

## **Cartography: Map Types**

**Denis Wood** (denis.wood@mac.com)

3205 Hillsborough St.

Raleigh NC 27607

**John Krygier** (jbkrygier@owu.edu)

Department of Geology & Geography

Ohio Wesleyan University

Delaware, OH 43015

**Keywords:** applied maps, classification, particular maps, thematic & reference maps, universal / general maps

**Synopsis:** To classify is human, as is to reclassify. Accepted map types vary over time in tandem with different criteria for classification. This essay reviews common map typologies and their evolution overtime. It links such classifications with the intents and goals of the typologists and details recent shifts in map typologies, tied to shifts in mapping technologies, who create maps, and how we think about mapping.

### **Glossary**

Applied maps: an early term, used by Eckert in 1925, for the category that would later become thematic maps.

Classification: systematic grouping based on assumed similarity of items.

Particular maps: maps of some area less than the entire earth. As compared to Universal or General maps.

Thematic maps: one of two grand classes of maps (the other being “reference maps”) distinguished by a “special purpose” or focus on one or a few distributions of specific data (usually statistical). Also known as applied maps, special purpose maps, statistical maps.

Reference maps: one of two grand classes of maps (the other being “thematic maps”) distinguished by a “general purpose” or focus on a collection of general environmental data (eg., roads, boundaries, cities, states, etc.).

Universal or General Maps: scale based classification including all maps of the world as a whole. As compared to particular maps.

That the classification of maps is not for the faint of heart was made clear as long ago as 1692 when, in a supplement to *Norte de la Navegación Hallado por el Cuadrante de Reducción que Ofrece*, the Basque geographer Antonio Gaztañeta y de Iturribáizaga sorted maps into the following categories: 1) those hidden as state secrets; 2) rolled, not folded; 3) folded; 4) those which flake when handled; 5) those whose colors suppose precepts; 6) imaginary, or genuinely imaginary; 7) blank; 8) those that are oriented; 9) unoriented; 10) those that can be read like a book; 11) those of fusty smell; 12) shared among the faithful; 13) those capable of alarming the meek; and 14) additional copies. Nearly three hundred years later Helen Wallis and Arthur Robinson ventured a more capacious categorization in their *Cartographical Innovations* of 1987. The 191 map types they identified included the following: 1) chorographic; 2) fan; 3) globe, pocket; 4) imaginary; 5) plan, plat; 6) tactile; 7) enclosure; 9) moral statistics; 10) sanitary; 11) tithe; 12) eclipse; 13) magnetic north; 14) wave directions; 15) flow line; 16) point symbol, divided circle; 17) spot height; 18) hand colored; 19) lettering, type inserted; 20) map surface, ceramic; 21) map surface, metal; 22) anaglyptographically reproduced; 23) inked; 24) atlas, island. One of these two map type classifications is fictional and one is real, and it is difficult to ascertain which is which.

To classify, of course, is human and doubtless there are as many classifications of maps as there are types of maps in the classifications. But human action is always motivated, and during the twentieth century what motivated the dominant classification of maps – the division into two overarching types, the *general-purpose* (or *reference*) map and the *special-purpose* (or *thematic*) map – was the need to isolate and make visible a practice of making small-scale, typically statistical maps that could be justified as a subject in a university curriculum. The classification emphasized a division of labor between technicians, who were responsible for the reference (topographic, base) maps, and scholars, who created the thematic (special purpose, applied) maps. Excluded thereby were those who were neither technically trained nor academically educated to make maps, that is, everyone else. This division of maps and their making arose in the nineteenth century as part of an effort to rationalize a scientific cartography in the service of a geography struggling to validate its status as a science. Today this “great types” classification is withering along with the academic enterprise that called it into being. The terms of the classification are largely meaningless to the vast majority of technically and intellectually competent people making and working with maps outside the cartographic establishment as, indeed, to most of those within it.

The division of maps into types began early in the history of mapmaking, but far more often than not it was a division based on differences in scale. On the one hand were maps of the world as a whole, that is, *universal* or *general* maps. On the other hand were *particular* maps, that is, maps of continents, regions, countries, or even smaller parts. Here, for instance, from his

*Dictionarium Britannicum* of 1730, is Nathan Bailey's definition of a map: "A plain figure, representing the several parts of the surface of the earth, according to the laws of perspective, or it is a projection of the surface of the globe, or part thereof in *plano*, describing the several countries, islands, seas, rivers, with the situation of cities, woods, hills etc. Universal maps, are such as exhibit the whole surface of the earth, or the two hemispheres. Particular maps, are such as exhibit some particular part or region thereof."

