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VIEWPOINT



## Motives for Patenting a Map Projection: Did Fame Trump Fortune?

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### ABSTRACT

John Parr Snyder claimed that patenting a map projection was largely pointless because essentially similar transformations are readily available in the public domain. Map projection patents are rare, many patentees did not attempt to develop their patents, and none who did seems to have made much money. An explanation for their decision to patent lies in recognition that the patent system and peer-reviewed scientific journals are parallel literatures, either of which can satisfy an innovator's need for attention, as suggested by achievement motivation theory. Moreover, no single factor can account for the invention of a map projection that was patented: not mathematical expertise; not work experience as a draftsman, map publisher, or professional geographer; and not prior experience with the patents system. But for all but one of the 17 inventors for whom microdata research tools yielded basic details about their lives, at least one of these factors was present.

### KEYWORDS

History of cartography; map projection; patents; invention; achievement motivation theory; John Parr Snyder

## Introduction

This paper summarizes the 21 patented map projections discussed individually in a chapter in my recent book *Patents and Cartographic Inventions: A New Perspective for Map History* (Monmonier, 2017). It extends that discussion with a more systematic exploration of factors that might account for both a projection's invention and its inventor's decision to seek patent protection. In addition to illustrating the relevance to map history of achievement motivation theory and microdata research tools used by genealogists, it questions the reliability of explanations based on inference and spotty data.

My decision to devote a chapter to map projections was partly inspired by the late John Parr Snyder, who argued that to patent a projection was pointless insofar as anyone who might want to use a patented projection could avoid paying a licensing fee by finding a non-patented projection with essentially similar properties (Snyder, 1993: 302). He bolstered this argument by noting that very few projections had ever been patented. Indeed, his monumental 1993 history *Flattening the Earth: Five Hundred Years of Map Projection* and his *Bibliography of Map Projections* (Snyder and Steward, 1988), compiled with geographer Harry Steward, collectively mention only 14 patented projections. By contrast, his impressively exhaustive *Bibliography* lists 2551 publications of all types, mostly technical articles describing a particular projection and its development, useful properties, and pattern of distortion.

## Intellectual property and parallel literatures

Filing a patent is not the only way to turn a clever idea into intellectual property: a map cast on an innovative projection can be printed, published, and registered for copyright. Although the copyright protects only a particular instantiation of an idea, it is inherently more durable. In the United States, for instance, a patent lasts only about 20 years whereas a copyright might last 120 years (Monmonier, 2017: 8). I say 'about' and 'might' because the duration of both kinds of property right has changed over time, with the imposition of a mandatory maintenance fee shortening the life of some patents, and successful lobbying of the Congress extending the term of copyright to lengths beyond the comprehension of the Constitution's Framers (Monmonier, 2017: 29–31). This seems an appropriate point to note that I focused on patents awarded in the United States. That said, I strongly doubt that similar investigations focused on patent systems elsewhere would yield markedly different conclusions.

An important difference between patents and copyrights is that the patent system requires publication so that subsequent inventors might advance, rather than merely reinvent, the state of the art. Moreover, when a patent drawing is published, it is in the public domain from the outset, and can be reproduced without any need to obtain permission – an obvious boon to anyone who writes about patents.

Mandated publication made the patent system a complement to the more typical system of scholarly, scientific, and technical publishing. These systems are parallel literatures that not only disseminate information about innovations but also provide quality assurance, with the conventional journal relying on editors and referees as editorial gatekeepers, and the patent system depending on a rigorous and often contentious vetting by patent examiners. (I can say ‘contentious’ because I have read some of the relevant correspondence in the US National Archives and can attest to the patent examiners’ careful scrutiny and insistence on clarity, novelty, usefulness, and non-obviousness.) A key difference is the patents system’s distinct dialect – I call it *patentesque* – which almost always requires the assistance of a patent attorney as both an official advocate and an editorial advisor or ghost writer. Published patents always include the attorney’s name.

