemporaries took for granted the assumptions of a diffusionist model of development, whereby modern institutions came about through contact with those already established as modern and developed, with the nature of that contact the primary index of maturation. For Veblen, the Teutonic tutelage of American mathematics was an unalloyed good—a benevolent colonialism that nurtured American mathematics to maturity.

By 1950, the colonials had begun to become the colonists, at least in the particular form of scientific colonialism envisioned by Veblen. Following the war, new United States government programs built on existing philanthropy-centered infrastructures of international educational exchange in order to drive a dramatic increase in the number of foreign students and researchers in the country's universities, including a significant share of visitors from the developing world.[13] With respect to Latin America, such scientific and educational exchanges became part of the legacy of more than a century of economic,

9. Veblen, "Opening Address" (ref. 8), 124.

10. Parshall, "Marshall Stone" (ref. 1), 467. Karen H. Parshall and David E. Rowe, *The Emergence of the American Mathematical Research Community, 1876–1900: J. J. Sylvester, Felix Klein, and E. H. Moore* (Providence, RI: American Mathematical Society, 1994), chs. 4, 5, 10. As many historians have documented, such transatlantic (especially U.S.-German) ties were common across a wide range of disciplines, from history to physics.

11. Flexner to Keppel, 31 Oct 1936 and 22 Jan 1937, IAS, General Files, Box 12, Folder Carnegie Corporation.

12. See Reinhard Siegmund-Schultze, *Mathematicians Fleeing from Nazi Germany: Individual Fates and Global Impact* (Princeton, RI: Princeton University Press, 2008); Nathan Reingold, "Refugee Mathematicians in the United States of America, 1933–1941: Reception and Reaction," *Annals of Science* 38 (1981): 313–38; and Brittany Shields's essay in this volume.

13. Liping Bu, *Making the World Like Us: Education, Cultural Expansion, and the American Century* (Westport, CT: Praeger, 2003), esp. ch. 5; Paul A. Kramer, "Is the World Our Campus? International Students and U.S. Global Power in the Long Twentieth Century," *Diplomatic*

military, and political hegemony in the American hemisphere.[14] Although "colonial" historiography can be of mixed relevance to Latin American science, the term remains apt as an actors' category associated with frameworks oriented around migration and institution-building in higher education.[15] For mathematics, new postwar Pan-American ties were evident in the 1950 Congress's official delegations from universities and scientific societies of Argentina, Brazil, Chile, Colombia, Cuba, Mexico, Panama, Peru, Uruguay, and Venezuela.[16] Latin American mathematicians were also especially well represented in an organizing conference for the IMU that Stone held in conjunction with the ICM—of the nine countries outside of Northern, Western, and Southern Europe officially represented, four were from Latin America.[17]

Postwar American mathematicians' links to Latin American institutions emerged most directly from Franklin Roosevelt's interwar "good neighbor" policy of patronage and fraternity toward the region's countries. From the mid-

History 33, no. 5 (2009): 775–806; Margaret O'Mara, "The Uses of the Foreign Student," *Social Science History* 36, no. 4 (2012): 583–615.

14. See George C. Herring, *From Colony to Superpower: U.S. Foreign Relations Since 1776* (Oxford: Oxford University Press, 2008), esp. chs. 4, 9, 13–14.

15. See Eden Medina, Ivan da Costa Marques, and Christina Holmes, "Introduction: Beyond Imported Magic," in *Beyond Imported Magic: Essays on Science, Technology, and Society in Latin America*, ed. Medina, Marques, and Holmes (Cambridge: MIT Press, 2014), 1–23, on 4–5. Recent surveys of the historiography of science in Latin America include Michael Lemon and Eden Medina, "Technology in an Expanded Field: A Review of History of Technology Scholarship in Latin America in Selected English-Language Journals," in Medina et al., eds., *Beyond Imported Magic*; Stuart McCook, ed., "Focus: Global Currents in National Histories of Science: The 'Global Turn' and the History of Science in Latin America," *Isis* 104, no. 4 (2014): 773–817. On the varieties of imperialism, colonialism, and other economic, political, and cultural formations in the Americas, see Gilbert M. Joseph, Catherine C. LeGrand, and Ricardo D. Salvatore, eds., *Close Encounters of Empire: Writing the Cultural History of U.S.-Latin American Relations* (Durham, NC: Duke University Press, 1998).

16. Graves et al., *Proceedings* (ref. 8), 7–20. There is also a mathematician from Puerto Rico in the official membership.

17. J. R. Kline, "Report on the International Conference of Mathematicians, Columbia University, New York City, U.S.A., 27–29 August 1950," 1 Mar 1951, UNESCO File NS/84 (dated 28 May 1951) / UNESDOC 126553eb, 69. Represented countries Argentina, Brazil, and Uruguay were on Stone's 1943 itinerary, discussed below, and most of the Latin American delegates had either studied in the United States or had other dealings with the Rockefeller or Guggenheim Foundations or with UNESCO. Cuba was the fourth represented country. Mexico was notably not represented at Stone's conference. A total of twenty-two countries were formally represented, in addition to an official observer from Israel. The other non-European countries (as defined in the grant report to UNESCO) were India, Japan, Turkey, the United States, and Yugoslavia. On Stone and the IMU, for which he would become the inaugural president, see Parshall, "Marshall Stone" (ref. 1), 465–66, 471–77.

1930s, Harvard mathematician George Birkhoff joined other leading American men of science in touring the region, establishing contacts with local academics, and reporting on the conditions for science they encountered.[18] Government bureaus such as the Office of Inter-American Affairs (OIAA) joined private entities like the Rockefeller and John Simon Guggenheim foundations to underwrite such travels, and the institutional lines between these bodies were often blurred. While serving as an officer of both the Guggenheim Foundation and the OIAA, for instance, Henry Allen Moe helped orchestrate the Latin American travels of both George Birkhoff (in 1942) and Birkhoff's former student, Marshall Stone (in 1943).[19] Stone's influential post-voyage report for Moe (addressed to his OIAA Committee) made its way through the American Mathematical Society (AMS) and Mathematical Association of America's War Policy Committee, which Stone chaired, to the officers of the Rockefeller Foundation, which underwrote the War Policy Committee's activities. Annotations in the Rockefeller Foundation's copy of Stone's report show that it was attentively read by Harry Milton Miller, an assistant and later associate director of Rockefeller's Natural Sciences Division under Warren Weaver. Miller, in turn, was the prime mover behind his foundation's own interventions in Latin American mathematics.[20]

These closely connected American experts modeled their inter-American outreach on their understanding of its transatlantic predecessor. Young Latin American mathematicians would complete their studies in leading U.S. institutions, while leading U.S. scholars would travel to key regional centers in

18. Parshall, "Marshall Stone" (ref. 1), 464–67. Birkhoff was to have presided over the American-hosted International Congress of Mathematicians, originally planned for 1940. Veblen became its president-in-waiting after Birkhoff's death in 1944. On Birkhoff's travels in Latin America, see also Eduardo L. Ortiz, "La Política Interamericana de Roosevelt: George D. Birkhoff y la Inclusión de América Latina en las Redes Matemáticas Internacionales," *Saber y Tiempo: Revista de Historia de la Ciencia* 4, no. 15 (2003): 53–111, and 4, no. 16 (2003): 21–70. Cf. Olival Freire Jr. and Indianara Silva, "Diplomacy and Science in the Context of World War II: Arthur Compton's 1941 Trip to Brazil," authors' translation of their Portuguese article in *Revista Brasileira de História* 34, no. 67 (2014): 181–201, http://arxiv.org/abs/1407.6770 (accessed 29 Aug 2016). On the good neighbor policy in Brazil, see also Antonio Pedro Tota, *The Seduction of Brazil: The Americanization of Brazil during World War II*, trans. Lorena B. Ellis (Austin: University of Texas Press, 2009).

19. Parshall, "Marshall Stone" (ref. 1), 464–65.

20. Stone to Moe (copy), 13 Apr 1944, RF, Record Group 1.1, Series 200D, Box 127, Folder 1561. On Miller's Latin American interventions, see esp. Maria Gabriela S.M.C. Marinho, *Norte-americanos no Brasil: uma História da Fundação Rockefeller na Universidade de São Paulo, 1934–1952* (Bragança Paulista: Universidade São Francisco, 2001), ch. 4.

Latin America. Their movement between North and South was to form a virtuous circle: northern elites helped to identify prospective fellows and to prioritize southern institutional needs, while southern fellows built ties to northern institutions that helped them recruit future expert visitors and implement reforms at home. As they had before and during the war, American mathematicians also used their work with United States government agencies and leading philanthropies to cultivate relationships with influential bureaucrats and policymakers who might fund or otherwise facilitate their research at home and their travels abroad.[21]

United States foundations, and later the federal government, accounted for the largest concerted efforts to build Western mathematical institutions in Latin America from the 1930s onward, but they were not alone. On a more-or-less individual basis, short-term and long-term migrants from Spain, Italy, France, Germany, Poland, and the United States brought mathematical expertise, correspondence networks, institutional wherewithal, and collections of books and papers to a small set of cities and universities in Latin America in those early years. Interwar immigrants from Spain and Italy, including political and religious refugees, were particularly numerous and influential in establishing mathematical programs and libraries in South American metropoles. Spaniard Julio Rey Pastor, typically cast as the father of Argentine pure mathematics, joined others with established European reputations and the small class of home-grown elites (often of European or upper-class parentage) to reshape the engineering, technical, and in some cases arts and philosophy arms of South American higher education. Their efforts established a place for mathematics fashioned after its role in European scholarship and pedagogy.[22]

21. On interwar philanthropic relations, see Reinhard Siegmund-Schultze, *Rockefeller and the Internationalization of Mathematics Between the Two World Wars: Documents and Studies for the Social History of Mathematics in the 20th Century* (Basel: Birkhäuser, 2001). On wartime contacts and their postwar uses, see Michael J. Barany, "Remunerative Combinatorics: Mathematicians and their Sponsors in the Mid-Twentieth Century," in *Mathematical Cultures*, ed. Brendan Larvor (Cham: Springer, 2016), 329–46.

22. See Luis Santaló, with M. O. González, Godofredo García, and Rafael Laguardia, *Latin American Contribution to Scientific Progress: Mathematics* (Montevideo: UNESCO Science Cooperation Office for Latin America, 1951). This report was among the first mathematics projects of UNESCO's Science Cooperation Office for Latin America, discussed below. On Santaló, see Carlos Borches, "Luis Santaló: Geometra y Maestro" and "La Etapa Argentina de Santaló: Un Matemático de Dos Mundos," *La Ménsula* 15 (2012): 1–6. On Pastor, see Carlos Borches, "Rey Pastor y el Nacimiento de la Escuela Matemática Argentina," *La Ménsula* 17 (2013): 1–6. See also Thomas F. Glick, "Science and Society in Twentieth-Century Latin America," in *The Cambridge History of Latin America*, vol. 6: *1930 to the Present*, part 1: *Economy and Society*, ed.

