DEVELOPMENT OF NEW TYPES OF TERRESTRIAL GLOBES IN THE NINETEENTH AND EARLY TWENTIETH CENTURIES

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The production and use of globes underwent significant changes in the nineteenth century. Terrestrial and celestial globes lost their exclusive meaning as scientific instruments and as valuable objects of representation. They became more and more simple teaching devices, used not only in schools and other educational institutions but also in private and semi-private environments of the bourgeoisie and of the bourgeois middle classes. The growing demand for globes and the application of modern cost effective industrial production methods were the preconditions that globes became commercially successful mass products. Subject of the following overview is one aspect of these complex processes: the development of new types of terrestrial globes. The focus of the considerations is therefore on new construction methods, functions, and uses. Relief globes and thematic globes as well as globes with new developed sophisticated mounting systems represent new, science-based cartographic expression forms and models. Globes to be illuminated from the inside and clockwork-driven globes stand for technological progress. ‚Snap open' globes, and the so called hanging or suspension globes were special developments for the use in schools. Cardboard dissected globes, collapsible or folding globes, inflatable globes, and umbrella-like globes are regarded as less expensive globe-like materials for teaching geography. Jigsaw puzzle globes, globes with magnetic attachments, and dollhouse globes involve also educational aspects and could be used in a playful manner as didactic aids.

Introduction

The production and distribution of globes underwent significant changes in the nineteenth century. Commercial serial production by larger companies and technical innovations led to the development of globes from handcrafted objects to standardized, industrial mass products. In contrast to the past, production took place in more and more countries; especially in the United States of America, numerous new globe-producing companies established themselves. Whereas previously globes, one earth globe and one celestial globe, were usually produced as pairs, from the middle of the century onwards producers increasingly dispensed with the celestial globe. Through the use of lithography to reproduce globe maps (from about 1850 also colour lithography), through simple assembly without complex mountings and through the use of mechanical presses for the production of the spheres, it was possible to produce globes much more cheaply than before and sell them at lower prices. That promoted the spreading enormously.

In the course of the nineteenth century, numerous small companies producing globes with low capacities were replaced by large companies with impressive production figures and supra-regional, sometimes international significance. The use of globes in schools and their entry into middle-class and petty-bourgeois households led to high production figures. These were the source of entrepreneurial success for the established, supra-regionally active globe manufacturers and publishers. Smaller companies attempted to address previously unaddressed customer groups with new, innovative products in order to hold their own on the market against the large globe-manufacturing companies.

Another aspect of entrepreneurial activity and success specific to the nineteenth century was the large number of different globe products offered by the major globe manufacturers. These were offered in different language versions, in several diameters of the spheres and in numerous equipment variants, which differed essentially by size, stile and material of the mountings.

Newly developed products were increasingly protected by patents. In the nineteenth century, for example, the United States Patent Office registered 163 patents relating to globe production and equipment

variants; numerous globe maps were provided with a copyright.

The increasingly supra-regional producers advertised their products through newspaper advertisements and often also through printed publishing directories and sales catalogues. Globes were presented at national and international industrial and commercial exhibitions. The mentions in the exhibition catalogues as well as the prizes awarded by the respective juries served advertising purposes as well as the recommendations of national committees on the use of globes in school teaching.

Nevertheless, globes were primarily commercial products, globes manufacturers - often publishing houses that offered various teaching materials (maps, atlases, blackboards, globes and technical instruments) for sale - were primarily profit - oriented companies. As such, they often paid more attention to marketing and sales than to the accuracy and timeliness of their products. While the map images of the terrestrial globes were (had to be) updated from case to case, this was rarely the case with the celestial globes.

In what follows, we will focus on one aspect of these complex processes: the development of new types of terrestrial globes. In doing so, we will limit the consideration to objects produced in series - globes that are described but cannot be verified, or, more specifically, prototypes that did not enter into series production, will not be taken into consideration.

And apart from a discussion of so - called thematic globes, the content - related development and design of globe maps will not be addressed in this contribution-the focus of the considerations is therefore on new construction methods, functions, and uses of terrestrial globes.