## Twenty-one patented map projections

Although Snyder and Steward identified only 14 patented map projections, I expanded my dataset to 21 patents through a mildly obsessive probing of Patent Office databases as well as Google Patents, an online database related to the massive Google Books scanning initiative. Although the unique patent numbers referenced by Snyder and Steward made it easy to retrieve the corresponding patent documents, additional patented map projections were not easily identified, largely because patent titles are often short and vague, ‘map projection’ is not an official category in the US Patent Classification, and full-text searching with ‘map projection’ as the key almost always fingered an invention that was not a map projection. Moreover, every single plausible criterion I devised excluded at least one patented projection recognized by Snyder. In the end, I canvassed all remotely relevant categories, and when it was questionable whether a patent was for a projection or a globe, I included it (Monmonier, 2017: 137–138). Screening was largely visual because the drawings on a patent document’s first page are a consistently reliable indicator of its novelty and intended use. For consistency with Snyder’s analysis, I included only patents filed before 1990.

Table 1 summarizes the 21 patented map projections. To discern possible temporal trends, I sorted the rows according to the date of filing, and included each patentee’s nationality as well as the patent number and date of filing, and a concise description of the projection. Filing dates are only moderately clustered, with six of the 21 patents filed over the nine-year period 1937–1945, which seems faintly reflective of the Theory of Multiples (Ogburn and Thomas, 1922), often invoked for time-was-ripe explanations of prominent multiples like the apparent independent derivations of the Law of Conservation of Energy four times in 1847. This notion, which conflates mental prowess with state of the art or culture, might be relevant to both the invention of a map projection and its inventor’s decision to seek a patent.

Particularly intriguing is the cluster of polyhedral projections patented in the late 1930s and 1940s by James Addison Smith (1939), R. Buckminster Fuller (1946), Joel Crouch (1947), and Irving Fisher (1948). This cluster might reflect a heightened interest in global geopolitics related to German territorial expansion in the 1930s. By contrast, my research found noteworthy concentrations of map-related patents filed between 1911 and 1927 and between 1985 and 2000, but not for the 1930s and 1940s. Moreover, patent activity largely increased over time, but with noteworthy declines in the 1930s and early 1940s, amid the lingering effects of the Great

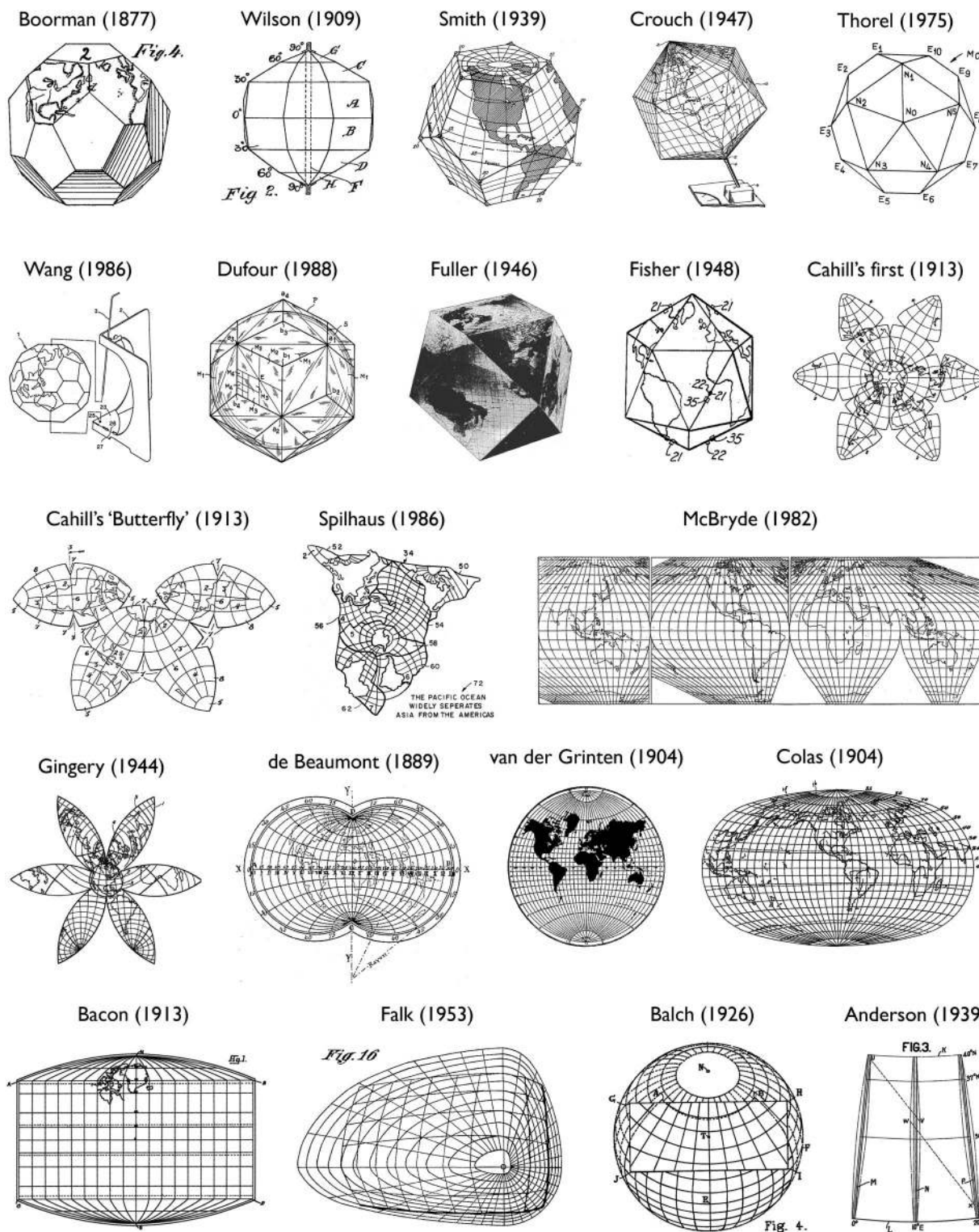
**Table 1.** Patented map projections and their inventors, ordered by date of filing.