This scale-based typology served from the sixteenth century into the nineteenth when mapmaking began to be called upon to support the ambitions of geography to situate itself in the scientific academy. Inspired by the examples, as well as the labors, of Carl Ritter and Alexander von Humboldt, Hermann Berghaus began producing high-quality maps of climate, hydrography, vegetation, anthropology, ethnography, and other topics collected in his *Physikalischer Atlas* of 1838, which was later distilled, revised, and redrafted as *The Physical Atlas* by A. K. Johnston in 1848. During the latter part of the nineteenth century such "applied maps" as these were increasingly distinguished from less narrowly focused "geographic maps" at every scale. In his "On the Nature of Maps and Map Logic" of 1908, Max Eckert refined these map categories, distinguishing geographically *concrete* maps that "reproduce facts as they exist in nature, such as the distribution of land and water and of heights and depressions" from geographically *abstract* maps that "present, in cartographic form, the results of scientific induction and deduction and in most cases, can be traced back to the study of the scientist."

In 1925 Eckert expanded on his effort to establish the abstract maps as scientific in a discussion of "applied maps" in the second volume of his *Die Kartenwissenschaft*: "The applied map design is done at the desk of a scholar, because the practical cartographer has done enough in drawing a perfect base map," Eckert wrote. "Only seldom does the real cartographer proceed to the field of applied cartography. It is generally known that he has other work to do. Moreover he has no time to care about scientific problems and their translation into cartographic form which is a full-time occupation, because he is already totally occupied with his manual, but nevertheless scientifically guided work." As Eckert concluded, "The matter of applied map design is the very task of a geographer." Erwin Raisz, in the first textbook of cartography to appear in English, his *General Cartography* of 1938, distinguished between a similar pair of categories that he called *general* and *special*. He refined this distinction through a second edition (in 1948), and in a 1962 revision that he called *Principles of Cartography*.

By then, however, Nikolaus Creutzberg had rechristened the *special* category as *thematic* (in a paper of 1953), and Raisz now incorporated the new term in his revision: "Maps," Raisz wrote in 1962, "are of many kinds. Perhaps the most important difference is between serial and individual maps. Large-scale topographic maps and charts come in sets and are usually made in government offices with highly specialized equipment and broken down to jobs with rather rigid standards. In the second class we have maps often on smaller scale which the individual can design and draw. In the first, the technical training is the more important; in the second, the knowledge of geography and certain ability in graphic expression." This second category Raisz now broke down into 1) charts; 2) thematic or single-factor maps; 3) land-use maps; 4) city

maps; 5) transportation; 6) political and historical maps; 7) maps of the various sciences; 8) maps for illustrations and advertising; and 9) cadastral maps. Marking the growing importance of the thematic category was Eduard Imhof's simultaneous publication of *Thematische Kartographie*; and soon the "single-factor map" was the subject of Erik Arnberger's *Handbuch der Thematischen Kartographie* in 1966, Werner Witt's *Thematische Kartographie* in 1967 (with its second edition of 1970), and Sylvie Rimbert's *Leçons de Cartographie Thématique* of 1968.

Implicit in this classification was a narrative about the genesis of maps. Initially this had three phases. Raisz, for example, wrote in his 1938 text that: "The process of revealing the Earth's pattern has three phases: The surveyor measures the land, the cartographer collects the measurements and renders them on a map, and the geographer interprets the facts thus displayed." The problem with this version was that it minimized the role of the cartographer, and Arthur Robinson soon collapsed the three phases into two. In *Elements of Cartography* (1953) – which through its six editions would become the defining textbook for Anglo-American cartography in the second half of the twentieth century – Robinson reconceived the process as follows: "The entire field of map making is usually thought of as consisting of two distinct phases," he wrote. "The first is concerned with the detailed large-scale topographic mapping of the land or charting of the sea. The remaining large proportion of cartographic activity is less clearly defined, being usually thought of merely as smaller-scale, special cartography, or simply as *not* the first mentioned."

That is, Raisz's *surveying* was aggregated to topographic mapping, and his *interpretation* to what was soon to be rechristened thematic mapping. "Topographic mappers," Robinson went on, "make maps from field or air survey and are concerned with such things as the shape of the earth, height of sea level, land elevations, and exact and detailed locational information. Generally speaking, this group, which includes the great national survey organizations, national land offices, and most military mapping organizations, makes the basic maps from which the other group starts." This other group does not make maps from surveys but "using the detailed maps, compiles from them the basic data required and then proceeds to add relationships, generalizations, and a host of other kinds of material. To this group belong the geographers, historians, economists, and many others of the social and physical sciences who are seeking to understand and interpret the social and physical complex on the earth's surface."

