

## Cartography: history

**Mark Monmonier**

*Syracuse University, USA*

As a rubric, *History of Cartography* has two distinct connotations: (i) the chronicle of technical and intellectual developments surrounding mapmaking and map use and (ii) the interdisciplinary endeavor that invokes historical context in studying both the map as a visual object and the societal impacts of cartographic technology and mapping activity. (It should not be confused with *historical cartography*, the mapping of past events by historians and historical geographers.) A third and equally pervasive connotation is the comprehensive *History of Cartography* initiated by J.B. Harley (1932–1991) and David Woodward (1942–2004) and published by the University of Chicago Press. Because the several volumes of the *History* reflect major divisions in map history, the series provides a convenient framework for much of this entry, which also identifies important English-language synopses and appropriately emphasizes developments since 1900, including dynamic maps and geospatial technology. This entry also examines academic activities, including conceptual frameworks, key individuals, and the institutional apparatus of map collections, exhibitions, conferences, and journals.

Encompassing geospatial technology, this entry demands a definition of *map* with two levels: the narrow, traditional sense of a graphic framework whereby symbols representing geographic features facilitate navigation, planning, and general understanding (Harley and Woodward 1987, xv–xvii) and the broader, more recent sense of

topologically structured geographic information intended to support spatial analysis, graphic display, or both. The word *cartography* merits a similar disambiguation insofar as it encompasses not only the traditional focus on mapmaking but also the broader context of map use and mapping as a governmental, commercial, and intellectual endeavor.

### Frameworks and chronologies

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Systematic study of salient trends in map history involves the overlay of three factors: a classification scheme that recognizes the diverse ways in which maps are produced and used; a chronological schema akin to the eras or stages of development common to broad-brush historical narratives; and distinctive themes such as the impacts of technological innovations like printing and photography and political revolutions like the rise of the nation state. Science, technology, and state formation have precipitated distinctive changes in cartographic symbols and formats as well as in the social relations surrounding maps and mapping.

### Modes of mapping practice

How maps are made and used, and to what ends, is arguably the most revealing basis for sorting cartographic artifacts into categories for historical analysis. Competing categorizations include map scale, which is both the lynchpin of cartographic theory and a key characteristic of any map. Even so, categories based on scale are too coarse and internally varied to sustain a broad range of meaningful interpretations and

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conclusions. Similarly limited are categorizations based upon whether the mapmaker is a governmental or a private-sector entity, whether the map is circulated on paper or electronically, or whether replicated images were copied by hand, engraved on a copperplate or lithographic stone, or transferred photographically. Although the reproduction method leaves distinctive marks on the artifact, these differences in appearance are less socially and intellectually significant than differences among cartographic modes such as property mapping, marine charting, and geodetic surveying.

The concept of cartographic modes was introduced by Matthew Edney (1993) as a framework for studying the development of European cartography between 1500 and 1850, which includes the Age of Discovery and the rise of capitalism. His schema initially consisted of nine *modes of cartographic practice*, defined as “sets of cultural, social, and technological relations which define cartographic practices and which determine the character of cartographic information” (Edney 1993, 54). Although these modes overlap and interact, each has a typical range of map scales as well as distinctive forms, innovations, and user communities. *Celestial mapping*, with ties to astrology and astronomy, looks heavenward and has the smallest scales. Small-scale maps are also the most characteristic product of *geographical mapping*, which summarizes spatial knowledge for the entire world and its regional subdivisions. *Geodetic mapping*, which measures the size and shape of the planet, is a continental or global endeavor most conveniently depicted (if at all) on small-scale maps; even so, its most important products are the highly precise triangulation networks that provide a geometric framework for the large- or medium-scale maps generated by *topographic mapping*, which focuses on the representation of places and the Earth’s surface, and by *urban mapping*, a historically important

endeavor focused on cities. Measurement is no less basic to *property mapping*, which promotes land ownership with large-scale representations, and *boundary mapping*, which delineates national territories and their provinces on medium- or small-scale maps. *Marine charting*, which produces small-scale maps of the seas and medium-scale maps of harbors, interfaces with topographic mapping along the coastline. *Thematic mapping*, which encompasses the broadest range of scales, typically exploits topographic maps and marine charts as spatial frameworks for plotting natural or social phenomena.