The majority of the developments in the nineteenth century that will be presented in what follows were, incidentally, accompanied by explanatory printed brochures or at least leaflets.

A look back

For a better understanding of the context it seems reasonable to outline briefly the situation in the eighteenth century: The terrestrial and celestial globes that had become established since the early sixteenth century in Europe and that had constantly been developed further were generally produced in series and have map pictures copied in copperplate engraving and often coloured by hand. The globe spheres were mounted in a mounting with four feet that was generally made of wood, and was supplemented by additional measurement fittings equipped with scales - horizon circle, meridian circle, altitude quadrant and with an hour circle and hour pointer as well as a compass. With these fittings, which were generally made of metal, the globes could be used as a mechanical analogue calculator and geographical and astronomical problems could be solved by means of directly reading the results.

The map pictures - of terrestrial as well as of celestial globes - documented changes resulting from new geographical knowledge and newly introduced constellations. With reference to terrestrial globes, at the end of the eighteenth century, the expansion of geographical knowledge as a result of the sea voyages under the command of Captain James Cook (1728-1779) was particularly relevant.

From the first half of the sixteenth century to the middle of the nineteenth century, globes were generally produced and marketed as pairs: one terrestrial and one celestial globe designed by the same author, with the globe spheres produced with the same diameters and mounted in identically designed mountings.

English and French globes met the highest standards in regard to quality and equipment in the eighteenth century.

Due to their complex production, terrestrial and celestial globes were expensive objects. They served not only as scientific instruments and teaching aids; owning them was an indication of learning and scientific interest and also often a symbol of wealth, or at least affluence.

New developments in the nineteenth and early twentieth centuries

This situation fundamentally changed over the course of the nineteenth century-also due to the introduction of lithography as a new method for reproducing globe maps, something that will, however, not take in closer consideration in the following.

Ever more globe makers stopped using mountings that were costly to produce and replaced them with simpler variants, even including mounting the globe spheres on a column attached to a base without measurement fittings. The globe thus lost its problem solving function as mechanical analogue calculator.

While globe pairs, one terrestrial and one celestial globe, were generally produced up to this point in time, as of the middle of the century, producers ever more frequently dispensed with the celestial globe, which means that considerably more terrestrial globes than celestial globes were consequently produced.

Relief globes

Terrestrial relief globes were developed as a new type of globe and produced in series. This development began in the 18th century but these early objects were all handcrafted unique pieces.

Terrestrial relief globes represent the surface profile of the earth plastically. However, this is not true to scale in relation to the sphere size, because the level differences on the earth's surface are too small in comparison to the sphere size to be perceived. Therefore, the elevations are increased by a factor, usually between 20 and 40. The plastic representation of the terrain thus has a different scale in the height dimension than the globe sphere.

In 1808, the geographer and educator Johann August Zeune (1778–1853) from Berlin began to produce terrestrial relief globes in small series, which were originally intended as teaching aids for educating blind individuals. In 1820, Karl Wilhelm Kummer (1785–1855) took over the production and improved the design process. Modified according to Carl Ritter's (1779–1859) ideas related to scientific geography, Kummer was already able to offer two globe sizes in three different versions in 1821.

Other smaller and larger Berlin companies and workshops – manufacturers of geographical instruments and teaching aids as well as book and map publishers – quickly took over the product. Terrestrial relief globes thus developed into a successful product for export on the one hand and were also imitated and produced abroad on the other (fig. 1).

The earliest globe that also included the surface profile of the seafloors in the form of a relief also comes from the nineteenth century - Thomas Jones (life data not available) from Chicago developed an object of this kind in 1894, which was initially produced by the A[lfred] H. Andrews company and, as of 1900, by the Rand Mc Nally company.

Thematic globes

The map pictures of most terrestrial globes contained and contain thematic elements that go beyond topography. The terrestrial globe by Martin Behaim (1459–1507), which was made in Nuremberg between 1490 and 1493, already showed, for example, forty-eight flags and fifteen coats of arms for labelling the ownership claims of European powers.