This version of cartographic genesis actually creates three groups. In the first, of course, are those responsible for topographic mapping. Typically government employees, these work with highly specialized equipment at carefully defined tasks including surveying, drafting, engraving, and printing. That is, these mapmakers are technicians, laborers. Their adherence to strict standards, however, results in precision and accuracy. The second group uses the first's data to interpret social and physical patterns. These mapmakers are scientists, university people, professionals, thinkers. However, because their intellectual work is based on the careful labor of the topographers, it inherits the accuracy and precision of these technicians. Everyone else falls into a third group that is neither technically proficient nor educationally equipped to make maps. This renders any maps they might make of doubtful value.

Valorized above all by this typology were university cartographers and what was soon universally known as the thematic map. As it brought the thematic map to prominence, the typology also created a novel map type rarely catalogued, yet highly prominent in the literature. This was the base map. The base map was what university cartographers compiled from the technical work of the topographers: “All special-purpose maps are made on the foundation of a base map,” Robinson wrote in his first edition, where the base map was the subject of an entire chapter. “This base map is compiled first, and the accuracy with which it is made determines in large part the accuracy of the final map.” The base map fails to appear in cartographic typologies, however, because once the university cartographer has performed his interpretation, the base map disappears.

Classifications are systematic segmentations of the world. Ideally they’re consistent, clearly demarcated, and complete; in other words, they obey unique classificatory principles, consist of mutually exclusive categories, and have a slot for everything in their purview. It may be the case that no classification in existence fully satisfies these requirements, but the schemes of Eckert, Raisz, Robinson, Imhof, Arnberger and the others fall wildly short of the mark. The supporting story of how maps are produced is broadly untrue and historically it is emphatically false. For example, the corpus of maps made prior to the inauguration of large-scale topographic mapping was obviously not based on it, nor were the vast majority of later maps based on precedent mapping traditions, including urban cadastres, railway maps produced by houses like Rand-McNally, early highway maps, small-scale thematic maps in atlases of the nineteenth and early twentieth centuries, maps of diseases at large and small scales, Sanborn insurance maps, most planning maps, illustrative and advertising maps of all kinds, and so on. Indeed it is hard to say to what extent even today the origin myth has much validity.

None of these problems, however, mattered at mid-century when university cartographers were attempting to justify their positions on university faculties. As students of classification have long observed, among other things, classifications are about struggles for professional authority. Foreclosing one labeling option as they preset others, categories valorize this point of view and silence those. Valorized by the map types constructed by Eckert, Raisz, Robinson, Imhof and the rest, were academic mapmakers like themselves and the maps they alone made, the thematic maps that were shifted by this academic classification from a marginal position in the world of maps to center stage.

Ensuing developments were dramatic. Robinson had not used the word “thematic” in the first (1953) edition of his text, but Imhof, Arnberger, Witt, and Rimbert had all published their thematic cartography texts by the time Robinson published his third edition (with Randall Sale in 1969). Dispensing with efforts to classify map types (“To attempt to catalog with precision the infinite number of kinds and uses of map is an impossible task”), Robinson immediately launched into a history of cartography. Where in the earlier editions this history had moved from “The Beginnings of Cartography” through “The Early Modern Period” to “Twentieth Century Cartography,” in the third edition it moved from “The Beginnings of Cartography” through “The Dark Ages,” “The Renaissance,” and “The Early Modern Period” to “The Rise of Thematic

Cartography.” “In addition to the nautical chart and the topographic map,” Robinson now wrote, “a third great class, the thematic map, was added to the repertoire of cartography by the early nineteenth century.” Noting that in the past the thematic map had been called the “special purpose map,” Robinson claimed that, “Its main objective is specifically to communicate geographic concepts such as the distribution of densities, relative magnitudes, gradients, spatial relationships, movements, and all the myriad interrelationships and aspects among the distributional characteristics of the earth’s phenomena.” At this point in the text Robinson recapitulated the substance of his earlier “two phase” description of the field, but when he reached the second, dependent phase, he now added, “The other category, which includes thematic cartography ...”