Though the Latin American developments described here were principally driven by actors located in the Western hemisphere, and though the particular mathematics that took hold could be found in many parts of the developed world, Europe continued to figure crucially across the international discipline of mathematics. For U.S. mathematicians who had built a national discipline through direct exchanges with European counterparts, Europe's relevance generally went without saying. For Latin American actors, this orientation toward Europe was one part practical and two parts promissory.[23] U.S. and Latin American mathematicians alike presumed the relevance and importance of European actors and institutions for Latin American audiences and participants. Legitimate subjects of research and means of instruction and dissemination took European models, and this made it easier to exchange people and texts with European institutions and (perhaps more importantly) to expect to do so in the future. As in Europe, mathematics in Latin America was expected to subsist unevenly, with a handful of elite centers and a small cadre of men at the reins of institutional power judged according to their reputations in the disciplinary landscape of European mathematics.

By the end of the Second World War, there were two principal hubs of South American mathematics: a Spanish-speaking one centered around Buenos Aires and Montevideo, and a Portuguese-speaking one within Brazil

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Leslie Bethell (Cambridge: Cambridge University Press, 1995), 461–536, on 509–13. There is a considerable recent literature from Brazil (including several doctoral theses supervised by Ubiratan D'Ambrosio) on Brazilian mathematics and its institutional contexts in this period, e.g.: Circe Mary da Silva, "Politécnicos ou Matemáticos?" *História, Ciências, Saúde—Manguinhos* 13, no. 4 (2006): 891–908; Rogério Monteiro de Siqueira, "Enciclopedismo, Distinção Profissional e Modernidade nas Ciências Matemáticas Brasileiras (1808–1930)," *Revista Brasileira de História da Ciência* 7 (2014): 81–91; Oscar Abdounur and Adriana Cesar de Mattos, "The Introduction of the European University System in Brazil," in *The Globalization of Knowledge in History*, ed. Jürgen Renn (Berlin: Max Planck Research Library for the History and Development of Knowledge, 2012), 365–81; André Luís Mattedi Dias, "Engenheiros, Mulheres, Matemáticos: Interesses e Disputas na Profissionalização da Matemática na Bahia (1896–1968)" (PhD dissertation, Universidade de São Paulo, 2002); Plínio Zornoff Táboas, "Luigi Fantappiè: Influências na Matemática Brasileira. Um Estudo de História como Contribuição para a Educação Matemática" (EdD dissertation, Universidade Estadual Paulista, Rio Claro, 2005); Lucieli M. Trivizoli, "Intercâmbios Acadêmicos Matemáticos entre EUA e Brasil: Uma Globalização do Saber" (EdD dissertation, Universidade Estadual Paulista, Rio Claro, 2011). On the broader development of Brazilian science, a significant survey is Simon Schwartzman, *A Space for Science: The Development of the Scientific Community in Brazil* (State College: Pennsylvania State University Press, 1991).

23. Cf. Manu Goswami, "Imaginary Futures and Colonial Internationalisms," *American Historical Review* 117, no. 5 (2012): 1461–85.

orbiting São Paulo and Rio de Janeiro—with a range of centers of research and teaching scattered through the rest of the region connected to each, mostly according to language. A third arm of Latin American mathematics ran through Mexico and the Caribbean. The institutions of this latter group enjoyed closer integration with U.S. counterparts, and were regular waypoints for South American travelers in passage to and from the United States. Perhaps due to proximity, Mexican mathematicians were particularly well represented in U.S.-based regional efforts (such as those of the Rockefeller Foundation) but often left out of other projects conceived of as "Latin American." Conversely, Americans like Princeton's Solomon Lefschetz who maintained close ties to Mexican mathematicians were largely absent from inter-American undertakings directed farther south.

For mathematics, as for the sciences, a wide range of efforts spearheaded by U.S. foundations, Latin American universities and governments, and various individual actors provided the institutional, political, and practical basis for postwar programs on regional, continental, and hemispheric scales. Although direct U.S. government enterprises provided some of the greatest conduits for the circulation of people and resources, and the foundations that dominated interwar exchanges continued to play a significant role for mathematicians, many of the most visible postwar programs for mathematics flowed through the newly founded United Nations Educational, Scientific and Cultural Organization. Headquartered in Paris, UNESCO in its early years reflected a broad coalition of hegemonic interests centered around France, Britain, and the United States.[24] UNESCO's formal entry into the organization and development of Latin American science began with a resolution at the organization's second General Conference, in Mexico City in December of 1947. The organization's Science Cooperation Office for Latin America, based from 1949 in Montevideo, Uruguay, coordinated scientific planning and funding across numerous disciplines and institutions.[25] The office sponsored conferences,

24. William R. Pendergast, "UNESCO and French Cultural Relations 1945–1970," *International Organization* 30, no. 3 (1976): 453–83. Pendergast notes, in particular, French Foreign Ministry targets for cultural influence through technical assistance in Latin America from 1957 (on 469–70). Cf. Ekbladh, *Great American Mission* (ref. 7), 85, on the Tennessee Valley Authority and American New Dealism as a model for Julian Huxley's early direction of UNESCO development programs.

25. Patrick Petitjean, "Crossing Borders: Contributing to the development of science in Latin America," in *Sixty Years of Science at UNESCO 1945–2005*, ed. Patrick Petitjean, Vladimir Zharov, Gisbert Glaser, Jacques Richardson, Bruno de Padirac, and Gail Archibald (Paris: UNESCO, 2006), 71–72. The office was established in consultation with the Rockefeller

workshops, courses, and exchange programs, and coordinated visits by European and American mathematicians to Latin America to provide advanced training, stimulate research, and suggest institutional reforms.

In large part, mid-century mathematicians were beneficiaries of broader undertakings linked to an assortment of political and economic interests. As members of academic scientific communities, they had the personal connections and institutional means to join in varyingly posed projects of scientific exchange and uplift. At an organizational level, the differences between mathematical and other scientific efforts can be hard to detect apart from the obvious disparities in considerations related to material resources or access to field sites. Mathematics-specific developments and their historiographical implications are most visible at the level of individual negotiations, voyages, and institutional arrangements.

CERTAIN INCLINATIONS

No amount of organization, aspiration, or sponsorship could diminish a basic exigency with which administrators grappled continuously: fellowships needed fellows. Identifying the most promising fellowship candidates could be a daunting task, one ill-matched to the often limited technical expertise of the cultural attachés and other diplomats and bureaucrats on whom program administrators often relied for other aspects of local information.[26] Those like the Rockefeller Foundation's Harry Miller made every trip to the region into an opportunity to scout for possible fellows and to cultivate local contacts who might recommend fellows thereafter.[27] Program administrators' interlocking networks of trusted informants helped them make effective assessments

Foundation, International Labour Organization, and Smithsonian Institution, among a number of non-governmental organizations. For a broader analysis of UNESCO's vision of scientific internationalism, see Perrin Selcer, "Patterns of Science: Developing Knowledge for a World Community at Unesco" (PhD dissertation, University of Pennsylvania, 2011, UMI No. 3463035). Cf. Marcos Chor Maio, "O Projecto UNESCO e a Agenda das Ciências Sociais no Brasil dos Anos 40 e 50," *Revista Brasileira de Ciências Sociais* 14, no. 41 (1999): 141–58, on the particular role of race, anthropology, and the social sciences, all construed in internationalist terms, in UNESCO's early interventions in Brazil.

26. See Stone to Moe, 13 Apr 1944, RF (ref. 20), 3. Miller professed that he was "certainly in no position to judge on the technical side" specific aspects of Massera's fellowship, discussed below, in Miller to Massera, 16 Apr 1947, JLM, Folder 5A.

27. On Rockefeller officers' cultivation of contacts and deliberate use of travel in personal assessment, see Krige, *American Hegemony* (ref. 6), 78–79.

without comprehensive understandings of the people, places, or subject matter being assessed.

Some guiding assumptions helped narrow the field. Fellows had to be young, so as to be open to new approaches and to have time to foster durable institutions on their return.[28] Their ties to American institutions were to keep them apprised of their field, connect them to outlets for their research, and store them with intellectual stimulation that could sustain them through the drudgery of building national and regional mathematics communities.[29] Notwithstanding the prominence of such figures as Emmy Noether (a leading German mathematician, well known in the U.S., who died in 1935) or Mary Cartwright (already a fellow of the Royal Society in 1947), the present and future leaders of mathematics were simply presumed to be male. In addition to these motives, which were broadly shared across development-oriented programs in this period, such emphases on youth and masculinity reflected a somewhat older tradition of locating mathematical promise in the virile vigor of young men, whose supposed special capacity for genius and exertion made them the privileged vessels of mathematical innovation.[30]

One of Miller's contacts, Walter S. Hill, of the Faculty of Engineering in Montevideo, wrote to Miller in May, 1944, to recommend "a young man of exceptional talent and background" who might benefit from further training in the United States.[31] That young man, José Luis Massera, had already caught Stone's attention during the latter's visit to Montevideo the previous summer.

28. E.g., Miller to Dreyfus, 13 Jan 1945, and Miller to Hayes, 19 Dec 1944, RF, Record Group 10.1, Series 305E, Box 20, Folder Omar Catunda. In both letters Miller expressed reservations about the advanced age (35) of an applicant who was not in a position to depart immediately. On "identifying" purportedly "politically neutral" foreign leaders as a long-standing prerogative of U.S.-based educational exchange programs, cf. Kramer, "World Our Campus" (ref. 13), 779.

29. These latter rationales and assumptions are detailed, e.g., in Flexner to Keppel, 31 Oct 1936, IAS (ref. 11).

30. See Andrew Warwick, *Masters of Theory: Cambridge and the Rise of Mathematical Physics* (Chicago: University of Chicago Press, 2003), ch. 4; Amir Alexander, *Duel at Dawn: Heroes, Martyrs, and the Rise of Modern Mathematics* (Cambridge, MA: Harvard University Press, 2010). I here suggest a later and more gradual periodization for the particular fixation on youth often associated with mathematicians than do Warwick or Alexander. The well-known age limit for the prestigious Fields Medal, for instance, came about only after the period considered here, through a process involving many figures involved in the international exchanges considered here or in other related projects.

31. Excerpt of W. S. Hill to H. M. Miller, 15 May 1944, RF, Record Group 10.1, Series 337E, Box 56, Folder José Luis Massera. A copy of the entire letter, in Spanish, is included in Massera's own records related to his Rockefeller fellowship in JLM (ref. 26).