In the second half of the nineteenth century, however, we see the beginning of the development of specific, so-called, thematic globes, whose map pictures were determined by circumstances related to the earth in the broadest sense, while the generalized topography only served the purpose of orientation. They include geologic and geo-tectonic as well as meteorological globes, climate globes, politico-economic globes, and world traffic and world trade globes. Technical prerequisite for these new forms of cartographic expression was the introduction of lithographic area colour printing into cartography, a reproduction method that made it possible to print colour-differentiated areas in a single printing process.

At the beginning of this development stands a remarkable handcrafted globe. "Johnston's Geological & Physical Globe showing the structure of the Earth, currents of the ocean, and lines of equal temperature" with a diameter of about 76 cm combined physical geographical data with geological and hydrological data and also mapped isotherms. This first thematic globe was designed by the Scottish geographer and cartographer Alexander Keith Johnston (1804–1871) from Edinburgh on the basis of the thematic maps of his "Physical Atlas" published 1848–1850, which in turn was based on the "Physikalischer Atlas" edited by Heinrich Berghaus (1797–1884) 1838–1848. Johnston's globe was presented at the London Great Exhibition in 1851 and was awarded six medals (one for the decorative mounting).

The first reference to a series-produced thematic globe comes from Berlin. In 1858 *A[ugust] Köhler's Atelier für geographische Reliefarbeiten*, in which among other things relief globes were made, published a publication with extensive explanations on a terrestrial climatic-magnetic relief globe which was offered for sale in three diameters – 41 cm, 67 cm and 124 cm[1]. The development of this thematic globe – which could not yet been proven – seems to have

1 Anonym: Erläuterung des klimatisch-magnetischen Erdglobus und des optische Ringe erzeugenden Saturnglobus verfertigt in A. Köhler's Atelier in Berlin unter der Leitung von P. Beron (Berlin 1858). Product catalogue with mention of the climatatic-magnetic globes in the appendix.

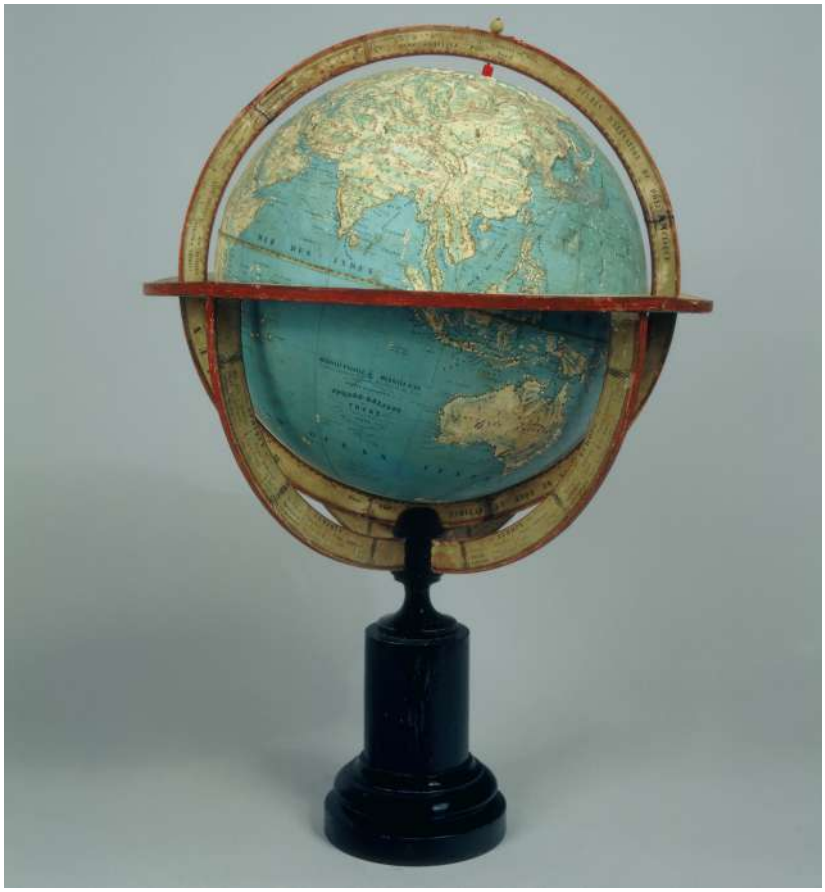

Figure 1. Thury, Sphère-Reliefs, Dijon, c.1855.
Source : BnF, département des Cartes et plans, GE A-1534