As Edney (1993, 59–64) observed, these modes represent a convergence of mapping practice around 1500 followed by a marked divergence before 1800. By the sixteenth century the collective emergence of mercantilism, printing, the commodification of land, and the modern territorial state had led to four distinct modes – charting, geodesy, small-scale chorography (place mapping), and large-scale topography – which by the early eighteenth century had amalgamated into a relatively amorphous “mathematical cosmography” inspired by the Scientific Enlightenment and exemplified by systematic and detailed national surveys like the mapping of France by the Cassini family. Fragmentation into the aforementioned modes by 1800 reflects the increased political, economic, and intellectual complexity of European society.

Edney’s schema also included four institutional endeavors that cut across multiple modes. *Military cartography*, for instance, employs geographical maps for strategic planning, topographic maps for tactical operations, and marine charts for naval activities. At local as well as provincial and national scales, *administrative cartography* intersects property mapping, thematic mapping, topographic mapping, and urban mapping. The *map trade*, which became *map publishing* after printing and engraving technologies vastly expanded the

cartographic marketplace in the sixteenth century, encompasses the commercial distribution of maps of all types, and *map collecting* by institutions and individuals brings together maps useful for military intelligence, general reference, and scholarly research. And in the twentieth century in particular, antiquarian dealers have touted rare and merely old maps as aesthetically attractive investments.

Technological advances in the twentieth century required two additional modes of cartographic practice: *overhead imaging*, whereby aircraft and satellite platforms and diverse imaging technologies vastly increased cartographic coverage and content, and *dynamic cartography*, whereby interactive and animated displays offer comparatively complete and often engaging displays of temporal or complex phenomena. In addition, *academic cartography* emerged as a distinct institutional endeavor focused on the systematic, scholarly study of not only the design and production of maps but also the cultural connotations and societal impacts of mapping activities.

### Historical approaches

The scholarly study of map history has roots in the eighteenth century, but systematic treatments were largely lacking until Manuel Francisco de Barros e Sousa Santarém (1791–1855), the Portuguese scholar-diplomat believed to have coined the term *cartography* to describe the study of old maps, published his *Facsimile-Atlas* of early maps in 1841. Another milestone was *l'Atlas des monuments de la géographie*, published in 1879 by the French civil engineer Edmé-François Jomard (1777–1862), who assembled a collection of facsimiles to emphasize cartography's close ties to progress in science and discovery. In turn, Jomard's atlas was the source of several reproductions in the *Facsimile-Atlas to*

*the Early History of Cartography, with Reproductions of the Most Important Maps Printed in the XV and XVI Centuries*, published in 1889 in Swedish and English by Adolf Eric Nordenskiöld (1832–1901), a Finnish natural scientist, arctic explorer, and map collector. Although many of Nordenskiöld's images were necessarily reduced in size, the *Facsimile-Atlas* (1889) was a useful general reference for librarians, historians, and map collectors. Systematic cataloging of old maps fostered problematic notions of inevitable, ever increasing cartographic progress propelled by advances in mathematics and natural science, measuring techniques, and graphic reproduction.

Facsimile atlases were followed by narrative histories, such as Lloyd A. Brown's *The Story of Maps*, published in 1949. A former map curator at the University of Michigan's William L. Clements Library, Brown traced cartography's evolution as a modern science from the ancient geographies of Strabo and Alexander the Great to the International Map of the World, a heroic multinational endeavor frustrated by two world wars, limited cooperation, and lack of a clear-cut need. Military strength and world peace, he argued, depended on reliable maps, and fully complete and reliable maps were impossible without peace and prosperity. Like most narrative histories, Brown's *Story* put maps, geometric accuracy, and cartographic coverage at center stage and paid little attention to the complexity of maps as social and cultural texts.