By the time of his text’s fifth edition, with Sale, Joel Morrison, and Phillip Muehrcke (in 1984), the moves Robinson had made in the third edition had been solidified. Among other things, Imhof’s textbook had gone into a second edition (in 1972), Arnberger had supplemented his *Handbuch* with his *Thematische Kartographie* (in 1977), Barbara Petchenik had provided psychological justification for the claims of thematic mappers in her “From Place to Space: The Psychological Achievement of Thematic Mapping” (in 1979), and Robinson himself had published *Early Thematic Mapping in the History of Cartography* (in 1982). This last meant that a map type that had existed for scarcely more than a generation now had a history which, in a burst of retrospective reclassification, relegated most of the history of mapmaking to “The Development of the Base Map,” while it hitched the history of thematic mapping to the prestigious history of science. Finally, the first edition of Borden Dent’s *Principles of Thematic Map Design* was to appear the following year (1985) with its definitive opening: “Maps are graphic representations of the cultural and physical environment,” Dent intoned. “Two subclasses of maps exist: general-purpose (reference) maps and thematic maps. This text concerns the design of the thematic map.”

Can it be surprising that Robinson now felt empowered to risk a classification of maps? While continuing to acknowledge that the variety of maps was unlimited, there were, he now ventured, “recognizable groupings of objectives and uses for maps, which permit us to catalogue them to some degree.” He discussed these under three headings: scale, function, and subject. Scale varied, Robinson noted; and there was no limit to the possible subjects of maps; but when it came to function, there were three classes: general maps, thematic maps, and charts. Since Robinson had now isolated scale as an independent factor, he could be more subtle than he had been even as recently as 1969. Large-scale general maps are still usually topographic, but Robinson acknowledged that much larger scale maps are often required by engineers, and that small-scale general maps of states, countries, and continents also exist. General maps are typified by the portrayal of “things such as roads, settlements, boundaries, water courses, elevations, coastlines, and bodies of water.” Thematic maps, which now may be large- as well as small-scale, “concentrate on the spatial variations of the form of a single attribute, or the relationship among several.” Charts remained segregated in a separate class to serve the needs of nautical and aeronautical navigation.

The triumphant progress of the thematic map continued. Arnberger's *Thematische Kartographie* went into a second edition (in 1987), and Dent's *Principles of Thematic Map Design*, now called *Cartography: Thematic Map Design*, went into a second (1990), third (1993), fourth (1996), and fifth edition (1999). In 1992 Judith Tyner published *Introduction to Thematic Map Design*. Tyner's slant on map classification was individual. While acknowledging that there were three classes, Tyner made these out to be general-purpose, special-purpose, and thematic. General-purpose maps, she proposed, "do not emphasize one type of feature over another," while special-purpose maps "are created for a very specific type of user. Geologic, soil, and cadastral maps are included here," along with all navigational maps. Thematic maps, Tyner allowed, "have been called a variety of names (special subject, statistical, distribution, and data maps) but the term 'thematic' is now generally accepted." She stressed a point subdued since Raisz: "Although general-purpose and special-purpose maps are produced by cartographic agencies, institutions, and firms (frequently by teams of specialists such as surveyors, photogrammatrists, designers, and cartographers), a thematic map, even if produced by a similar agency, is probably the work of only one or two people."

There were, of course, dissenting voices. In his *Cartographic Design and Production* (of 1973), J. S. Keates noted that the "expression 'thematic' does suggest that the subject-matter deals with a particular theme or subject, but as this is true of all maps it is not particularly helpful in determining a category." In his later *Understanding Maps* (1982, with a second edition in 1996), Keates also argued that cartography had arbitrarily limited its scope with its emphasis on the thematic map. John Campbell acknowledged the reference/thematic distinction in his *Introductory Cartography* (of 1984) but he also observed that the "problem with dividing maps into reference and thematic types is that there is no clear-cut dividing line between the two." Phillip Gersmehl echoed this sentiment in his *The Language of Maps* (1991) when he noted that, "The distinction between reference and thematic is thus more than a little blurry."