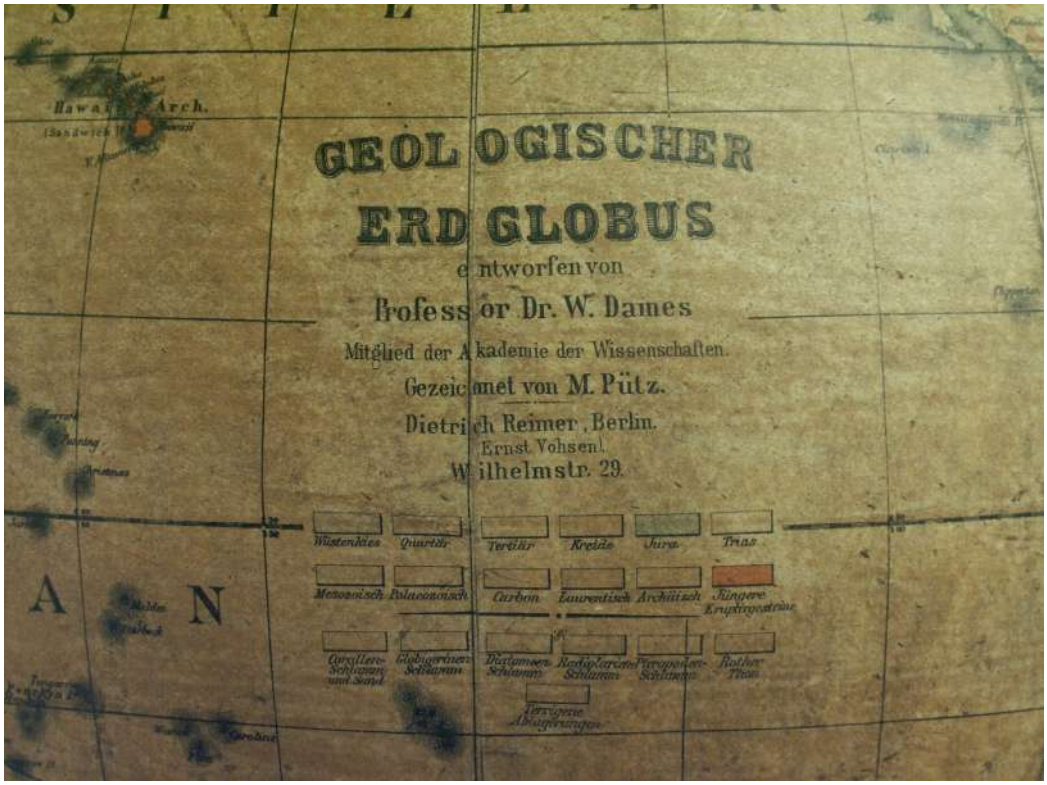

Figure 2. Wilhelm Dames, Geologischer Erdglobus, Berlin, Dietrich Reimer, 1898.
Source : Austrian National Library, Globe Museum: Gl. 331.

taken place in collaboration with the Bulgarian scholar Petăr [Pierre] Béron (c.1800–1871).

A newspaper note from 1866 reported a 'geological globe' designed by the geologist and palaeontologist Rudolph Ludwig (1812–1880) from Darmstadt that was supposed to be made in Gotha[2], but a publisher's catalogue of the *Geographisches Institut* in Weimar, dated c. 1875, lists this globe as a series product[3]. Unfortunately it could not be proven yet.

1872 saw the publication of a thematic globe that depicted in particular the telegraph lines on land as well as the submarine telegraph cables laid to transmit Morse code, and even two planned connections of this kind. This "Telegraphic Globe" was produced by the New York Silicate Book Slate company in a diameter of 31 cm. Between 1890 and 1895, the Belgian *Institut National de Géographie* in Brussels produced five globes, each with a diameter of 12.5 cm, which depict several phenomena of physical geography (climate / air pressure and winds in the month of July / terrain / coral reefs, volcanoes and earthquakes / glaciers and drift ice) cartographically.