Stone had relayed to Moe in his April, 1944, report on his travels that Massera was young ("under forty") and showed a promising combination of interests, training, and judgment that would help him "make a real contribution to mathematical and scientific development" in Uruguay.[32] Born in Italy to Uruguayan parents, Massera was trained as an engineer in Uruguay by a small corps of European mathematicians who visited periodically from Buenos Aires, including Italian Jewish emigrant Beppo Levi, who supervised some of Massera's first mathematical research. Upon Hill's recommendation, Miller wrote to his other Uruguayan contacts to assess Massera's eligibility for a fellowship, inquiring after his employment status, family situation, research record, physical health, personal qualities, and other involvements. At the same time, Miller turned to a parallel cadre of contacts at elite American universities to negotiate terms for a suitable placement. In just over six months, by the end of November, 1944, Massera was awaiting a visa to embark on a year's fellowship at Stanford University.[33]

Miller, as a program officer of the Rockefeller Foundation, had to be adept at negotiating fruitful alliances without a thoroughgoing familiarity with any of the parties so joined. Official letters of support, informal remarks in person and in writing, application paperwork, and other sources of information could tell Miller most of what he needed to know to guide prospective fellows through the appropriate academic and governmental bureaucracies. When these sources failed him, as sometimes they did, he had to be equally adept at renegotiating accommodations that could maintain his foundation's prerogatives in the face of inopportune surprises. Massera's Italian birth presented one easily solved complication: until the United States concluded a peace treaty with Italy, Massera would be unable to pass through the Panama Canal and would instead travel to Stanford by way of the U.S. East Coast.[34] A different difficulty, one Miller had not quite appreciated on the basis of his initial intelligencing, would put Massera's fellowship severely in doubt.

32. Stone to Moe, 13 Apr 1944, RF (ref. 20), 6. Stone assessed Massera in conjunction with Massera's colleague Rafael Laguardia, who (as Hill also noted) was then visiting Harvard on his own fellowship, having impressed Birkhoff on the latter's 1942 visit. Miller's annotations about Laguardia, but not Massera, suggest that he read Hill's and Stone's reports within a few months of each other.

33. See 1944 correspondence in RF (ref. 31).

34. Massera to Wells, 26 Feb 1947, JLM (ref. 26). Massera initially projected to Miller that he would travel through New York, but FBI records indicate he ultimately traveled instead via Miami. Memos of 12 May and 2 Jun 1947, FBI Headquarters File 100-HQ-341838, Section 01.

Early on, Massera's colleague Rafael Laguardia had advised Miller of "a certain inclination for politics," and Massera himself reported that he was Secretary General "of an important institution which is aiding the allies"—the Acción Antinazi de Ayuda a los Pueblos Libres organization.[35] It was only later that Miller learned that Massera was a fast-rising member of the Uruguayan Communist Party.[36] The fact itself did not appear to bother Miller, but neither was it lost on him that this would complicate Massera's entry into the United States. Massera was not the only Rockefeller fellow in this period whose file was peppered with notations about Communist politics, though he was surely the most politically active such fellow among the mathematicians.[37] Through his contacts in the region, Miller sought consular assurances over Massera's prospects. By January, Rockefeller officials were confident enough to joke in letters amongst themselves that Massera "will probably try to convert the people at Stanford."[38] Massera later shared this humor in a letter to his prospective Stanford supervisor expressing his disappointment at the "anti-democratic" roadblock to his voyage: "I am a Communist and . . . [m]aybe [the State Department] think that I was going to organize the Social Revolution at Stanford University."[39]

For U.S. authorities, Massera's politics were no laughing matter. "Massera allegedly has the intelligence and training to understand atomic bomb formulas if available," wrote one FBI analyst at a later point in Massera's case, and the Bureau noted every possible contact with American nuclear physics.[40] In

35. Massera to Miller, 15 Jun 1944, and Laguardia to Miller, 2 Jul 1944, RF (ref. 31). The organization's name (which does not appear in the Rockefeller dossier) is from a biographical sketch in JLM, Folder 11B. An accompanying translation gives the name: Antifascist National Action of Solidarity Towards the Free Peoples.

36. Massera joined the Partida Communista de Uruguay in 1942, was elected to its Central Committee in 1950, and joined its Executive Committee in 1955. For more on Massera's political and scientific lives (and their intersections), see Vania Markarian, ed., *Un Pensamiento Libre: Cartas de José Luis Massera* (Montevideo: Archivo General, Universidad de la República, 2005); Roberto Markarian and Ernesto Mordecki, eds., *José Luis Massera, Ciencia y Compromiso Social* (Montevideo: Pedeciba, 2010); Vania Markarian, "José Luis Massera, Matemático Uruguayo: Un Intelectual Comunista en Tiempos de Guerra Fría," *Políticas de la Memoria* 15 (Summer 2014–2015): 215–24.

37. Cf. RF (ref. 28), esp. Miller diary, 11–15 and 18 Oct 1950.

38. Hackett to Miller, 23 Jan 1945, RF (ref. 31). An assurance from the U.S. Consulate in Montevideo is recorded in Sparks to Rockefeller Foundation, 4 Jan 1945, RF (ref. 31).

39. Massera to Szegö, 7 Jan 1946, JLM (ref. 26). FBI analyst Donald L. Allen excerpted from this letter in his report of 11 May 1948, FBI Headquarters File 100-HQ-341838, Section 02.

40. Memo, 4 Mar 1947, and Report of Charles G. Campbell, 21 Aug 1947, FBI (ref. 34). On the problematic and consequential notion that atomic bombs could be expropriated on the basis

March, 1945, Massera's visa was denied, and Miller began to work through the Foundation's contacts with U.S. immigration authorities, the office of the Attorney General, and the State Department, while expressing a greater pessimism to Rockefeller colleagues. In October, 1946, Miller learned that Massera was running for the Uruguayan Congress, though unlikely to win a seat. Angst at the embassy led Miller to muse about the possibility of awarding Massera a fellowship to go to Russia, instead.[41] By January, 1947, however, he learned that a visa could be granted (though the FBI recorded that this was over the protests of the American Ambassador to Uruguay), and by March Massera was off to California.[42]

The surprises and adaptations did not stop there, however. Miller's confidant in the Rockefeller Foundation's International Health Division in Buenos Aires, in addition to helping Miller with local negotiations over Massera's visa, had at an early stage suggested Massera might be well suited to a stay at Stanford or Princeton, or perhaps even to splitting his fellowship between the two institutions. Miller encouraged Massera to consult with several contacts, particularly Alberto González Domínguez of Buenos Aires, to explore his possibilities for placement further. González Domínguez pointed Massera to Stanford University's Gábor Szegö and two of Szegö's colleagues, a suggestion whose pertinence Massera confirmed by tallying the institutional affiliations of everyone whose papers were indexed under "functions of a complex variable" or "differential equations" in the 1941 and 1943 editions of *Mathematical Reviews*, a review journal founded by the AMS and underwritten by the Rockefeller Foundation and Carnegie Corporation in 1940.[43] Massera also estimated that Stanford's proximity to Los Angeles and the California Institute of Technology would still further increase the value of a stay in Stanford, although Miller annotated that particular claim with a "sic!" in his translated copy of Massera's proposal.[44]

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of secret formulas, see David Kaiser, "The Atomic Secret in Red Hands? American Suspicions of Theoretical Physicists During the Early Cold War," *Representations* 90 (2005): 28–60.

41. Miller diary, Montevideo, 23–26 Oct 1946, RF (ref. 31). Typical of men in his position in this period, Miller used the word "Russia" as a catch-all for the much wider range of places and institutions under Soviet influence. The initial visa denial was communicated to Miller in a confidential letter Pierson to "Dusty" [Miller], 7 Mar 1945, RF (ref. 31).

42. Caldwell to Miller, 8 Jan 1947, RF (ref. 31). Memo, 4 Apr 1947, FBI (ref. 34).

43. See Reinhard Siegmund-Schultze, "'Scientific Control' in Mathematical Reviewing and German–U.S.-American Relations between the Two World Wars," *Historia Mathematica* 21 (1994): 306–29.

44. Massera to Miller, 30 Nov 1944, RF (ref. 31). The two institutions are separated by more than 350 miles.

Massera and Miller both wrote directly to Szegö, who wondered in his reply to Miller whether Massera's interests were as well aligned with his own as was supposed, but who nevertheless assured both correspondents that Massera would be welcome at Stanford.[45] Miller, eager to set the fellowship in motion, was sufficiently satisfied to approve the destination. Upon meeting, however, Szegö and Massera were mutually disappointed. Szegö worried to Miller that, although Massera was an able mathematician, his command of the relevant literature was significantly impaired by his lack of access to recent journals in Montevideo.[46] Massera, for his part, found Szegö an outstanding mathematician but also one much too busy to provide the sort of mentorship Massera desired.[47] By September, Massera had sought and received approval to transfer his fellowship to the East Coast, where he was based at Richard Courant's institute at New York University but commuted by train for part of each week to study at Princeton University under Solomon Lefschetz. He greatly impressed both men, but found the latter's seminar more conducive to his studies than the former's intensely focused research group.[48]

In a move not uncommon for fellows whose geographic remove (and in Massera's case, political activity) made further U.S. travel in the near future unlikely, Massera arranged to delay his return to Uruguay until after an American Society of Engineering Education meeting in June, 1948.[49] When Miller next saw him that October, Massera had just completed a short stay in prison.[50] The next the Foundation heard from him was the following March, by way of a clipping from a communist periodical where Massera recounted the "Yankee Gestapo" actions against Edward Condon and railed against the "hypocritical blanket" of American "Freedom of Investigation."[51]

45. Szegö to Massera (Massera's copy), 17 Oct 1944; Massera to Miller, 30 Oct 1944; Miller to Massera, 14 Dec 1944, RF (ref. 31). JLM (ref. 26) contains further Massera-Szegö correspondence.

46. Miller diary, Stanford, 13–14 Jun 1947, RF (ref. 31).

47. Massera exit report, Sep 1948, RF (ref. 31).

48. Miller diary, 15 Sep 1947; GRP diary, 6 Oct 1947; Courant to Maggi, 10 Mar 1948; Massera exit report, Sep 1948, RF (ref. 31).

49. Miller diary, 1 Jun 1948, RF (ref. 31).

50. Miller did not record the reason for Massera's imprisonment, though it was likely political. Miller noted that "he will continue to engage in political activities (Communistic). He said that the overthrow of the U.S. Government is not the business of Uruguayans, that it is up to the Communists in the U.S.A.!" Miller diary, 13–15 Oct 1948, RF (ref. 31).

51. News clipping transmitted by Rivera to Miller, 11 Mar 1949, RF (ref. 31). On the Condon affair, see Jessica Wang, "Science, Security, and the Cold War: The Case of E. U. Condon," *Isis* 83, no. 2 (1992): 238–69.

By the Rockefeller Foundation's standards, Massera's trip was a resounding success. Despite difficulties finding an appropriate placement using the partial information available to him (and the greater difficulties of migrating once the placement was approved), he had met and impressed several prominent mathematicians, sharpened his skills under the close guidance of a few of them, and forged lasting ties with American scholars and institutions. His work while a fellow led to several publications in leading American journals, including the *Annals of Mathematics* edited by Lefschetz, and he continued to maintain scholarly ties to the United States thereafter.[52] For instance, his command of Russian (a skill he pursued out of political conviction) put him in demand as a reviewer for *Mathematical Reviews*, and in this and other capacities he helped link mathematicians across the Iron Curtain.[53] These broad international ties would make him a cause célèbre some three decades later, when an international group of left-leaning mathematicians (led in part by Laurent Schwartz, discussed below) agitated for his release from an extended political imprisonment in Uruguay.[54]

Stepping beyond the Rockefeller Foundation's perspective, the fallout from Massera's visit looks more mixed. Visa troubles extending from his Rockefeller-related negotiations prevented Massera's intended attendance at the 1950 ICM.[55] While he was in the United States, government agents followed his movements, intercepted his mail, investigated the Russian-born Lefschetz, and interviewed Szegö, Miller, and others, though his FBI file reflects uncertainty over some of his whereabouts and activities.[56] Although atomic secrets motivated some of their early concerns regarding Massera, the

52. J. L. Massera, "The Number of Subharmonic Solutions of Non-linear Differential Equations of the Second Order," *Annals of Mathematics* 50, no. 2 (1949): 118–29. Massera, "On Liapounoff's Conditions of Stability," *Annals of Mathematics* 50, no. 2 (1949): 705–21.