Erwin Raisz offered a more schematic treatment in his 1938 textbook *General Cartography*. Raisz was a Harvard faculty member as well as an accomplished illustrator, widely recognized for his insightfully detailed physiographic diagrams. His calligraphic dexterity is readily apparent in elegantly hand-lettered timelines for Antiquity (300 BCE–300 CE) (Raisz 1938, 15), the Middle Ages (400–1400) (1938, 25), the

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Renaissance (1470–1700) (pp. 36–37), Modern Maps (1700–1930) (pp. 52–53), and the United States (1750–1930) (pp. 60–61). Most events are tagged with the name of a specific mapmaker; his Renaissance timeline includes separate columns for England and France; its Modern Maps counterpart assigns noteworthy developments to Italy–Spain–Latin America, France, Netherlands–Germany–Austria, Great Britain, and “Others,” whereas his United States timeline is divided equally between “Surveys, Official Maps” and “Private Cartography.” This emphasis on persons, national traditions, and technology is typical of the “internal histories” that arose in the late nineteenth century, when mapmakers began to enrich their manuals and textbooks with historical narratives of steady progress in overcoming diverse challenges.

J.B. Harley and David Woodward questioned the reliability of internal histories, which not only emphasize scientific progress, famous firsts, and intriguing artifacts, but also tend to ignore the influence on mapmakers and mapping institutions of intellectual and political movements. Harley was a historical geographer with Marxist leanings, whose careful examination of late eighteenth-century English county maps and detailed maps produced during the American Revolution aroused a critical appreciation of old maps as historical sources with limitations beyond the obvious consequences of imprecise instruments and sloppy fieldwork (Edney 2005b). Woodward was a historian of cartography whose research on map engraving and printing inspired a wider interest in how maps were circulated and used (Edney 2005a). In spring 1977 he persuaded Harley to forego plans for a four-volume history of mapping in North America and collaborate on a general history of cartography focused on the societal context within which maps were produced and consumed (Woodward 2001, 23–24). They planned

to cover the period from prehistory through the end of World War I in four books, divided chronologically at 1470, 1660, and 1800 and totaling no more than a million words. Their hope of having all volumes in print by 1992, the 500th anniversary of Columbus’s widely celebrated voyage to North America, greatly underestimated the richness of map history as an academic endeavor.

### A “big book” project

Their million-word estimate proved similarly naive insofar as the *History of Cartography*, when completed in the early 2020s, will be at least seven times as large, and take its place alongside monumental “big book” reference works like the *Dictionary of American Regional English* (1985–2012) and the *Dictionary of Scientific Biography* (1970–1990). From the beginning Harley and Woodward recognized that their project would require numerous collaborators, grant support, and a committed and competent publisher (Woodward 2001). The University of Chicago Press, with which Woodward had worked, filled the publishing role, and “the History Project” (as it came to be known) has drawn substantial support from the National Endowment for the Humanities, the National Science Foundation, and the University of Wisconsin–Madison, which added Woodward to its geography faculty in 1980.

Volume One, titled *Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, appeared in 1987. Its 21 chapters are largely interpretative narratives focused on a region, a time period, a type of map use, or perhaps all three, as exemplified by the title of chapter 12: “Maps in the Service of the State: Roman Cartography to the End of the Augustan Era.” Topics covered in various chapters include the measurement and calculation methods of the

Babylonians and Greeks, Ptolemy's *Geography*, maps for urban planning and civil engineering in the early Roman Empire, Woodward's recognition that medieval *mappaemundi* were symbolic representations of history rather than geometric representations of the planet, the development and use of *portolan* sailing charts in the fourteenth and fifteenth centuries, and an increased number and variety of maps overall.

In their preface, Harley and Woodward proclaimed a fundamentally new definition of *maps* as "graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world" (Harley and Woodward 1987, xvi), and in chapter one, "The Map and the Development of the History of Cartography," Harley appealed for recognition of map history as a distinct scholarly pursuit devoted to questioning the map's role in sociopolitical discourse. Eight other scholars contributed most of the essays, and the editors concluded with a call to fill gaps in the historical record, enhance understanding of the map's emergence as a means of human communication with diverse geometric frameworks, and widen appreciation of the social context, including the map's use as an intellectual weapon. In their view, a comprehensive reference work that got the facts right could stimulate critical scholarship as well as enlighten curious readers. To this end, Volume One set a standard for the thorough fact checking, careful editing, and accessible typographic design that permeates the series.