The Berlin Dietrich Reimer publishing house published a geologic terrestrial globe with a diameter of 34 cm in 1898. The author, Wilhelm Dames (1843–1893) from Berlin was a geologist and palaeontologist. His globe shows the distribution of major geological formations in relation to the spherical shape of the earth (fig. 2).

In 1907, the same publishing house also published two other thematic globes, each with a diameter of 34 cm. The author of these so-called meteorological globes was Carl Kassner (1864 - 1950), a meteorologist, also from Berlin. His globes show meteorological phenomena (distribution of atmospheric pressure, temperatures, and air streams, the centres of action in the atmosphere - high- and low-pressure regions - as well as the influence of land and water and of mountains and ocean currents and the displacement of air masses), on the one hand in January and on the other in July and thus facilitated a comparison of climate conditions between the seasons of the year based on cartography.

In 1892 the Dietrich Reimer publishing house published its 'world traffic globe' with a diameter of 80 cm as a further thematic globe, which was designed by the Berlin geographer and cartographer Heinrich Kiepert (1818 - 1899). That serial product corresponded to the public's general interest in world traffic and world trade at the end of the nineteenth century. Several globe producers followed this example with similar products at the beginning of the twentieth century. Such world traffic globes have numerous thematic entries: on the water: ocean currents, drift-ice limits, oceanic shipping lines with distance specifications, and submarine telegraph cables; and on land: railway lines, caravan routes, telegraph lines, and navigable rivers and harbours (fig. 3).

A special type of thematic globes

The 'children's globe' produced by the publishing house of Joseph August Brandegger (1797–1890) located in the small town of Ellwangen, Württemberg, from in the middle of the century represents a special kind of thematic globe. In addition to the graticule, it also shows the continents, large islands, and oceans as well as a sparse labelling of depictions of animals, people, plants and ships, which are oriented in their design towards childlike expectations (fig. 3).

Globes with sophisticated mounting systems

In the United States, it is possible to find evidence of patent documents, especially from the nineteenth century, for special, pedagogically inspired terrestrial globes. In the following only two of these innovations will be emphasized that were actually produced and can be found in collections today.

In 1845, Silas Cornell (1789–1864) from Long Island near New York applied for patent protection for his "Improved Terrestrial Globe" that was intended for the use of schools, academies, and families. This instrument is distinguished by the fact that seasonal differences in solar radiation could be clearly presented by means of a thin metal disc called a 'day circle'.

And, in 1874, Ellen Eliza Fitz (c. 1835–1886) from New Hampshire working as a governess in St. John County in New Brunswick, Canada, applied for patent protection for a special mounting with double circles representing day and twilight (fig. 4). With its invention, it was possible to make the phenomena of earth-sun relationships and their effects on solar heating as well as the length of day and night comprehensible in an improved and enhanced form in comparison to Cornell's globe.

2 Nachrichten, in Allgemeine Schul-Zeitung (Leipzig) 43 (1866) p. 62-63, 63.
3 Anleitung zum Gebrauche der Erd- und Himmelsgloben des Geographischen Instituts zu Weimar (Weimar, s.a. [c.1875]), second cover page.