| Inventor                       | Nationality           | Date of Filing | Patent No. | Description of Projection                |
|--------------------------------|-----------------------|----------------|------------|--|
| Boorman, J. Marcus             | USA                   | 06/07/1876     | 185,889    | polyhedral (15, 22, 23, 24, or 37 faces) |
| de Beaumont, Henry Bouthillier | Swiss                 | 15/10/1888     | 400,642    | whole-world (curved grid lines)          |
| Van der Grinten, Alphons       | USA (b. Germany)      | 02/10/1899     | 751,226    | whole-world (world in a circle)          |
| Colas, Jules A.                | USA                   | 24/02/1902     | 752,957    | whole-world (curved grid lines)          |
| Wilson, William                | British               | 28/07/1909     | 944,248    | 8 globe gores (48 faces)                 |
| Cahill, Bernard J. S.          | USA                   | 05/03/1912     | 1,054,276  | polyhedral (6 lobes, 12 sections)        |
| Bacon, George Washington       | British (b. USA)      | 04/05/1912     | 1,050,596  | whole-world (straight parallels)         |
| Cahill, Bernard J. S.          | USA                   | 11/02/1913     | 1,081,207  | polyhedral (4 lobes, 8 sections)         |
| Balch, Samuel W.               | USA                   | 12/12/1924     | 1,610,413  | projections for great-circle routes      |
| Anderson, William C.           | USA                   | 22/08/1936     | 2,155,387  | conic for plotting great-circle routes   |
| Smith, James Addison           | USA                   | 22/11/1937     | 2,153,053  | polyhedral (12 faces)                    |
| Gingery, Walter                | USA                   | 27/11/1942     | 2,352,380  | circle plus 6 petal-like lobes           |
| Crouch, Joel                   | USA                   | 25/01/1944     | 2,424,601  | polyhedral (20 faces)                    |
| Fuller, Richard Buckminster    | USA                   | 25/02/1944     | 2,393,676  | polyhedral (14 faces)                    |
| Fisher, Irving                 | USA                   | 19/02/1945     | 2,436,860  | polyhedral (20 faces)                    |
| Falk, Gerhard Ernst Albrecht   | German                | 10/02/1949     | 2,650,517  | photographic (larger scale city centre)  |
| Thorel, Jean                   | French                | 11/04/1974     | 3,868,781  | polyhedral (30 faces)                    |
| McBryde, F. Webster            | USA                   | 29/06/1977     | 4,315,747  | interrupted (7 lobes)                    |
| Spilhaus, Athelstan            | USA (b. South Africa) | 15/03/1985     | 4,627,622  | interrupted (3 lobes)                    |
| Wang, Su Hi                    | Taiwan                | 16/04/1985     | 4,620,842  | polyhedral (32 faces)                    |
| Dufour, Henri                  | France                | 16/03/1987     | 4,773,861  | polyhedral (30 faces)                    |