53. Massera is credited with more than 200 reviews in the MathSciNet database of *Mathematical Reviews* entries, and Russian-language articles account, e.g., for fifteen of his first sixteen reviews (those of works published by 1950). For Massera's mediation of early Soviet outreach from the new International Mathematical Union, see Massera to Topchiev, 31 Jan 1955, JLM (ref. 26).

54. On Massera's imprisonment (from 1975 to 1984), see Markarian, *Un Pensamiento Libre* (ref. 36); Markarian and Mordecki, *José Luis Massera* (ref. 36); Reuben Hersh and Vera John-Steiner, *Loving and Hating Mathematics: Challenging the Myths of Mathematical Life* (Princeton, NJ: Princeton University Press, 2010), ch. 3.

55. Courant, 8 Mar 1950, Massera to Stone, 22 Jul 1950, Massera to Kline, 4 Aug 1950, and Kline to Massera, 16 Oct 1950, JLM (ref. 26).

56. E.g., Szegö to Massera, 18 Feb 1948, JLM (ref. 26); Memo, 8 Apr 1947, and Report of Charles G. Campbell, 21 Aug 1947, FBI (ref. 34); Reports of Donald L. Allen, 11 May 1948, and Alfred B. Novak, 5. Jun 1948, FBI (ref. 39). A memo of 18 Apr 1947 claims Massera was at MIT at

FBI was ultimately most preoccupied by his more conventional political interests and his potential as a propagandist. Viewed from 1945 or 1946, his Communism could be amusing or annoying. By 1948 it was even alarming to some, but for key scientific sponsors his youth and mathematical promise won the day.[57] In the rapidly shifting political environment of the early Cold War, small shifts in time, place, and perspective could have outsized effects on mathematicians' travel, and consequently on the forms of their engagement in an international community.[58] Though Massera and Miller tried to drive a wedge between the former's intercontinental mathematics and his local politics, different views and effects of his politics across institutions and continents remained decisive for his mathematical itinerary before, during, and after his Rockefeller fellowship.

A FRENCH CONNECTION

Visiting New York University in the spring of 1948, Massera was likely among the first from his continent to learn of a recent development in the theory of differential equations put forward by the young French mathematician Laurent Schwartz. The development was Schwartz's theory of distributions, and its prophet that Spring was the pre-eminent Danish mathematician Harald Bohr, younger brother of the famous physicist Niels. The younger Bohr was an active participant in the efforts of Stone and others to reestablish international

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the start of his fellowship. In Palo Alto, the FBI cultivated informants in Massera's department and residence. The initial report on Lefschetz is by John H. Lupton, 5 Mar 1948, FBI (ref. 39).

57. The FBI recorded that he was received as "That important man from Uruguay" at the San Francisco headquarters of the Communist Party; Memo, 15 Sep 1947, FBI (ref. 34). Massera's correspondence from the period indicates that he followed American politics, and the FBI came to the same conclusion in its examinations of his letters and news clippings in his personal notebook. Analysts worried that he was spreading anti-U.S. propaganda back home. Infrequent political observations pepper the correspondence in JLM, Folders 26A and 26C. Neither Louis Nirenberg (Massera's NYU office mate) nor Peter Lax recalled in interviews that Massera's politics were particularly obvious while he was at NYU. Their impressions match those of Paul Halmos when interacting with Massera in Montevideo: "From personal observation I wouldnt [*sic*] know that Massera is a communist. . . . He is a remarkably pleasant almost placid type and he certainly doesn't do anything like going around and spreading propaganda among students at the institute. Just the opposite: as far as I can tell from external observation he is the only one at the institute who really works." Halmos to Stone, 15 Oct 1951, MSP, Box 38, Folder 15.

58. On the early Cold War's effects on American scientists, with particular attention to such uneven and changing contexts, see Jessica Wang, *American Science in an Age of Anxiety: Scientists, Anticommunism, and the Cold War* (Chapel Hill: University of North Carolina Press, 1999).

mathematical institutions after the Second World War.[59] He first encountered Schwartz and his theory at a 1947 international colloquium sponsored by the Rockefeller Foundation in Nancy, France, where Schwartz had recently taken a faculty position.[60]

Schwartz initially presented distributions as a way to "rehabilitate" an "abuse of language" underwriting a widely used method in mathematical physics.[61] Schwartz offered a formal mathematical justification for this method based on generalizations of the concepts of functions and derivatives. Since the advent of the calculus, these two fundamental terms have been repeatedly redefined by reformers of various stripes to justify or rule out different means of mathematical argument.[62] Distributions (Schwartz's substitute for functions) and their derivatives replaced a calculus developed around theories of sets with a corresponding one centered on the related theory of topological vector spaces. Emphasizing the theory's close associations with a variety of familiar techniques and frameworks, Schwartz and his advocates promoted a view of the theory as especially perspicuous and useful while simultaneously at the forefront of mathematical scholarship.

Following the Nancy colloquium, Bohr and his colleague Børge Jessen invited Schwartz to lecture on his theory in Copenhagen in what Schwartz would later characterize as his first major academic voyage.[63] While Bohr hosted Schwartz, he received an invitation from Richard Courant and Oswald

59. See, e.g., the Stone-Bohr correspondence in AMS, Box 32, Folder 63.

60. On the Nancy colloquium and the Bohr connection, see Colloques Internationaux du Centre National de la Recherche Scientifique, *Analyse Harmonique: Nancy, 15–22 Juin 1947* (Paris: CNRS/Gauthier-Villars, 1949); Laurent Schwartz, *Un Mathématicien aux Prises avec le Siècle* (Paris: Odile Jacob, 1997), 253, 309 (Schwartz's autobiography appears in English as Laurent Schwartz, *A Mathematician Grappling with His Century*, trans. Leila Schneps [Basel: Birkhäuser, 2001]); Anne-Sandrine Paumier, "Laurent Schwartz (1915–2002) et la vie collective des mathématiques" (PhD dissertation, Université Pierre et Marie Curie, Paris 2014), ch. 3; Anne-Sandrine Paumier "Laurent Schwartz (1915–2002) et le colloque d'analyse harmonique de Nancy, 15–22 juin 1947," *Gazette des Mathématiciens* 147 (2016): 39–51; Anne-Sandrine Paumier, Michael J. Barany, and Jesper Lützen, "From Nancy to Copenhagen to the World: The internationalization of Laurent Schwartz and his theory of distributions" (in preparation).

61. Laurent Schwartz, "Généralisation de la Notion de Fonction, de Dérivation, de Transformation de Fourier et Applications Mathématiques et Physiques," *Annales de l'Université de Grenoble* 21 (1945): 57–74, on 57–58. See Michael J. Barany, "Integration by Parts: Wordplay, Abuses of Language, and an Intercontinental Mathematical Theory in the Early Cold War," in revision for the *British Journal for the History of Science*.

62. An account of this history culminating in Schwartz's theory is Jesper Lützen, *The Prehistory of the Theory of Distributions* (New York: Springer, 1982).

63. Schwartz, *Mathématicien aux Prises* (ref. 60), 309.

Veblen to visit the United States early in the following year. Charmed in equal parts by Schwartz's theory and "his most sympathetic and inspiring personality," Bohr accepted the East Coast grandees' invitation with an indication that he might lecture on "the generalization of the notion of differentiability of Laurent Schwartz."[64]

Schwartz, for his part, was part of a close-knit and bold band of what one skeptical American termed "the self-appointed group of young French geniuses" trying to rewrite the foundations of mathematics under the collective pseudonym Nicolas Bourbaki.[65] Bohr, more sympathetically, would herald "the group of most promising and closely collaborating young French mathematicians who secure for French mathematics in the years to come a position worthy of its illustrious traditions."[66] The collaborators of Bourbaki, as the group's members called themselves, included several men who made extended trips to South America (especially Brazil) in the early postwar years, with Schwartz himself among the Bourbaki globetrotters. Bourbaki's earliest representative in South America was André Weil, a beneficiary of the Rockefeller Foundation's efforts to situate French mathematicians displaced by the Second World War, who remained in the American hemisphere to teach in São Paulo from 1945 to 1947 and was hired by Stone at the University of Chicago immediately thereafter.[67]

Weil was joined in São Paulo in 1945 by geometer Oscar Zariski, whose added presence dissuaded the Rockefeller Foundation from sending at least one São Paulo mathematician slated for a fellowship northward "at the very moment when the Mathematics Department here has been temporarily

64. Bohr to Courant, 1 Nov 1947, and Courant to Bohr, 27 Oct 1947, New York University Archives, Richard Courant Papers, Box 30, Folder 15. Peter Lax (interview with author, New York, Mar 2014) recalls Bohr introducing Courant's group to distributions on that visit.

65. Morse to Oppenheimer, 16 Nov 1949, IAS, Member Files, Box 85, Folder Jean Leray. On Bourbaki, see Liliane Beaulieu, "Bourbaki: Une Histoire du Groupe de Mathématiciens Français et de ses Travaux (1934–1944)" (PhD dissertation, Université de Montréal, 1989); Maurice Mashaal, *Bourbaki: Une Société Secrète de Mathématiciens* (Paris: Éditions Pour la Science, 2002); Leo Corry, "Writing the Ultimate Mathematical Textbook: Nicolas Bourbaki's *Élements de Mathématique*," in *The Oxford Handbook of the History of Mathematics*, ed. Eleanor Robson and Jacqueline Stedall (Oxford: Oxford University Press, 2009), 565–88.

66. Harald Bohr, "Address of Professor Harald Bohr," in Kline, "Secretary's Report" (ref. 8), 127–34, quote on 130.

67. See Rute da Cunha Pires, "A Presença de Nicolas Bourbaki na Universidade de São Paulo" (EdD dissertation, Pontificia Universidade Católica de São Paulo, 2006). On French academic influences in the University of São Paulo, see Marinho, *Norte-americanos no Brasil* (ref. 20), 43–47.

strengthened by the addittion [*sic*] of two ~~foreign~~ [*sic*] competent mathematicians."[68] The next year, Bourbaki collaborator Jean Dieudonné began his own two-year appointment in São Paulo. These itineraries, along with Bohr's, attest to a general principle about North American and European mathematics in Latin America: French, American, and other mathematicians (and their theories) reached the region by many routes, and few such routes amounted to bilateral exchanges. Latin American mathematics emerged through its integration into intercontinental circuits of travel and communication that simultaneously shaped relationships among all their nodes. This was possible, in part, because moving mathematics often amounted primarily to moving people, whose itineraries were more directly governed by political and disciplinary formations and less governed by other desiderata affecting investments in scientific infrastructure.