As their plans evolved, Harley and Woodward added a fifth volume to encompass the twentieth century. The series swelled to six volumes after they discovered numerous scholars who could collectively cover mapping by indigenous and non-Western societies. Though not part of the original four-volume plan, these topics became the focus of Volume Two, published as three separate books: *Cartography in the Traditional Islamic*

*and South Asian Societies* (1992), *Cartography in the Traditional East and Southeast Asian Societies* (1994), and *Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies* (1998). Harley died in 1991, but Woodward continued the series, often with the support of associate or assistant editors.

When Volume Three, *Cartography in the European Renaissance*, was published in 2007, its 2334 pages, bound as a set of two large books, dwarfed Volume One's 654 double-column, 21.59 × 27.94 cm (8.5 × 11 inch) pages, which had established the series' internal design. Aware of the challenge posed by the explosion of mapping activity after 1650 and sharing the publisher's concern about production costs – Volume Three overran its original budget of a million words by 30% – Woodward adopted an encyclopedic format for the remaining three volumes. This shift from a small number of relatively long narrative essays authored by comparatively few scholars to a much larger number of encyclopedia entries also acknowledged cartography's increased complexity, allowed the participation of many more contributors, and afforded a workable strategy for controlling each volume's length. Consistent with the series' role as a reference work, the encyclopedic strategy and Woodward's plan to share editorial responsibilities also promised to reduce production time.

Harley's sudden death in 1991 demonstrated that "big book" projects, which might outlive their founders, need a succession plan. Before Woodward died of cancer in 2004, he appointed coeditors for Volume Four, *Cartography in the European Enlightenment*, scheduled for release in 2018, and his coeditor for Volume Six, *Cartography in the Twentieth Century*, published in 2015, continued as sole editor. In 2008 Matthew Edney, who became project director, appointed an editor for Volume Five, *Cartography in the Nineteenth Century*, planned for publication in

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2021. Entry-term lists for these encyclopedic volumes reflect the systematic polling of broadly constituted boards of international advisors as well as *hierarchically integrated conceptual clusters* (HICCs) based on Edney's modes of mapping practice and institutional endeavors, which were reworked into multiple levels so that important topics would not be overlooked.

Each volume's HICCs reflect key developments in its respective era. For example, Volume Four details the impact on cartography of the flowering of science, technology, and rational philosophy in the eighteenth century, when mapping became an important instrument of scientific inquiry, especially in the natural sciences, and maps based on observation and measurement had become markedly less decorative than their Renaissance counterparts. In addition, the map was now a powerful device for organizing knowledge in a revealing, readily accessible way as well as a commonplace tool of governmental administration, including planning and maintaining public civil infrastructure. Military cartography faced a similar need for systematic mapping after the open battlefield replaced the prolonged siege of fortified cities as the primary strategy for confronting hostile rivals. No less important to Enlightenment cartography was an increased public consumption of maps fostered by an expanding middle class and related improvements in literacy and education. By 1800 maps were a distinct part of Europe's visual culture.

The nineteenth century witnessed a strengthening of cartography's relationships with measurement, mathematics, and statistics, readily apparent in the diverse and complex thematic maps that accompanied advances in the physical, biological, and social sciences and in medicine and public health, all of which used maps for exploratory analysis, hypothesis testing, and serendipitous discovery. Geodetic networks

grounded in improved technologies for measuring angles and distances provided a framework for the mapping and demarcation of political boundaries and for the detailed topographic and hydrographic maps important to economic development and military defense. Mapping also supported the growth and densification of railway networks, particularly in Europe and North America, as well as mineral exploration and nascent efforts to inventory natural resources. By mid-century sparse networks of atmospheric observations had provided an empirical basis for understanding the development of storms and demonstrated the practicality of forecasting weather; by century's end map-intensive operational meteorology had become an essential service of central governments. International cooperation in meteorology, geology, and geography fostered an appreciation of standardized measurements that culminated in the International Meridian Conference, which established the Greenwich meridian as the global standard for longitude in 1884 and provided a stable framework for the worldwide system of time zones, which continued to evolve in the following century.