Despite such blurring and polite internal discussions about things like Tyner's special-purpose maps, the orthodoxy of the reference/thematic distinction, and the history and the production hierarchy it entailed (including cartography positions on university faculties), seemed secure as the 1990s opened; but in fact, heterodox arguments had been gaining adherents throughout the 1980s, and these came from a confounding number of directions. Critics such as Denis Wood (especially in his *The Power of Maps* of 1992) and Brian Harley (in a number of essays collected in 2001 as *The New Nature of Maps*) called into question the relevance of the classification to anything but the authority it granted academic cartographers, and Wood in particular stressed its inadequacy as a formal classification. Others, including Robert Rundstrom (in articles he began publishing in 1990) and Doug Aberley (in his *Boundaries of Home: Mapping for Local Empowerment* of 1993), attacked the marginalization of non-professional mappers. They insisted that everyone was capable of making maps, and they theorized a growing body of mapping by First Peoples, bioregional activists, English parishes, and others, that has matured into a fully-fledged, counter-mapping movement (see the critical cartography article in this volume). Artists, too, who had worked with maps for decades, began to produce art maps in

astounding numbers (see the article in this volume). Many of these were explicitly constructed to call into question the authority of the received mapping tradition, and to deny, confound, ignore, or contest received map types.

At the same time the academic discipline built around the hand-crafting of thematic maps was being ever more rapidly consumed by what gradually became known as Geographic Information Science. GIS software, particularly once it spread to personal computers and the internet, made it possible for anyone to make maps (or at least the map types the software allowed you to make). Since the software contained the basic intellectual knowledge of the academic cartographer (for example, the functions and defaults involved in thematic mapping) and eased the technical skills required to make maps, it further empowered mapmakers outside the profession who, without a need to justify a position in the academy, found little utility in the reference/thematic distinction.

But the distinction is losing its force even within what remains of cartography. In 1999, Terry Slocum published *Thematic Cartography and Visualization*, sure to be the last in the lineage of comprehensive thematic cartography texts that was inaugurated with Imhof's *Thematische Kartographie* in 1962. In Slocum's second edition, retitled *Thematic Cartography and Geographic Visualization* (with Robert McMaster, Fritz Kessler, and Hugh Howard, 2005), Slocum pretty much dissolves the distinction when he admits that, "Although cartographers commonly distinguish between general-reference and thematic maps, they do so largely for the convenience of categorizing maps. The general reference map also can be viewed as a thematic map in which multiple attributes are displayed simultaneously; thus, the general-reference map can be termed a multivariate thematic map. Furthermore, although the major emphasis of general-reference maps is on *location* of spatial phenomena, they can also portray the *spatial pattern* of a particular attribute (e.g., the pattern of drainage on a USGS topographic sheet)." Cynthia Brewer's *Designing Better Maps* (2005) rarely uses the term "thematic" and never defines it; while John Krygier and Denis Wood intentionally excluded the terms "thematic," "reference," and "base map" from their *Making Maps* (2005).

To classify remains human, however, and the classification of maps endures unabatingly. The Cambridge Historical Commission files maps under the following categories: 1) Raisz Maps, 2) First Period Reconstructed Maps, 3) Harvard Maps, 4) Insurance Maps, 5) Library of Congress Maps, 6) Sanborn Maps, 7) USGS Quad Maps, 8) Ward Boundary Maps, 9) Transit Maps, and 10) Miscellaneous and Correspondence Maps. In *Mapping Hacks: Tips and Tools for Electronic Cartography* (2005), which details an array of techniques, tricks, and hacks that anyone can try, authors Schuyler Erle, Rich Gibson, and Jo Walsh sort mapping into nine categories: 1) mapping your life, 2) your neighborhood, 3) your world, 4) mapping on the web, 5) mapping with gadgets, 6) mapping on your desktop, 7) names and places, 8) building the geospatial web, and 9) mapping with other people, a classification that reflects the burgeoning interest in mapping outside academic cartography and its growing relevance to everyone's life. In their *Else/Where: Mapping* (2006), Janet Abrams and Peter Hall attend to the diverse creative community working with maps, which they divide into four classes: 1) mapping networks, 2)



mapping conversations, 3) mapping territories, and 4) mapping mapping. Their typology embraces the most traditional of maps as well as many far beyond anything academic cartographers would agree were maps. Not only are such distinctions as that between thematic and reference maps missing from these books, so is any reference to the academic cartography literature. Except as it is embedded in GIS software, it is almost as though the world of mapmaking dreamed by Eckert and built by Raisz, Robinson, Imhof, Arnberger, and others, had never even existed.

The future proposes a further relaxation of typological rigor. If anything defines early twenty-first century mapping it is surely the Google Map mashup. A mashup combines content from multiple sources into a single hybrid. While maps have always been mashups (traditionally known as compilations), technology such as Google's application programming interface allows just about anyone to create maps from diverse data sources created by themselves and others. As such mapping technology continues to evolve and grows in accessibility, and as more people make increasingly sophisticated and diverse maps, new map types and new classifications of map types are sure to follow.

*Plus ça change ...*