By the end of the 1940s, the combined effects of wartime and early postwar American efforts with this broader circulation of (especially French) mathematicians and mathematics meant that a significant cohort of mathematicians in South America, by the end of the 1940s, leaned considerably more toward abstract theories and internationalist orientations than even many counterparts in the developed world.[69] When the ICM came to the United States in 1950, the young mathematicians to the south were keen and ready.

AN ATLANTIC TRIANGLE

After an official welcome, the first item on the program of the 1950 ICM was the presentation of two Fields Medals by the selection committee's chair, Harald Bohr.[70] His words and his presentation's prominent place in the program unambiguously signaled to those at the Congress that the medals' recipients bore notice for both their recent work and future promise.[71] Bohr's audience may have marked the special enthusiasm with which he heralded the

68. Zariski to Miller, 11 Jun 1945, RF (ref. 28).

69. There were, of course, many alternative visions of modern mathematics. See Leo Corry, "Introduction: The History of Modern Mathematics—Writing and Rewriting," *Science in Context* 17 (2004): 1–21.

70. On the Fields Medal in this period, see Michael J. Barany, "The Myth and the Medal," *Notices of the American Mathematical Society* 62, no. 1 (2015): 15–20, on 16–17.

71. Bohr, "Address" (ref. 66).

second medalist, Laurent Schwartz, and "the wide field he has opened for new researches" with this theory of distributions.[72]

Schwartz's own presentation at the Congress was singled out as a highlight of the Congress by AMS librarian and Swarthmore professor Arnold Dresden in his account to the Rockefeller Foundation's Warren Weaver.[73] It is reasonable to suppose that Dresden's view was shared by Alberto González Domínguez, an Argentine delegate to both the IMU and ICM meetings (and one of Massera's sources of information, noted above). Soon thereafter, González Domínguez began to pursue distributions in connection with quantum electrodynamics and presented on the topic at a 1951 regional mathematics symposium sponsored by UNESCO, the first symposium of its kind in South America.[74] Schwartz recounted years later that his own ties to Latin America resulted from the 1950 Congress in at least two ways. Most directly, the Congress launched him to international fame, so that his name frequently topped lists of those who might be invited abroad. But most exciting, young, West European mathematicians of this period spent most of their transatlantic travels in the United States, not Latin America. Hence the importance of the Congress's second effect, which was to advertise his status as an unwelcome visitor in the eyes of the U.S. State Department.[75]

In 1945 and 1946, Schwartz had campaigned as a candidate for the Trotskyist Party in local legislative elections in Grenoble, where he had worked under an assumed name (and met covertly with fellow Trotskyist activists) during the German occupation.[76] Though he had effectively left the Trotskyist Party by

72. Bohr, "Address" (ref. 66), 133. The other medalist was Atle Selberg, a Norwegian mathematician who had recently won a position at the Institute for Advanced Study in Princeton.

73. Excerpt from Weaver Diary, 7 Sep 1950, RF, Record Group 1.1, Series 200D, Box 125, Folder 1546.

74. Alberto González Domínguez, "Distribuciones y Funciones Analíticas," in *Symposium Sobre Algunos Problemas Matemáticos que se Están Estudiando en Latino América, Punta del Este 19–21 Diciembre 1951* (Montevideo: Centro de Cooperacion Cientifica de la UNESCO para America Latina, [1952?]). On the symposium's fortuitous organization, at the behest of Rafael Laguardia and Paul Halmos (in order to make the most of the latter's visit to Montevideo) and enabled by a small surplus in the annual budget of UNESCO's Latin America office and the administrative dexterity of its director Angel Establier, see Halmos to Stone, 15 Oct 1951, MSP (ref. 57).

75. Schwartz, *Mathématicien aux Prises* (ref. 60), 323–25.

76. Schwartz omitted from his autobiography that he was also a candidate in Grenoble for the Fourth International, at least according to an anonymous foreign (i.e., non-U.S.) FBI informant. Hoover to Neal, 26 Jan 1950, National Archives and Records Administration, RG 65, Box 5327, FBI Headquarters Case File 100-HQ-367305 re Laurent Schwartz 490/45/01/4.

1948, Schwartz made no secret of his leftist politics.[77] So it was not surprising that his first application to visit the United States (made to visit Princeton, New York, and Chicago in conjunction with his invitation to the Second Canadian Mathematical Congress, in August 1949) was denied. In 1949, in the midst of trying to rectify his visa situation, Schwartz was also invited as a prestigious "hour speaker" in Analysis for the ICM, and by the end of that year the Fields Medal committee had also reached its favorable decision on his count. It took the ICM's organizers a full year of inquiries and negotiations to secure Schwartz a visa to attend, and the process left considerable ill-feeling and mistrust.[78] Schwartz did not return to the United States for a decade after the Congress, and though the FBI dropped its opposition to Schwartz after the close of the Vietnam War, and his file ceased to grow after 1977, his visa status was not fully regularized until 1991.[79]

A rising star of French mathematics, eager to travel and do good but effectively barred from the United States, Schwartz's conscription as a technical expert for UNESCO was many times over-determined.[80] Under the auspices of its Technical Assistance program, UNESCO sent dozens of mathematical "experts" on "field missions" across the developing world beginning in the 1950s.[81] Schwartz returned from his two-and-a-half-month mission to Rio de

77. Schwartz, *Mathématicien aux Prises* (ref. 60), 272–78.

78. On the timing of the visa denial, the Canadian invitation, and the Fields Medal deliberations (with particular attention to Bohr's role in all three), see Paumier et al., "From Nancy to Copenhagen" (ref. 60). On the ICM's negotiations, see Wilder to Kline, 2 Dec 1949, and Kline to Wilder, 16 Dec 1949, AMS, Box 25, Folder 48; Wilder to Kline, 25 Aug 1949, AMS, Box 35, Folder 48; ICM Organizing Committee minutes, 29 Oct 1949, AMS, Box 37, Folder 56.

79. Schwartz, *Mathématicien aux Prises* (ref. 60), 319–25. Visa Action Request, 27 Sep 1977, and attached remarks, National Archives and Records Administration (ref. 76). Schwartz's retrospective assessment of his status in the eyes of U.S. authorities appears to have been strongly colored by his 1949–1950 experience and another clash over his application to enter the United States as an invited speaker at Berkeley's 1968 Centennial Week Celebration, during which he also planned to speak against the Vietnam War. Apart from these and his involvement with the 1967 Russell Tribunal that accused the United States of war crimes in Vietnam, he seems not to have bothered the FBI to any great degree.

80. Schwartz's UNESCO missions to Rio de Janeiro in 1952 and to Buenos Aires in 1958 are discussed below. Surviving UNESCO records for his missions are incomplete, but it is reasonable to suppose some UNESCO role in his 1953 trip to Mexico and his 1956 trip to Colombia, as well as at least some of his numerous other efforts in North Africa, South and Southeast Asia, and Latin America after 1952, attested in a variety of sources. His zeal for butterfly collecting only reinforced his appetite for tropical travel.

81. Field missions in areas other than mathematics began almost immediately after UNESCO was founded. Schwartz's 1952 mission is among the earliest I have located in advanced

Janeiro in October, 1952, with one of the more articulated visions of the UNESCO project for Latin American mathematics.[82] At first glance, he wrote in his mission report, Brazil seemed a rapidly developing nation of grand cities, albeit with frail transportation and communication networks and a backward countryside. But even in the metropoles, Schwartz diagnosed, universities were caught in a "vicious circle": the primary and secondary education on which universities relied was itself dependent on a robust university system to supply primary and secondary instructors. The universities were crippled by selfish and short-sighted organization, frail and time-consuming supporting infrastructures, and low and patchwork faculty remuneration. In response, Schwartz "tried through personal contacts to play the role of an expert proper and to have an influence on the moral development of the University, in general."

Schwartz's assessment was shared by his compatriot and fellow Bourbaki collaborator Charles Ehresmann, whose overlapping mission in Rio de Janeiro extended to December, 1952.[83] Like Schwartz, Ehresmann worried about the scale of the task of training a suitable corps of secondary teachers. Though he found local mathematicians' preparation for an advanced course related to his recent research wanting, he was nonetheless sure of his value in fostering "a favorable research climate" while there, and hoped to continue training and collaborating with some of the local faculty and students by post. He added that Brazil's industrialization and its corresponding investment in nuclear physics would require as an "indispensable tool" greater training in the most recent areas of mathematics, specifically mentioning his own field of topology and Schwartz's theory of distributions.[84]

Such pleas for the relevance of mathematics to development were not uncommon in expert reports. Mathematics was always a relatively small part of the granting programs of the major international organs invested in Latin America. In part, this reflected the relative scale of mathematics among the scientific disciplines in Latin America, North America, and Europe alike. In part,

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mathematics or related fields for any region, although UNESCO's indices for this period are not comprehensive.

82. Laurent Schwartz, Mission Report, 1952, UNESDOC 159434.

83. Charles Ehresmann, Mission Report, 1952, UNESDOC 159433.

84. On nuclear physics in the region, especially in Brazil and Argentina, see Glick, "Science and Society" (ref. 22), 498–504, 522–25; Diego Hurtado de Mendoza, "Autonomy, even Regional Hegemony: Argentina and the 'Hard Way' toward Its First Research Reactor (1945–1958)," *Science in Context* 18, no. 2 (2005): 285–308; Jonathan Hagood, "Bottling Atomic Energy: Technology, Politics, and the State in Peronist Argentina," in Medina et al., *Beyond Imported Magic* (ref. 15), 267–85.

it reflected assessments of the more pressing needs of recipient nations, with more resources being directed toward engineering and primary and secondary education.[85] In part, it was a matter of the interests of Western scientists in the region—there was more pressing demand for biological, medical, and anthropological projects more intrinsically tied to the local conditions of recipient nations. Fellows themselves occasionally joined the chorus of experts in pointing to the comparative lack of funding for such mathematical undertakings, while attempting to justify their own work under other, better-funded rubrics.[86]

These efforts at justification would seem to place a premium on the theoretical content of mathematicians' projects, but assessments of such content were instead typically confined to evaluations of the intellectual fit and suitability of host institutions for traveling fellows. Amalgamated across the fellowship programs as a whole, content-based considerations shaped the range of mathematical subjects pursued in the region according to the nominee fellows' intellectual contexts and the interests and assumptions of the administrators and established mathematicians who controlled access to funds and other forms of support. Those contexts were guided by the comparatively large role of engineering and applied mathematics in Latin American institutional infrastructures for mathematics, which favored fields at least adjacent to mathematical physics, engineering, and related areas.[87] On the other hand, the abstract mathematics pursued by mathematicians in the region strongly reflected the priorities of the particular European and American visitors who shaped curricula and libraries both directly and indirectly through their activities and mentorship. For postwar Brazil, as elsewhere in the region, this meant a preponderance of interest in differential equations, but shaped by the distinctive prerogatives of the Bourbaki collaborators and sympathizers who dominated the rosters of long-term visitors—an orientation that continues in Rio de Janeiro's Instituto de Matemática Pura e Aplicada (IMPA, discussed below) to this day.