Depression. Though the numbers are small, this cluster of patented world map projections runs counter to both trends and suggests global conflict as a partial explanation for heightened interest in claiming a map projection as a property right.

Most of the 21 patents can be described as polyhedral, but they vary widely in number of faces. Moreover, their configurations are remarkably diverse, as described in Figure 1, for which I collected representative images from the published patents and thickened faint lines as needed. Amateur mathematician J. Marcus Boorman (1877) devised five different polyhedra, and most had facets that were not regular polygons. William Wilson (1909) invented a globe constructed from eight gores, each with six planar faces covering  $30^\circ$  of latitude, while Smith (1939), Crouch (1947), Jean Thorel (1975), Su Hi Wang (1986), and Henri Dufour (1988) presented their inventions



**Figure 1.** Representative illustrations from each of the 21 United States patents, identified by inventor and year of issue and ordered in the sequence discussed. Compiled by author from patent documents, all in the public domain.

largely as configurations of flat faces equal in size and shape, intended to approximate a globe. Fuller (1946) and Fisher (1948) provided both two- and three-dimensional examples, whereas Bernard J. S. Cahill (1913a; 1913b), F. Webster McBryde (1982), and Athelstan Spilhaus (1986) clearly intended their interrupted projections solely as flat maps. Interrupted but hardly polyhedral is the Walter Gingery's (1944) idiosyncratic arrangement of six lobate sections surrounding a circular map of North America like the petals of a flower. Also not polyhedral are the very different whole-world map projections patented by Henry Bouthillier de Beaumont (1889), Alphons van der Grinten (1904b), Jules Colas (1904), and George Washington Bacon (1913). The three other projections were highly customized. Gerhard Falk (1953) invented a photographic and mechanical strategy for mapping an urban area with a larger scale near the city centre, and its value is conflated with the arguably greater financial benefit of his unique folding scheme, also patented. The last two patents described map projections customized to address a navigation problem – Samuel Balch (1926) patented a method for plotting great-circle routes on an oblique Mercator or gnomonic projection, and William Anderson (1939) patented a somewhat similar approach for plotting great-circle routes to a cone.

## Training and experience

In an effort to discover relevant experience, including occupation and training, I used Ancestry Library Edition as a portal to manuscript census schedules, city directories, yearbooks, and other sources of microdata used by genealogists, and I supplemented these findings with searches of newspaper and periodical databases, which occasionally yielded a published obituary. What I found was edifying in some cases and disappointing in others. The two Frenchmen (Henri Dufour and Jean Thorel) and the resident of Taiwan (Su Hi Wang) left no biographical footprint, at least not in the sources I consulted, and I omitted them from subsequent tables. For several of the other inventors, the record is spotty. By contrast, Fisher, Fuller, and Spilhaus were widely hailed for their respective accomplishments in economics, architecture, and the earth sciences, and their life stories were comparatively easy to reconstruct.