Mapping's close relationships to society and technology are particularly apparent in the emergence of a mass cartography promoted by lithography, photography, and industrialized map production, exemplified in turn by inexpensive reference atlases for the home, textbooks with abundant maps, and school atlases. Increased consumption of maps by government, business, and the public accompanied the growth of geographic and general literacy, which also benefited from improved access to public education and municipal libraries. By 1900, a fitful increase of maps in newspapers reflected a growing thirst for spatial information as well as advances in printing and engraving.

## Twentieth-century developments

Technology and map use combined with state formation and global forces to make the twentieth century a distinctive and coherent period of map history. Overhead imaging emerged early in the century when the integration of photography and propeller-driven airplanes provided systematic aerial surveys for topographic mapping and related administrative and military endeavors. Satellite surveillance and the electronic capture and processing of overhead data, which followed in the 1960s, were part of a far-reaching electronic transition that included geographic information systems, global positioning systems, enhanced methods for measuring distances and angles and for reconciling measurement errors, and the computational power required for fly-by animation, LiDAR imaging, network adjustment in geodesy, advanced spatial statistics, and the numerical simulation of environmental processes (Foresman 1998).

Technologies that combined transport and mapping fostered new kinds of national territory. Maps were used to partition and control navigable airspace, extend terrestrial boundaries seaward, and divide the seabed on the continental shelf and beyond. The cartographic coastline provided an anchor for exclusive economic zones 200 nautical miles wide, which encroached on the high seas, created heretofore improbable neighbors like Japan and the United States, and precipitated litigation before the World Court when coastal neighbors could not agree on a common boundary. In addition, submarine mapping and space exploration produced remarkably detailed maps of the ocean floor, the Moon, Mars, and asteroids a few kilometers wide, which in turn revealed prominent features like seamounts (sub-marine volcanoes) and impact craters amenable to international naming conventions. As with the electronic gazetteers developed to support topographic

mapping, computerized inventories of feature names provided a framework for applying new toponyms and resolving disputes.

Exploration and mapping of outer space and the seafloor continued the longstanding association of cartography and warfare, a synergy further underscored by weapons systems like the cruise missile and the unmanned aerial vehicle, or drone, which made air strikes both more precise and more likely, thereby undermining diplomacy while reducing (but hardly eliminating) civilian casualties. Military spending was a driving force, directly or indirectly, behind many developments in geospatial technology, which trickled down to civilian applications and reproduced a multitude of prohibitive cartographies (Monmonier 2010). Developments rooted in military research include GPS, digital terrain models, and high-interaction display software like Google Earth. These origins spawned debates, still ongoing, over whether geospatial technology can ever be value-neutral (e.g., Harley 1991).

Particularly noteworthy is GPS, originally devised to guide cruise missiles but used widely after 2000 for vehicle navigation and traffic-flow monitoring, land survey and environmental data collection, and tracking sex offenders, criminal defendants, Alzheimer's patients, children, pets, and packages. An essential component of almost all wireless telephones, GPS supports instantaneous map displays of the user's immediate surroundings and can compile extensive location histories, invisible to the user but archived indefinitely in the interest of national defense. Although the marked expansion of satellite surveillance after 1990 epitomizes the diverse impacts of mapping on society during the twentieth century, earlier cartographic activities with important influences on individuals and society at large include highway mapping, weather prediction, hypothetical environments proposed by planners and landscape architects, and video

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entertainment for both mass audiences and individual users. Video games, which are inherently spatial if not blatantly cartographic, enhanced players' hand-eye coordination and raised expectations among a new generation of map users.

The twentieth century also witnessed a markedly increased use of maps as tools of public administration, for diverse activities such as land-use zoning, hazard modeling and mitigation, real-property assessment, community policing, and the creation and adjustment of special districts for historic preservation, additional municipal services, and school attendance. Particularly significant is the redistricting software that raised partisan gerrymandering to new levels, first by promoting bizarre congressional districts in the remap following the 1990 Census and then by using shape geometry to craft equally effective but less visually inflammatory gerrymanders that undermined collaborative decision-making by giving one party a distinct advantage in the vast majority of districts. The inherent ambiguity of geospatial technology became apparent when interactive software that encouraged citizens to create alternative redistricting plans reinforced the questionable notion that single-member districts and first-past-the-post voting are essential for representative government (Monmonier 2001).