85. Mathematics education was one such area receiving greater attention. However, although there was some overlap in personnel (particularly the person of Marshall Stone), efforts to promote post-secondary mathematics and varying domains of mathematics education were typically kept programmatically distinct. See Fulvia Furinghetti, "History of International Cooperation in Mathematics Education," in *Handbook on the History of Mathematics Education*, ed. Alexander Karp and Gert Schubring (New York: Springer, 2014), 543–64.

86. E.g., Nachbin to Miller, 18 Oct 1955, RF, Record Group 10.1, Series 305E, Box 51, Folder Elon Lages Lima.

87. See da Silva, "Politécnicos ou Matemáticos?" (ref. 22), and Glick, "Science and Society" (ref. 22), 492. Several of the above-cited reports on various Latin American sites discuss the comparative strength of theoretical physics research in the region.

Ehresmann's case for distributions as a basic tool for the advancement of nuclear physics in Latin America was already implicit in the 1951 presentation by González Domínguez at the UNESCO symposium, noted above. The same symposium featured presentations by Gustav Doetsch, an early West German promoter of distributions, and Leopoldo Nachbin, whose pursuit of distributions is considered below.[88] By the time of UNESCO's 1954 successor to that symposium, Schwartz's theory ranked among the region's best known and most pursued recent approaches to mathematics. At the 1954 meeting, the Hungarian-trained John Horváth, then of the University of the Andes in Bogotá, Colombia, presented early results in what would be a career-long engagement with the theory.[89] At that same conference, elder-statesman Julio Rey Pastor surveyed the state of modern mathematics in Latin America and devoted an entire section of his talk to the work of "los entusiastas de la teoría de Lorenzo Schwartz"—whose enthusiasm, it should be said, he found a touch ridiculous.[90] Dean of the enthusiasts was Roque Scarfiello, who had already attended Schwartz's popular Paris seminar. Pastor closed by mentioning the young Argentine emigré Alberto Calderón, whose work on singular integrals and other topics directly related to Schwartz's theory would make him one of the leading mathematicians of the postwar period. Distributions were exciting, modern, and (perhaps most importantly) amenable to limited programs of research on the basis of brief exposure abroad or occasional short interventions by foreign experts. Schwartz's theory, by the mid-1950s, was at once the leading evidence of the proliferation of modern mathematics in Latin America and among the chief emblems of the ideals and practicalities of the region's mathematical future.

STIMULATION ABROAD

UNESCO's Technical Assistance missions were premised on a hypothesis whose dubiousness rang loudly even in early reports from the program's earnest supporters like Schwartz and Ehresmann. The hypothesis stipulated that

88. Also present were Paul Halmos, who presented on the closely related topic of operators in Hilbert spaces, and Mischa Cotlar, who likewise worked on topics related to the theory.

89. See Norbert Ortner, "On Some Contributions of John Horváth to the Theory of Distributions," *Journal of Mathematical Analysis and Applications* 297 (2004): 353–83.

90. Julio Rey Pastor, "La Matemática Moderna en Latino América," in *Segundo Symposium sobre Algunos Problemas Matemáticos que se Están Estudiando en Latino America, Villavicencio-Mendoza 21–25 julio 1954* (Montevideo: Centro de Cooperacion Cientifica de la UNESCO para America Latina, [1954?]), 9–30, on 15–16.

it would be possible to build substantial domestic programs of research and higher education on the basis of visits of a few months by the most able foreign experts. Such visits, Schwartz countered, could at best offer an "aperitif de choc"—a brief and intense shock to the local culture through an infusion of new ideas and literature—for those prepared to benefit from these brief injections of foreign expertise.[91]

To be sure, visiting foreign experts did meaningfully connect mathematicians from developing regions to elite metropolitan centers, albeit not with the intensity and regularity of exchange for which their sponsors may have hoped. Tangibly, visitors brought books and papers (and the expertise to guide the acquisition of more of the same) to build up local mathematics libraries. Meanwhile, UNESCO experts in particular stayed just long enough to give courses at a variety of levels on modern subjects and to arrange for their course notes to be compiled, edited, and reproduced. In many cases, these represented the first Spanish- and Portuguese-language textbooks on their subjects, and they circulated widely.[92]

Several months' residence of trusted mathematicians and the institutional legwork and relationship-building required to support them also gave UNESCO a privileged source of information about whom best to send abroad for further training. Starting in the 1950s and accelerating in the early 1960s, UNESCO sent nearly two dozen Latin American fellows to study mathematics in Western Europe, the United States, the USSR, and later the increasingly present and established centers of mathematical research in Mexico, Argentina, and Brazil.[93] Drawing on the system of informants and regional organizers cultivated by the Rockefeller Foundation, among others, since the 1930s,

91. Schwartz, Mission Report (ref. 82).

92. Many such editions can be found in leading Western centers of research, such as the Institut Henri Poincaré in Paris, to which many French UNESCO mathematicians returned, and the Institute for Advanced Study in Princeton. My assessment here is based on a survey of more than two dozen files and reports for field missions in mathematics and closely related areas from the UNESCO archive in Paris. A significant share of the surviving paper trails for a number of UNESCO projects involves acquiring books and journals for students and for institutional libraries. Paul Halmos described a related arrangement for his U.S. State Department funded travel, which came with $150 that he used to import back volumes of several American mathematics journals; see Halmos to Stone, 15 Oct 1951, MSP (ref. 57).

93. These data come from a survey of UNESCO's directories of fellows, especially the *Directory of Unesco Fellows: Latin America and the Caribbean, 1948–1968* (ED/74/2), at the UNESCO archive in Paris, as well as UNESCO Box EDV/FE/44: Unesco Sponsored Programme / L.A.S.C./ 1962–1966.

UNESCO's fellowship programs more than filled the void left by the Rockefeller Foundation's gradual retreat from sponsoring mathematics by the end of the 1950s, in favor of other fields.[94]

Near the start of that decade, UNESCO and Rockefeller's interlocking networks of informants established a stable consensus regarding the most promising young mathematicians of the region. From Brazil, all seemed to agree that the future lay with Leopoldo Nachbin, identified in Schwartz's 1952 report as "by far the best mathematician of Brazil."[95] Nachbin's exceptional fluency in advanced mathematics was aided considerably by the two years he spent as a U.S. State Department fellow and then Guggenheim Foundation fellow at the University of Chicago, starting in 1948 and ending with a trip to the 1950 ICM. In Chicago, Marshall Stone had assembled one of the world's leading departments of mathematics, a department that included multiple professors like Weil with significant Latin American experience.[96] Between his stay in Chicago and the many (especially French) mathematicians with whom he crossed paths in Brazil, Nachbin was among the best-connected Latin American mathematicians to his discipline's international community, such as it was at mid-century.

In July, 1955, Nachbin wrote to Harry Miller to follow up an inquiry about his chances for a Rockefeller fellowship. Nachbin had just returned from the Annual Meeting of the Brazilian Association for the Advancement of Sciences, where he was enlisted "to give a lecture on advancements of Mathematics in Brazil, a task which at the same time is difficult because people not mentioned are usually offended, and easy because there is little Mathematics going on around here."[97] A founding member of the IMPA in Rio de Janeiro, Nachbin had spearheaded what many saw as the first genuinely international Brazilian mathematics journal, and in just the past year, his institute had hosted

94. On the Rockefeller Foundation's move away from mathematics in Latin America, see Miller to Gama, 27 Mar 1957, RF, Record Group 10.1, Series 305E, Box 61, Folder Leopoldo Nachbin. The corresponding move in Europe is noted as early as 1949 in Gerard Pomerat to Maurice Frechet, 16 Feb 1949, RF, Record Group 1.1, Series 500D, Box 11, Folder 118.

95. Schwartz, Mission Report (ref. 82).

96. Saunders MacLane, "Mathematics at the University of Chicago: A Brief History," in *A Century of Mathematics in America, Part 2*, ed. William Duren (Providence, RI: American Mathematical Society, 1989), 127–54, on 146–49; Felix E. Browder, "The Stone Age of Mathematics on the Midway," *The University of Chicago Magazine*, 1976, reprinted in Duren, ed., *Century of Mathematics*, 191–93. Nachbin remained in contact with Stone after returning to Brazil; see, e.g., Nachbin to Stone, 25 Aug 1951, MSP (ref. 57).

97. Nachbin to Miller, 13 Jul 1955, RF, Nachbin (ref. 94).

distinguished visitors from the United States, France, and the leading universities of his continent for courses and seminars.[98] But "build[ing] up a mathematical atmosphere" in Brazil was hard work, and Nachbin, feeling stifled, sought renewed stimulation abroad.

Having glimpsed Schwartz at the 1950 Congress and studied with him on his 1952 mission to Rio de Janeiro, Nachbin made clear that the particular intellectual nourishment he most craved was Schwartz's Paris seminar on differential equations.[99] Schwartz reacted warmly to the proposition.[100] Miller, for his part, worried that the trip would take Nachbin away from his central place in Brazil's mathematical infrastructure, but the director of Nachbin's institute assured Miller that the first priority should be advancing research, which a fellowship would promote.[101] Nachbin added that a change of Brazilian presidential regime would mean a shake-up in the top academic institutions, so his current role should not be taken for granted.[102] He received his fellowship and exchange visitor's visa in the summer of 1956, and set off for short stop-overs at a UNESCO-sponsored symposium in Mexico on Algebraic Topology organized by Lefschetz and at his old department in Chicago that August and September en route to Paris.[103]

It was only after Nachbin arrived in Chicago that he received word from Schwartz that the seminar was not to proceed as planned. Schwartz initially promoted his theory for three distinct audiences: electrical engineers (whose routine calculations it purportedly justified), theoretical physicists (for some of whose theories it supplied a mathematical foundation), and mathematicians (for whom it was said to unify and simplify some unsatisfactory notions in the theory of functions and differential equations). By 1956, new developments in the theory of distributions and in quantum field theory meant that theoretical physicists and physics-inclined mathematicians tied to France, Britain, and the United States saw increasing common ground in their varied uses of Schwartz's theory. Schwartz resolved to change tack with his seminar that year and to join

98. 1954 IMPA Annual Report, RF, Nachbin (ref. 94).

99. Nachbin Proposal, RF, Nachbin (ref. 94).

100. Schwartz, 5 May 1956, RF, Nachbin (ref. 94).

101. Gama to Miller, 20 Mar 1956, RF, Nachbin (ref. 94).

102. Nachbin to Miller, 10 Feb 1956, RF, Nachbin (ref. 94). Juscelino Kubitschek had taken office at the end of January, 1956. On Kubitschek and modern science in Brazil, see Lars Denicke, "Fifty Years' Progress in Five: Brasilia—Modernization, Globalism, and the Geopolitics of Flights," in Hecht, *Entangled Geographies* (ref. 6), 185–209.