For a systematic exploration of the roles that occupation, experience in drafting and mathematics, and familiarity with the patents system might have played in the decision to patent, I compiled Table 2 for the 17 inventors for whom I had information about their principal employment. All but one of them had at least one type of relevant expertise. Smith was the exception: although he worked as an Internal Revenue Service agent in Seattle, his facility with the arithmetic of tax accounting did not seem relevant to his invention of a map projection. By contrast, 13 were either adept in drawing maps, through employment as a draftsman (van der Grinten, Colas), architect (Cahill, Fuller), or mapmaker (Bacon, Falk), or probably understood relevant practices because of training as a geographer (de Beaumont, Wilson, McBryde), engineer (Balch, Couch, Spilhaus), or construction superintendent (Anderson). The engineers presumably had at least a basic understanding of trigonometry and analytic geometry, Boorman published articles in a magazine for amateur mathematicians, Gingery and Crouch held degrees in mathematics, and Fisher had co-authored an elementary textbook on plane and solid geometry (Phillips and Fisher, 1896).

Six of the 17 inventors had substantial prior experience with the patents system. Boorman and Balch worked as lawyers, and the latter advertised himself as both a patent attorney and a mechanical engineer. In addition, Boorman, Fuller, Fisher, and Spilhaus held several patents and were no doubt familiar with the process. Fisher, whose engagement with the Patent Office began when he was a student, had once patented a business records

**Table 2.** Occupation and relevant training and experience of inventors, ordered by filing date.

| Inventor (year of birth – year of death)   | Occupation(s)          | Drafting experience | Mathematical Expertise  | Patenting Experience    |
|--|------------------------|---------------------|-------------------------|-------------------------|
| Boorman, J. Marcus (1831–1909)             | Lawyer                 | Unknown             | amateur mathematician   | lawyer; earlier patents |
| de Beaumont, Henry Bouthillier (1819–1898) | Academic geographer    | [Geographer]        | unknown                 | little if any           |
| Van der Grinten, Alphons (1852–1921)       | Draftsman              | Draftsman           | unknown                 | Canadian & French       |
| Colas, Jules A. (1851–1929)                | Draftsman              | Draftsman           | unknown                 | little if any           |
| Wilson, William                            | Geographic educator    | [Geographer]        | unknown                 | little if any           |
| Cahill, Bernard J. S. (1866–1944)          | Architect              | Architect           | unknown                 | one for globe in 1913   |
| Bacon, George Washington (1830/1–1922)     | Map & atlas publisher  | Mapmaker            | unknown                 | one before, one after   |
| Balch, Samuel W. (1862–1940)               | Mech. engr; pat. atty. | [Engineer]          | [engineer]              | patent attorney         |
| Anderson, William C. (1891–1969)           | Construction super.    | [Blueprints]        | unknown                 | little if any           |
| Smith, James Addison (1900–1971)           | IRS agent (accountant) | Unknown             | unknown                 | little if any           |
| Gingery, Walter (1884–1979)                | Principal; math. tchr. | Unknown             | M.A., mathematics       | little if any           |
| Crouch, Joel (1899–1957)                   | Engineering professor  | [Engineer]          | B.S., mathematics       | little if any           |
| Fuller, Richard Buckminster (1895–1983)    | Architect, designer    | Architect           | unknown                 | multiple patents        |
| Fisher, Irving (1867–1947)                 | Economist, inventor    | Unknown             | geometry textbook       | multiple patents        |
| Falk, Gerhard Ernst Albrecht (1922–1978)   | Map publisher          | Mapmaker            | unknown                 | map-folding patents     |
| McBryde, F. Webster (1908–1995)            | Geographer, consultant | [Geographer]        | unknown                 | little if any           |
| Spilhaus, Athelstan (1911–1998)            | Geophysicist, inventor | [Engineer]          | B.S. engineering; Ph.D. | multiple patents        |

system that earned him several million dollars (Monmonier, 2017: 151). Falk, a German military veteran who became a street-map publisher in the late 1940s, sought patents in multiple countries. On the same day that he applied for a US patent for his map projection, Falk sought a companion patent for the distinctive map-folding strategy whereby a user could navigate to any part of the map without opening the entire sheet (Falk, 1951). Although several of the other inventors had prior or contemporaneous patents, Table 2 lists eight inventors as having ‘little if any’ patenting experience. In these latter cases, I could not reliably say ‘none’ because patents databases disclose neither failed attempts nor the patenting experience of relatives or close associates.