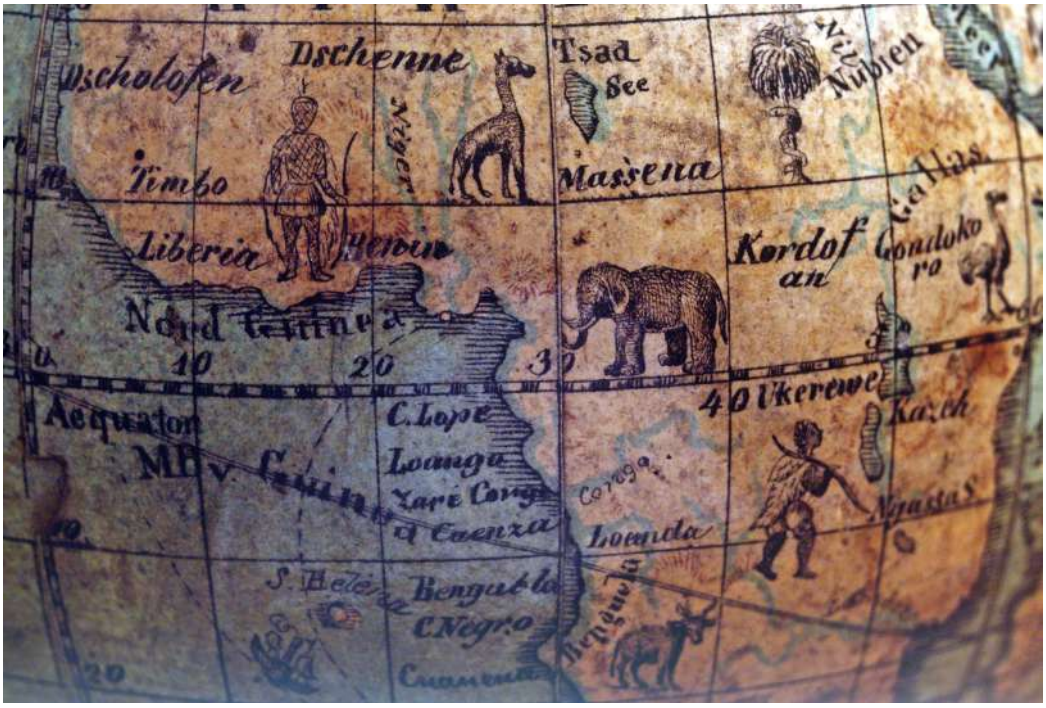

Figure 3. Joseph August Brandegger, Brandegger's Kinderglobus, Ellwangen, Brandeggersche Buchhandlung, c. 1850, detail. Source : Austrian National Library, Globe Museum: Gl. 335

Figure 4. Ella Eliza Fitz, Fitz Globe, Boston, Ginn & Heath, c. 1875.
Source : Austrian National Library, Globe Museum: Gl. 260.

Illuminated globes

The first globes illuminated from the inside were produced in the 1880s. The glass globe sphere with map picture thus had circular cut-outs at the poles, through which the burning wick of a petroleum lamp was inserted to provide illumination. The map image was printed onto the glass sphere using a special transfer printing process[4] (fig. 5).

In 1900, the Imperial German Patent Office granted the already mentioned Berlin publishing house Dietrich Reimer a patent on a transparent globe, illuminated from the inside. The light source was named as an electric incandescent lamp, petroleum, gas or acetylene burner, with the last three variants being designed for ventilation through openings in the north and south poles. As serial products globes illuminated by electric incandescent lamps were produced from the 1920s onwards and became extremely successful commercial products.

Mouth-blown glass in various diameters was used as the material for the spheres. At the South Pole, a slightly larger opening was left open through which a light bulb with socket could be inserted, which also connected the globe to the mounting. The globe segments were glued to the glass sphere from the outside, which required special care, as the paper had to connect exactly to the edges. The segments were not allowed to overlap, as these areas would be darker with translucent lighting, nor were gaps allowed to form, as the light would flash through them.

Clockwork-driven globes

Clockwork-driven terrestrial globes do not actually represent a special development of the nineteenth century; such objects - produced as unique items - have been known for a long time. However, in the nineteenth and early twentieth centuries, such objects were, at the same time, produced and distributed in series as commercial products. Renowned globe makers in Europe and the United States produced apparatuses that were simple in quality and execution in cooperation with clockwork producers.

By means of a gear-driven transmission, the clockwork made the terrestrial globe rotate one time over a period of twenty-four hours and thus imitated the rotation of the earth around its axis. It was therefore possible to visualize the difference in local time in various regions of the world and hence the phenomena related to them (fig. 6).