103. Greenfieldt to U.S. Consul, 5 Jun 1956; fellowship summary sheet, 28 May 1956; Nachbin to Lefschetz, 18 Jul 1956, RF, Nachbin (ref. 94).

with physicist Maurice Levy for an intensive study of partial differential equations and distributions in relation to quantum field theory, an area for which Nachbin professed little interest, despite Schwartz's encouragement.[104]

Nachbin sought Miller's permission to change course and to stay in the United States until the subsequent edition of Schwartz's seminar, taking advantage in the meantime of the suite of experts on differential equations Chicago planned to host. Miller, for his part, was wary of each further day Nachbin might spend abroad. As far as he was concerned, Nachbin was urgently required for "the organization of advanced training of young mathematicians [in Brazil] who are certainly going to be needed in increasing numbers in connection not only with technological developments, but also in connection with the atomic energy experimental program and activities growing out of it."[105] For the Rockefeller Foundation, Nachbin was an indispensable agent of nation-building for a country whose rapid progress depended on highly trained mathematicians capable of working across the areas of applied mathematics, physics, and engineering.[106]

This rationale suited Nachbin well enough, so long as it afforded him the resources to pursue his studies abroad. He stressed to Miller that "[a]ny pioneering work is very slow and tiresome" in Rio de Janeiro, and that without stimulating research he would lack the intellectual nourishment to teach, "feeling like in prison" instead.[107] A protracted exchange of pleas and deflections between Nachbin and Miller was resolved only when a Guggenheim fellowship freed Nachbin to extend his North American voyage without further Rockefeller support. Nachbin was more practiced than most at this sort of sponsor shopping. Fellowship opportunities for promising Latin American mathematicians were few and interconnected, but these connections made it easier for the most promising young mathematicians to piece together support from multiple sources, including occasional stipends or subventions from host

104. Nachbin to Miller, 18 Sep 1956, with Schwartz enclosures, RF, Nachbin (ref. 94).

105. Miller to Nachbin, 21 Nov 1956, RF, Nachbin (ref. 94).

106. This reasoning can be found across multiple fellowship files from the period. Cf. Miller to Fernandez, 23 May 1958, RF, Record Group 10.1, Series 301E, Box 72, Folder Ricabarra: "Our regular fellowships, which are awarded to youngish scientists who have already clearly demonstrated their ability to do original investigative work, are for only a 12-month period, as the purpose of the fellowship is to give a qualified scientist the opportunity to get stimulation, ideas, and orientation which will serve him to a greater or lesser degree during the remainder of his scientific career, after he returns home." Similar ideas are also notable in the fellowship renewal documents for Elon Lages Lima; see RF (ref. 86).

107. Nachbin to Miller, 30 Jan 1957, RF, Nachbin (ref. 94).

institutions and conference organizers, in order to take them abroad for longer than any one sponsor might intend.

Nachbin had declined one such conference grant already obtained for the Mexico conference at the start of his travels upon receiving his Rockefeller fellowship, and the Institute for Advanced Study in Princeton offered to consider him for a supplemental grant for the end of his trip.[108] Though short-term visiting foreign mathematicians could not typically lead military and U.S. government projects, it was also routine for them to receive support from contracts held by host faculty or institutions. Before finishing his Guggenheim year at the Institute for Advanced Study, for example, Nachbin worked under Irving Kaplansky's Office of Ordnance Research contract at Chicago.[109] Securing each grant took time and effort, however, and Nachbin's opportunities were not limitless. It would take him another half decade to reach the Schwartz seminar in Paris, by then as a lecturing expert. His long path to Paris, of which his Rockefeller fellowship constituted just one part, exemplified the vast patchwork of hosts, sponsors, and others, often with conflicting agendas, that underwrote intercontinental ties both directly and indirectly, through cooperation, accommodation, and adaptation.

MORAL AND TECHNICAL CENTERS

At the same time Nachbin sought Schwartz in Paris, Schwartz himself had returned to South America—this time to Colombia and Argentina, in 1956. That September, as Nachbin adapted to news of the change in Schwartz's seminar, UNESCO officials received a formal request from the mathematics faculty of Buenos Aires that they sponsor a visit from a professor who could give a specialized course on analysis and topology, particularly distributions, in either French or (were that not possible) English.[110] A follow-up letter to Argentina's ambassador to UNESCO, Eduardo Mallea, clarified this oddly specific request. Though regulations prevented them from naming their

108. Nachbin to Lefschetz, 18 Jul 1956, RF, Nachbin (ref. 94). Morse to Nachbin, 19 Aug 1957, Oppenheimer to Nachbin and Morse to Oppenheimer, 21 Jun 1957, IAS, Member Files, Box 100, Folder Leopoldo Nachbin.

109. Nachbin to Oppenheimer, 28 Aug 1957, IAS (ref. 108).

110. UNESCO Correspondence File 51:37(82)AMS: ARGENTINA. In fact, two very specific visitor requests were submitted together, but the other—for a Spanish professor to teach a course in classical analysis—did not come to fruition.

desired visitor in their formal solicitation, there should be no doubt that the intended expert was Professor Laurent Schwartz.[111]

UNESCO officials in Paris were eager to collaborate on good terms with Argentina's new anti-Peronist government in a time of palpable political discord, and so shoehorned the proposal into the tight Technical Assistance budget for the following year. Schwartz made the trip the next summer, and by October, 1958, Schwartz was preparing for his return to Paris, "most satisfied" with the outcome of his UNESCO mission. His course on distributions had been well attended, and Scarfiello had edited notes from the course that were rapidly roneotyped and distributed across Latin America under UNESCO's auspices. Another course at a lower level in the faculty of engineering drew over a hundred auditors, though it was affected by a series of strikes and political disturbances.[112]

Even before Schwartz's departure, his mission was being reconfigured by his hosts as a bid for greater resources for mathematical study in ways that departed somewhat from the broader goals of Schwartz's Western sponsors. These proposals played out in two directions, which merged in UNESCO's paper trail into a single large undertaking.[113] First, Schwartz's host department sought to capitalize on his visit to solicit UNESCO support for a farther-fetched effort to host a Soviet expert on distributions—or "generalized functions," as they were called in the Soviet Union, Britain, and a handful of other places. The best known were Israel Gelfand and his student Georgii Shilov.[114] Indeed, plans were in the works for the

111. Schwartz himself was not contacted about the possibility of visiting until October 1957.

112. Schwartz Report, 8 Oct 1958, UNESCO (ref. 110). See Laurent Schwartz, *Matemática y Física Cuántica: Notas Tomadas en el Curso Dictado con el Auspicio de UNESCO durante los Meses de Julio a Octubre* (Buenos Aires: Facultad de Ciencias Exactas y Naturales, Departamento de Matemáticas, Universidad de Buenos Aires, 1958). Schwartz's notes reached far beyond South America. The first to borrow the Princeton Institute for Advanced Study's copy of these notes was visiting Oxford mathematician George Temple, who was credited in Britain with domesticating Schwartz's theory earlier that decade.

113. These are now contained in two thick folders: UNESCO 51/82/A031/TA: "Argentina—Latin American Centre for Mathematics—TA Project, Part I—up to 31/12/63" and "Part II—1/1/64 up to 31/12/66," split according to date.

114. On Gelfand and his mathematical milieux, see Slava Gerovitch, "Parallel Worlds: Formal Structures and Informal Mechanisms of Postwar Soviet Mathematics," *Historia Scientiarum* 22, no. 3 (2013): 181–200. On Shilov, see P. S. Aleksandrov, I. M. Gel'fand, E. A. Gorin, V. V. Grushin, A. N. Kolmogorov, O. A. Oleinik, V. P. Palamodov, and S. V. Fomin, "Georgeii [*sic*] Evgen'evich Shilov (obituary)," trans. A. Lofthouse, *Russian Mathematical Surveys* 31, no. 1 (1976): 233–49.

Department to have completed translating one volume of their monumental series of books on the subject by the coming July. But the Buenos Aires mathematicians were willing to entertain any of Gelfand's circle who could be persuaded to make the trip to lecture on the theory of distributions and its applications.[115]

Though no Soviet expert ultimately made the trip to Buenos Aires, the department's request was not implausible. UNESCO, more than other international organizations, regularly fostered connections between East and West through its efforts in the developing world, particularly in India. Though Soviet officials were (in many ways rightly) suspicious of UNESCO as an organ of Western cultural projection, after Stalin's death in 1953, its member states and institutions increasingly participated in UNESCO undertakings.[116] Although Soviet visitors to Latin America were less common, their publications (and translations of those texts) were eagerly sought and often supplied through UNESCO's auspices. Nachbin, among others, praised the availability of such inexpensive and high-quality (mathematically, if not materially) elementary texts from the Soviet Union.[117]

Schwartz's UNESCO-sponsored visit, the proposal stressed, had reinvigorated the Faculty of Exact and Natural Sciences at the university by treating a topic of interest in both pure and applied mathematics, with a special reference to quantum physics. It was perhaps the theme of a resurgent institution that led UNESCO administrators to commingle the request with another one received around the same time under Ministry of Education and Justice letterhead. The second request asserted the "deficient" and "low" level of university education across Latin America. Having received the impression that UNESCO would not underwrite an attempt to tackle all of the region's educational problems at once, the proposal's authors believed they had found a solution: a regional center for mathematics based in Buenos Aires.[118]

115. Undated memo (likely Sep–Oct 1958) titled "Participación de la Facultad de Ciencias Exactas y Naturales de la Universidad de Buenos Aires, en el Plan de Asistencia Técnica de las Naciones Unidas para 1959," and memos dated 2 Dec 1958, 2 Feb 1959, UNESCO (ref. 113).

116. For an early view of the Soviet-UNESCO thaw, see the War Documentation Project dispatch of John A. Armstrong, "The Soviet Attitude Toward UNESCO," *International Organization* 8, no. 2 (1954): 217–33.

117. Leopoldo Nachbin, review of *Foundations of Modern Analysis*, by Jean Dieudonné, *Bulletin of the American Mathematical Society* 67 (1961), 246–50, on 250.

118. 1958 Ministry of Education and Justice report, "Proyecto de creación de un Centro Regional de Matemáticas para América Latina," UNESCO (ref. 113).

Their explicit model was the Tata Institute of Fundamental Research, in Bombay, India.[119] Founded in 1945, the Tata Institute had come to be seen as a model for the regional elevation of elite mathematics in the developing world.[120] As with the founders of the Brazilian IMPA and the French Institut des Hautes Études Scientifiques, organizers for the Buenos Aires center would also have had in mind the successful American center for postdoctoral training and research at the Institute for Advanced Study in Princeton, which itself had started with the discipline of mathematics and an ambition to expand into other areas. The center was to be a hub of training and research that would draw young fellows for stays of one to two years of intensive study, and host a small number of foreign experts to impart the latest mathematical developments.[121]

The viability and promise of hosting foreign experts was, for the center's advocates, amply proven by Schwartz's successful mission. As for the university's suitability for promoting education and research within the region, thanks in part to a decade of investments from bodies like UNESCO, there was now one of the finest mathematical libraries in Latin America and even a working digital computer.[122] Schwartz's immediate successor as UNESCO expert suggested that Buenos Aires was well situated as a point of passage for travel within the region, so it would be natural for hosting South American mathematicians and receiving visitors to the continent for short stays en route to other institutions.[123] At a noon meeting on 24 November, officers of the University and UNESCO affirmed the proposed center's importance "tanto tecnica como moralmente"

119. Ibid. "Es de todos bien conocido el 'Tata Institute of Fundamental Research', de Bombay, que ha desempeñado un papel decisivo en el notable progreso científico de la India." (Everyone is familiar with the 'Tata Institute of Fundamental Research,' in Bombay, which has played a decisive role in India's notable scientific progress.)