## Promotion and profit

The categories ‘little if any’ and ‘unknown’ are markedly more common in Table 3, which addresses inventors’ attempts to profit from their patents. Although I assume that van der Grinten had hoped to monetize his patent, his only apparent effort to promote the idea were two short articles published around the time his patent was awarded, one in Germany and one in the United States (van der Grinten, 1904a; 1905). Although he worked for Rand McNally, his employer apparently had little interest in licensing his invention. Ironically, his map projection framed the National Geographic Society’s whole-world map for 66 years, starting in 1922, a year after both van der Grinten and his patent expired (Monmonier, 2017: 165). Although Cahill (e.g. 1909; 1939) promoted his map projection in the conventional scientific-technical literature with a handful of articles spread over three decades, I found no evidence of a financial benefit.

The five inventors listed at the bottom of Table 3 actively promoted their patents, but the results were mixed. Although Falk’s many street maps exploited his patent, his map projection seems less relevant to the firm’s success than his innovative folding scheme (Falk, 1951). Fuller was an adept promoter who used the popular press to publicize his world map, but he soon abandoned his patented map projection for a reworked framework that he protected with both a map copyright and the trademarked name Dymaxion (Monmonier, 2017: 153–155). Fisher and McBryde published maps cast on their patented projections, but I found no hint of a noteworthy lucrative reward. Although Spilhaus obviously had diverse applications in mind, his patent’s title (‘Map puzzle having periodic tessellated structure’) referred to a cartographic jigsaw puzzle marketed in the later 1980s by GeoLearning Corporation, to which he apparently licensed both the patent and the use of his name (Monmonier, 2017: 159).

## The patent as a signifier of achievement

In addition to confirming Snyder’s opinion on the dubious profitability of patented map projections, Table 3 reveals a striking relationship with the inventor’s age at time of filing: except for Gerhard Falk, who was 26 at the time, all were older than 40. Indeed, Balch, de Beaumont, and McBryde were in their 60s, Fisher and Spilhaus were in their 70s, and Bacon was in his 80s. This suggests that at least a few inventors viewed a patent as a capstone accomplishment, significant as part of the official historical record of creative achievement. Indeed, a patent not only creates an intellectual property that can be sold or licensed, it also creates a permanent record that is arguably more lasting than a name engraved on a granite headstone, and markedly less common than a journal article. That said, journal articles can be a more effective way of permanently associating one’s name with a particular cartographic framework, especially if they led to a prominent adoption

**Table 3.** Inventor’s age at filing, initiative in promoting patent, and financial benefits from patent, ordered by filing date.

| Inventor                       | Age at filing | Efforts to develop or promote the patent  | Estimated earnings   |
|--------------------------------|---------------|---|----------------------|
| Boorman, J. Marcus             | 45            | Unknown                                   | Little if any        |
| de Beaumont, Henry Bouthillier | 69            | Unknown                                   | Little if any        |
| Van der Grinten, Alphons       | 47            | Article in <i>American J. Science</i>     | Little if any        |
| Colas, Jules A.                | 50            | Unknown                                   | Little if any        |
| Wilson, William                | ?             | Unknown                                   | Little if any        |
| Cahill, Bernard J. S.          | 46 or 47      | Intermittent articles 1909 to 1940        | Little if any        |
| Bacon, George Washington       | 82?           | Unknown                                   | Little if any        |
| Balch, Samuel W.               | 62            | Unknown                                   | Little if any        |
| Anderson, William C.           | 45            | Unknown                                   | Little if any        |
| Smith, James Addison           | 49            | Unknown                                   | Little if any        |
| Gingery, Walter                | 58            | Unknown                                   | Little if any        |
| Crouch, Joel                   | 44 or 45      | Unknown                                   | Little if any        |
| Fuller, Richard Buckminster    | 48            | Frequent and diverse                      | Overhauled           |
| Fisher, Irving                 | 77            | Various, incl. cut-out in children’s mag. | Modest at best       |
| Falk, Gerhard Ernst Albrecht   | 26            | Used for published Falk Maps              | Possibly significant |
| McBryde, F. Webster            | 69            | Academic article; published maps          | Probably modest      |
| Spilhaus, Athelstan            | 73            | Marketed as a game                        | Probably modest      |



of the projection or its repeated mention in the scholarly discourse. Of course, an inventor could score a dual achievement by memorializing his map projection in both a patent and one or more journal articles. Alphons van der Grinten, an otherwise unknown Rand McNally draftsman, scored a trifecta of sort – albeit posthumously – with a patent, a few journal articles, and a 66-year run as the National Geographic Society's world map.