One might discuss whether the clockwork-driven terrestrial globes were scientific instruments or home furnishings, a discussion that is definitely justified due to the overwhelming number of terrestrial globes. In any case, it does represent a special kind of use for terrestrial globes.

School globes

Globes became established in the nineteenth century as a standard teaching tool in schools. The implementation of educational models in teaching reflected contemporary didactic concepts, not only in geography but also in other disciplines as mathematics, physics, chemistry, and biology. Globe making firms produced numerous globes for that purpose that were designated in their cartouches as 'school globes'. One may consider these products as new types of terrestrial globes, but since they differ from standard terrestrial globes in terms of neither cartography nor function, it is also reasonable to regard them more as title variants than as specific developments. However, two types of globes can be considered to be specially developed for school lessons:

'Snap open' globes

In 1900 the Austrian patent office grant a patent to the Prague globe manufacturer Jan Felkl & Son for a 'snap open' globe. In addition to its use as an ordinary globe it could be opened by pressing a button connected by a spring mechanism and then divided into two hemispheres connected by a small hinge. Hooks inside the hollow hemispheres could be unfolded upwards and the open globe could be hung from them at the top of a school blackboard. Thus it resembled a double hemisphere map (planiglob) which facilitates the understanding of map projections. A second version of this special construction could be divided into four quarters. An additionally patent was granted in the same year to a 'snap open' globe that concealed a smaller celestial globe inside the sphere. Felkl's sophisticated 'snap open' globes were produced in diameters of 22, 34 and 47 cm.

Such a 'snap open' globe, however, was already described in 1836 by the Leipzig school principal D. Vogel (life data not available) and produced by a mechanic named Apel (life data not available) with a diameter of 95 cm.[5]

4 Eighteen globe gores were lithographically printed on specially prepared transfer paper. These paper strips were pressed onto the equally with chemical substances specially prepared glass sphere. The map image was in this way transferred and after drying coloured by hand and then burned in.
5 D. Vogel: Erdkugeln für Volksschulen, in Allgemeine Schulzeitung (Leipzig) 36 (1836) colonne 1045-1047.

Figure 5. Petroleum lamp with illuminatable terrestrial globe, [c. 1870].
Source : Austrian National Library, Globe Museum: Gl. 647.

Figure 6: Desk clock with terrestrial globe, Berlin, Peter J. Oestergaard, [1902-1910].
Source : Austrian National Library, Globe Museum: Gl. 82

Hanging or suspension globes

The so-called hanging or suspension globe is a cardboard globe manufactured without a stand but mounted within a metal ring (sometimes designed as full meridian circle) with a hanging fixture threaded with a rope. For suspension the hanging globe could be pulled down and up again after the lesson by means of a rope pull system with counterbalancing weights attached to the ceiling of the classroom. Such hanging or suspension globes were mainly produced by US-American manufacturers and advertised in product catalogues of teaching material dealers.

New developed globe-like teaching aids

To make the production process more economical and to be able to sell the products more cheaply and thus attract new groups of buyers, as of the nineteenth century, special types of terrestrial globes were conceived and produced. Less expensive materials for teaching geography were needed in particular for educating children on the basis of modern teaching methods, called practical education. These globe-like teaching aids were each sold with an explanatory brochure. The learning process took place by using object and text together.

Cardboard dissected globes

So-called cardboard dissected globes assembled from printed cardboard segments came from England. This special type of globe goes back to a prototype from the year 1785 that was distributed by John Marshall (1756–1823) in London. In 1812, two such objects were produced from one Mrs. Johnstone (given name and life data not available)[6] and from Edward Mogg (life data not available, worked 1805–1848) from London[7]. Although these special teaching aids have been produced for several years, it seems as if they were not successful, or there is at least only very little information about them to be found today.

Collapsible or folding globes

Quite successful, in contrast, were the so-called collapsible or folding globes made of heavy paper and/or thin cardboard, which were published in several European cities almost at the same time starting in the 1820s.

Six segments or full gores pasted onto bendable cardboard could be assembled by means of drawbar eyes mounted on thin threads in such a way that a sphere-like form was created. From the 1820s onwards, such objects were produced simultaneously in Amsterdam, Graz, Karlsruhe, London, Madrid, Milan, Moscow, Nuremberg, Paris, St. Petersburg, Stuttgart, The Hague and Vienna and remained in production until the middle of the century (fig. 7 a et 7 b).