120. The Tata Institute has received relatively scant attention from historians of science in comparison with its importance as a node of elite theoretical science in the developing world, evident in archives of the period. On this lacuna, see Indira Chowdhury, "A Historian among Scientists: Reflections on Archiving the History of Science in Postcolonial India," *Isis* 104, no. 2 (2013): 371–80.

121. This would become one of several centers for advanced training under UNESCO's auspices. Cf. De Greiff, "The Politics of Noncooperation" (ref. 6), and David Nofre, "Managing the Technological Edge: The UNESCO International Computation Centre and the Limits to the Transfer of Computer Technology, 1946–61," *Annals of Science* 71, no. 3 (2014): 410–31.

122. See Pablo M. Jacovkis, "Un Lugar para Clementina: El Instituto de Cálculo entre 1957 y 1966," *La Ménsula* 13 (2011): 1–4.

123. Gaeta to Establier, 23 Oct 1958, UNESCO (ref. 113).

(as much technically as morally) for Argentina's desire to play an essential role in scientific investigation in the region.[124]

This did not stop other potential sites from vying to host such a center once they got wind of the plans for Buenos Aires. Within Argentina, the mathematical physics faculty of La Plata petitioned in November, 1958, for their inclusion in planning.[125] Organizers pressed single-mindedly ahead, nevertheless, in UNESCO's regional headquarters in Montevideo and in the presumptive host faculty in Buenos Aires. The next July, according to a UNESCO delegate to a crucial planning meeting for the center, the opposition among non-Argentine parties was palpable. Brazilian and Uruguayan representatives were particularly frustrated to have been left out of earlier negotiations, as presumably would have been a delegate from Mexico, had such a delegate been present.[126] Nachbin fired off a furious missive to the Paris office of UNESCO in September, 1959, lamenting that Brazilians had not been contacted until the July meeting, at which point the center's location was a fait accompli.[127] A regional UNESCO official worried in more measured tones in October that the Uruguayan and Brazilian reservations represented a "lucha de hegemonía" (hegemonic struggle) over the movement of scientific personnel and resources.[128]

Meanwhile, by February, 1959, Gelfand had effectively removed himself from consideration for a visit, though efforts to secure a Soviet expert continued.[129] Over the course of the next three months, the position envisioned for Gelfand was transformed into what were to be the inaugural UNESCO-sponsored foreign expert posts for the new center. Despite several headaches over foreign experts and the terms of UNESCO's funding arrangement, the center opened at the start of the academic year on 28 March, 1960, with an initial class of ten fellows. Among its initial offerings was a course by Scarfiello on the theory of distributions.[130]

124. 25 Nov 1958 memo on the 24 Nov meeting, UNESCO (ref. 113).

125. Letters to Luther Evans, 11 and 13 Nov 1958, UNESCO (ref. 113).

126. Swarbrick to Ibañez, Aug 1959, UNESCO, Box P.P. 1959–1960 and T.A. 1960, EDV/FE/39, Folder Correspondence with Field Science Cooperation Office, Montevideo.

127. Nachbin to Carneiro, 8 Sep 1959, UNESCO (ref. 113).

128. Ibañez Gomez to Establier, 9 Oct 1959, UNESCO (ref. 113).

129. Memo, 27 Feb 1959, UNESCO (ref. 113).

130. "First Course (April 1960–December 1961)," UNESCO (ref. 126); "Discurso del Doctor Angel Establier, Jefe de la Division de Actividades Regionales Cientificas de la Unesco, en el Acto Inaugural de las Actividades del Centro Regional de Matematica para America Latina," Buenos Aires, 28 Mar 1960, UNESCO (ref. 113).

CONCLUSION

The Buenos Aires center's UNESCO funding lasted only to 1964, its host university was dramatically disrupted by political violence in 1966, and no records point to operations beyond 1968.[131] By fits and starts, participants in other institutional formations in and around Latin American universities carried forward different aspects of the hybrid regional and international project briefly nucleated in the Buenos Aires collaboration. Today, Nachbin's IMPA stands out as an epicenter of South American mathematics. Its members, including the region's first home-grown Fields Medalist Artur Avila, are now preparing to host the 2018 ICM.[132]

Avila's biography encapsulates many features of the intercontinental enterprise that the postwar promoters of mathematical colonialism envisioned. After showing promise in school math competitions, Avila matriculated with a scholarship to IMPA, where he earned his doctorate and established ties to prominent mathematicians visiting from the United States and France. One of his initial advisors at IMPA was Elon Lages Lima, Nachbin's protégé. He trained intensively with mathematicians based in Brazil, who helped him convert early successes into invitations and fellowships to travel and collaborate with leading foreign scholars in his field. A star of international mathematics, Avila lectures across the globe and directs research at two different home institutions, IMPA in Brazil and the Centre National de la Recherche Scientifique in France, where he both embodies and advances the intercontinental model of his discipline that his countrymen helped to pioneer half a century prior.

On a geopolitical scale, postwar mathematical colonialism was an elite-driven, internationally oriented endeavor that blended the lofty discourse of technical and moral development with the tangled bureaucratic negotiations that enabled substantive coordination among a diverse mix of governments,

131. A near-contemporary survey by a directly involved mathematician is Luis A. Santaló, "La Matemática en Buenos Aires y La Plata: Período 1943–1972," in *Evolucion de las Ciencias en la Republica Argentina 1923–1972, Tomo 1: Matemática*, ed. Luis A. Santaló (Buenos Aires: Sociedad Científica Argentina, 1972), 54–103, on 66–67. On the 1966 events, see Eduardo Díaz de Guijarro, "1966: La Noche de los Bastones Largos: El Final de una Etapa," *La Ménsula* 6 (2008): 1–3. Santaló does not refer to the center's formal closing, and I found no such documentation from UNESCO offices in Paris or Montevideo, nor at the University of Buenos Aires Faculty of Exact and Natural Sciences. I was also unable to establish the precise circumstances of the center's closing through oral inquiries in Buenos Aires.

132. See, e.g., the special August 2014 edition of the Brazilian cultural magazine *Piauí* dedicated to Avila and Brazilian mathematics on the occasion of Avila's medal.

foundations, and other organizations. In these respects, mathematicians and their sponsors recapitulated the kinds of cultural projection and economic imposition long associated with more resource-intensive and ideologically charged postwar international programs. Though mathematicians attached themselves to these larger programs by stressing their contributions to technical training and research, the adjunct successes of mathematics in Latin America show how much room there was between the discourses and infrastructures of international development to pursue parallel projects alongside the higher-profile missions as well.

Accounting for such interstitial undertakings requires a redoubled attention to the personal scale of mathematical colonialism, driven by informal assessments, political compromises, and routine institution-building. Such attention shows not just that matters were complicated and idiosyncratic (as analyses on such scales often show), but that these complications and idiosyncrasies may well be necessary to understand how mathematicians integrated Latin America into an elite scholarly community that spanned continents as never before. That is, intercontinental mathematics came about not *in spite of* but rather *by virtue of* the manifold complications and idiosyncrasies evident at this personal scale. The exchanges that solidified modern mathematics in Latin America were rarely bilateral or top-down, relying instead on the piecemeal cooperation of numerous mathematicians, bureaucrats, and others. Personal interactions and relationships were thus defined by their intercontinental implications, even as those intercontinental ideals and practicalities were reconfigured around personal exigencies. Idiosyncrasy, ambivalence, and adaptation made mathematicians' informal networks far-reaching and robust, while also reinforcing both explicit and implicit biases that continued to limit access to an expanding mathematical discipline.

Consider the politics behind Schwartz's itinerary. Official U.S. anticommunism restricted his direct ties to the United States, but the United States also underwrote North-South exchanges in which Schwartz—first communist, then unabashed fellow traveler—played a starring role. Anticommunism and its associated cultural and economic politics help account for a great share of UNESCO's technical assistance budget from Western nations. Building on Schwartz's Buenos Aires visit, however, the same budgets and institutional infrastructures supported developments in Argentina that were oriented toward the Soviet Union and nonaligned countries in addition to the United States and France. Schwartz's analysis of Brazilian mathematics mixed political, cultural, and economic concerns in ways clearly connected to his own

convictions as a socially minded elite mathematician, but also clearly legible in the political and economic terms of sponsors who did not share his politics. Nor was it a matter of an ideological superstructure sitting largely detached above a technocratic or nonpartisan substructure of programmatic practice: one needs Cold War ideology to explain local details of exchanges like Schwartz's, but those details rarely stick to a neat Manichean script.

For Massera, who rivaled Schwartz as an outspoken Cold Warrior on the left, the connection between his mathematics, politics, and travel is likewise muddied. Massera's communism made a great difference for his own mobility, but it did not matter equally to everyone. The FBI regarded his capability to learn the mathematics of nuclear physics with extreme suspicion, but it was his sincere commitment to communist politics rather than any theoretical investigation that would dominate his FBI file—a commitment his mathematical counterparts in the United States hardly registered. Throughout his long career, Massera maintained strong ties to mathematicians in the First, Second, and Third Worlds, and his political and technical commitments figured differently in different interactions.

The elites of Latin American mathematics, for their part, maneuvered within the theoretical, administrative, and financial frameworks of their mathematical and bureaucratic interlocutors, vying for attention, resources, and stimulation. Nachbin, whose own politics were the least clear of the figures considered here, was a particularly skilled navigator of the period's often-ambivalent vehicles of investment and development. Where Massera's dubious links to atomic physics hindered his travel, Nachbin's and Schwartz's links (in many respects equally dubious) both explicitly and implicitly furthered their causes.

Although the particular mathematical details of these exchanges were often inaccessible to those holding the purse or issuing the visa, the mathematical particularities were nonetheless consequential. Schwartz's theory of distributions, arguably the single most successful mathematical theory to take root amidst these early postwar endeavors, thrived on the basis of a massive and consequential patchwork of particularities. It was particularly modern and abstract, teachable and researchable. It was particularly suited to the budgets and timeframes of particular sponsors and academic institutions, tied to particular branches of physics that appealed to particular imaginaries of modern economic development. It was a theory championed by particularly charismatic men of particular youth, promise, and vigor, who traveled frequently to particular parts of the world.

Some features of the striking success of the theory of distributions in 1950s Latin America are specific to the actors and notions involved, but others help outline broader features of mathematics in this period. Foremost, mathematicians combined travel of a range of durations and premises in order to seed and nurture international connections. Fellowships lasting months or years served different ends than expert visits of weeks or months, which in turn differed from shorter conferences and other gatherings. Each had its uses for forging interpersonal connections, spreading awareness of new theories or people, establishing competence in research and teaching, and meeting other requirements for an integrated disciplinary system. Above all, intercontinental mathematics in this period thrived on the presumption that ideas might travel on their own, but the discipline's new scale was predicated on the politically charged and resource-intensive travel of people.

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