That a patent represents official endorsement of a creative achievement ties the foregoing discussion to achievement motivation theory, articulated most prominently by social psychologist David McClelland (1961) in his book *The Achieving Society*. McClelland identified three acquired needs underlying much of human behaviour: the needs for achievement, affiliation, and power. Individuals vary in the extent to which they learned to pursue distinctive accomplishments, affiliate with a group or idea, or seek to control others. McClelland was fascinated with the need for achievement as revealed in the pursuit of prizes, successful business ventures, or the recognition (real or assumed) presumed to follow publication of a book, a poem, a scientific article, or a clever patent. Money is not the only symbol of achievement, he observed; diverse accolades can confer a sense of accomplishment. And if an inventor's motivation is not primarily financial, it is probably the need for recognition shared with amateur athletes, deer hunters, summer stock actors, people who enter puzzle contests, and most university faculty – a basic human agenda that conflates being noticed and being loved, and which, by extension, values fame above money.

For many of the inventors discussed above, particularly those with a career in law or engineering, or with a history of patent awards, filing a patent application was an obvious way to assert achievement. For inventors with an applied, non-academic bent and not aligned with the scientific-technical literature, the patent system must have seemed the obvious path to fame or archival immortality. Of course, a hobbyist who never learned to value recognition could merely file away his notes for heirs to discover, marvel over, and perhaps destroy.

### Inference and the limitations of microdata

Inferring the motives of long-deceased inventors is fraught with uncertainty, especially when inferences based on incomplete or spotty microdata like census schedules and city directories cannot be readily confirmed. Few inventors merited an obituary, even long obituaries are often incomplete, and microdata research tools developed mostly for genealogists often fail to link a person with a relevant census schedule. Moreover, the manuscripts for the 1890 US census were destroyed in a fire, census takers sometimes interviewed a poorly informed family member, non-disclosure rules in the United States embargo census information about individuals for 72 years, and not until 1940 did the US Census include a specific question about number of years of schooling. Although city directories might fill some gaps in the decennial census, directories were not always published every year, and when no one was home, the door-to-door canvasser might have relied on a misinformed neighbour or assumed that last year's entry was still reliable.

One anecdote underscores the frustrations posed by a fascinating link that cannot be reliably or readily confirmed, even with unacceptably obtrusive questioning of surviving relatives. Balch and Anderson, who separately patented map projections that focused on plotting great-circle routes, lived two miles apart in Montclair, New Jersey. Despite this unusual coincidence, I found no evidence that they knew each other. Balch was a mechanical engineer and patent attorney who devised a method for creating maps useful for plotting a shortest-distance route between two points as well as for allowing a navigator to determine the bearing and distance from the origin at any point along the route. Anderson was a construction superintendent with four years of college and sufficient mathematical savvy to create a map for plotting a great-circle route with a conic section and a protractor. Balch was not listed as Anderson's attorney, and as far as I can discern, neither developed his patent. Their geographic and conceptual proximity not only invites an inference that I have been unable to confirm but also raises the question of how obsessively a researcher is prepared to pursue a fact likely to remain elusive. And there remains the possibility that new information might invalidate the researcher's best guess.

### Concluding remarks

As readers no doubt understand, some of my statements are clearly speculative, and additional research is needed to confirm the argument that inventors who filed a patent application for an innovative map projection often sought fame rather than fortune. This additional research should encompass patent records for countries other than the United States, and because people's motives are inherently complex, a comprehensive study would require – as a minimum – access to personal correspondence and business records, which are often not preserved. Indeed, any argument involving motives, however intriguing, faces a daunting epistemological challenge.

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## Notes on contributor



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