No less emblematic of twentieth-century cartography is the paradox of globalized practices and customized content. Global standardization reflected increased communication within distinct mapping communities such as national mapping agencies, commercial mapmakers, and academic cartography. Textbook authors codified symbolization strategies, and successful software developers, most notably Esri, introduced new terminology and a standardized aesthetics readily implemented by a swelling cohort of eager users no longer hamstrung by the tedious, error-prone tasks of pen-and-ink cartography and manual

digitizing. New mapping communities arose along a spectrum stretching from the necessary uniformity of aeronautical charts and to the purposeful pursuit of novel advertising and tourist maps. In addition map projection software allowed a wider range of custom-tailored geometric frameworks, and a web cartography that empowered map users to be their own map-makers precipitated widespread customization of geographic scope, map scale, and content. Because millions of these use-specific maps were printed on inexpensive ink-jet and laser printers, the predicted demise of the paper map was delayed if not circumvented.

### Map history as an institutional endeavor

As an intellectual enterprise, the history of cartography is particularly indebted to the Russian historian Leo Bagrow (1881–1957), who built upon the facsimile atlases of Santarém, Jomard, and Nordenskiöld by establishing the journal *Imago Mundi* in Berlin in 1935. Its premier issue included several short notices, a bibliography of recent literature, and twelve articles – nine in German and three in English. Its subtitle, printed in both languages (“*Jahrbuch der alten Kartographie/ Yearbook of Old Cartography*”), underscored a focus on pre-nineteenth-century maps. Bagrow had written on map history while working as a hydrographic surveyor in the Russian navy. In 1918, he emigrated to Germany and in 1945 he moved again, to Sweden, where he continued to edit the journal until his death in 1957 (Skelton 1959). Despite multiple publication gaps related to geopolitical turmoil and editorial turnover – no issues were published for 1936, 1938, 1940–1946, 1957–1958, 1961, 1973–1974 – an increase from one to two issues per year in 2004 underscored *Imago Mundi*'s role

as the history of cartography's most influential academic journal.

J.B. Harley and Michael Blakemore highlighted *Imago Mundi's* crucial role in a content analysis of its first 30 volumes. Most of the articles published between 1935 and 1978 examined readily available printed maps “published in relatively large numbers, on paper or similar transportable media, yet which were sufficiently old to be of historical importance” (Blakemore and Harley 1980). Less than 5% of the articles examined mapmaking after 1800, and 78% of the mapmakers were Europeans. In concluding that prior scholarship collectively underrepresented important activity after the “Age of Discovery,” they identified three overarching themes: a Darwinian paradigm that emphasized steady, progressive improvement, typically by hypothesizing distinct stages of development; an “old is beautiful” paradigm that underscored an antiquarian fascination with Renaissance maps, their decorative flourishes, and heroic mapmakers; and a nationalist paradigm that reflected convenient access to maps produced in the authors' homelands. They concluded that the history of cartography was a fragmented discipline lacking coherence and balance.

Matthew Edney (2014), who tabulated both pages and articles, extended the analysis through 2010. In general, empirical studies dominated scholarship on map history throughout *Imago Mundi's* first 75 years. Edney identified three primary approaches to map history, which he labeled traditional, internal, and sociocultural. Traditional approaches, including biographical and bibliographical essays and content analyses, were dominant until the early 1960s. Internal studies, which focused on map forms and their related technologies and procedures, were then preeminent in the journal until around 1985 when traditional approaches enjoyed a brief

resurgence before losing ground to sociocultural studies after 1990. Geographical mapping has been the dominant mode throughout the period, accounting for 65% of all articles followed by marine charting at 15%. Although Renaissance cartography was the dominant chronological focus throughout the period, followed by Enlightenment cartography, “modern topics” (essentially the eighteenth and nineteenth centuries) emerged in the 1980s as a third theme. Overall, the twentieth century has fared no better than non-Western cartography, which accounts for only 10% of *Imago Mundi's* content.

The sociocultural turn is synonymous with the rise of a “critical history of cartography,” a rubric too readily conflated with Marxist, structuralist, poststructuralist, postmodern, and other avowedly “theoretical” academic ideologies that sometimes read like conspiracy theories. Nonetheless, the sociocultural history of cartography is fundamentally *critical* in its focus on questioning the map's creation and use in contexts that are intrinsically social, political, or cultural. This contextualized probing is inherently interdisciplinary as demonstrated by the active participation of art historians, literary theorists, social and political historians, and other humanists and social scientists at academic conferences on map history and in the pages of *Imago Mundi*.

As an intellectual discourse, the history of cartography relies not only on a refereed international journal but also on the synergy of face-to-face discussion at meetings like the International Conference on the History of Cartography (ICHC), initiated at London in 1964 and held every two years since 1967. *Imago Mundi, Inc.*, a registered charity in Britain, which appoints the journal's editor and editorial board, oversees ICHC. In 2011 a group of scholars associated with the charity formed the International Society for the History of the Map, which

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holds its own symposia and whose dues-paying members elect officers and are eligible for a reduced-rate subscription to the journal. The Commission on the History of Cartography, affiliated with the International Cartographic Association, also promotes map history. The Commission holds its own biennial symposia, a year out of sync with the ICHC and focusing on the nineteenth and twentieth centuries.

A third organization, the International Map Collectors Society serves map collectors, map dealers, and cartophiles in general by sponsoring an annual map fair in London and publishing the quarterly *IMCoS Journal* to which academic map historians often contribute. The symbiotic relationship between cartophiles and historians of cartography accounted for short-lived popular periodicals such as *The Map Collector's Circle* and *The Map Collector*, published in Britain 1963–1975 and 1977–1996, respectively, and *Mercator's World*, published in the United States between 1996 and 2003. *The Portolan*, published by the Washington Map Society since 1984, is a prominent example of a map history newsletter published by a state or local map society.

The intellectual apparatus of map history also includes specialized bibliographies of maps or mapmakers, such as Robert Karrow's masterful 876-page *Mapmakers of the Sixteenth Century and Their Maps: Bio-bibliographies of the Cartographers of Abraham Ortelius, 1570*. Published in 1993 by the Newberry Library, *Mapmakers* exemplifies map history's close ties to map collections at national, university, and endowed research libraries like the Newberry. Institutional map collections regularly sponsor themed exhibitions, and bibliographies and cartobibliographies advertise their holdings to historians and other empirical scholars.

Map history's scholarly infrastructure also includes online map collections and directories. Most institutional map collections have a presence on the Internet, and many websites provide carefully researched descriptions as well as zoomable map viewers, which allow detailed inspection of symbols, labels, and text. Particularly prominent is the David Rumsey Map Collection ([www.davidrumsey.com](http://www.davidrumsey.com)), a trove of high-resolution images scanned from the private holdings of a successful real estate investor. In 2009 Rumsey announced his plan to donate his entire collection of maps and digital images to Stanford University. Other valuable online resources are the Map History Gateway ([www.maphistory.info](http://www.maphistory.info)), maintained by Tony Campbell, former map librarian at the British Library, and the International Directory of Researchers in Map History ([www.maphistorydirectory.org](http://www.maphistorydirectory.org)), hosted by the Osher Map Library at the University of Southern Maine on behalf of Imago Mundi, Inc., which published nine editions of a printed directory between 1975 and 1998.

In sum, both cartography and map history have changed markedly during the twentieth century when overhead imaging and dynamic cartography emerged as distinct modes of mapping practice and both mapmaking and map use became more standardized globally, more customized to the preferences of individuals, and more crucial to science and government. In this vein the societal impact of mapping became more readily apparent not only in enhanced surveillance by the state but also in formal resistance through counter mapping. And by century's end map history had moved beyond the antiquarian tastes of map collectors to become an interdisciplinary scholarly endeavor with strong ties to geography, librarianship, the humanities, and the history of science. The *History of Cartography* series exemplifies this intellectual

maturation in its concern for the societal context within which maps were produced and consumed.

**SEE ALSO:** Cultural turn; Ethics in GIScience; Exploration; Geodesy; GIS: history; Governmentality; Interdisciplinarity and geography; Scale; Surveillance; Technology; Toponymy; Visualization; War

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## Further reading

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