In 1869, Dennis Townsend (born 1817) from Felchville, Vermont registered a patent that made it possible not only to hang paper-folding globes, but also to present them standing with the aid of metal wires. "Townsend's Patent Folding Globe for Schools and Families" was produced and published by George M. Smith & Co in Boston.

Inflatable globes

Around 1830, George Pocock (1774–1843) from Bristol developed and marketed inflatable globes with various diameters based on a thin paper (that was developed especially for this purpose) printed with a map picture.

A pair of bellows for inflating the balloon was provided along with the product. The construction was quickly copied and also produced by Philipp Cella (born 1790) from Munich in 1831 (fig. 8) and by Julius Ludwig Grimm (1806–1834) from Berlin in 1832. There is also knowledge of such a globe from the year 1833, drawn and lithographed by A. Desmadryl and published by E. Benoît in Troyes (Aube) in France. The inflated globe spheres were remarkably large: in the case of Pockock 61, 91, and 122 cm, in the case of Cella 114 cm, in the case of Grimm 112 cm, and in the case of Desmadryl/Benoît 130 cm in diameter. Until now it was hardly known that the mechanic Peter Bauer (1783-1847) from Nuremberg had also made such an inflatable globe with a diameter of 63 cm in 1835.[8]

Umbrella-like globes

Another new development were the so-called umbrella-like globes, first produced by John Betts

6 Johnstone: Description and use of Mrs. Johnstone's new invented pocket sphere, or the globe dissected (London 1812) cited after: Katie Taylor: Mogg's celestial sphere (1813): the construction of polite astronomy, in Studies in History and Philosophy of Science 40 (2009) p. 360-371, 362 and 370.

7 Edward Mogg: An explanation and description of Mogg's dissected globe; or pocket sphere (London 1812), cited after: Katie Taylor: Mogg's celestial sphere (1813): the construction of polite astronomy, in Studies in History and Philosophy of Science 40 (2009) 360-371, 362 and 370.

8 Luft-Globus!, in Allgemeine Polytechnische Zeitung (Nuremberg), 28. Mai 1835, p. 107.

Figure 7a: W. K. Krotowijm (cartographer), Semnoi Globus [Terrestrial globe], [St. Petersburg], Poljakov [Editor], 1849. Copper engraving on paper, hand coloured, diameter: 24,2 cm.
Source : Austrian National Library, Globe Museum: GL. 292 KAR MAG
Figure 7b : Cartouche of W. K. Krotowijm (cartographer), Semnoi Globus [Terrestrial globe], [St. Petersburg], Poljakov [Editor], 1849. Source : Austrian National Library, Globe Museum: GL. 292 KAR MAG

Figure 8. Philipp Cella (cartographer and editor]), Joseph Lacroix (printer), Pneumatisch. Portativer Erd-Globus. Nach der Erfindung von Pocock, München, 1831 (Koen. Bayer. Privileg). Diamètre : 114 cm, with an accompanying booklet and a bellow (air pump). Source : Austrian National Library, Globe Museum: Gl. 177.

(life data not available) from London starting around 1860. The surface consisted of a textile material printed with a globe map that could be spanned to form a sphere-like shape by means of a metal construction similar to the mechanics of an umbrella. Such constructions have also been handed down by the publishers Elsevier in Rotterdam in 1881 and by William M. Goldtwaite (life data not available) from Chicago in 1888.

However, descriptions of umbrella-like globes are handed down from the year 1833 from a Bavarian first lieutenant with surname Klein (given name and life data not available) from Munich[9], and from 1857 from a man called More from the small community Gray (Haute-Saône) in France[10], but the mentioned produced objects have so far not been verified.

Toys with educational purposes

Jigsaw puzzle globes

As of 1866, the first jigsaw puzzle globes came onto the market as educational toys. The globe sphere made of solid wood is divided up like a three-dimensional jigsaw puzzle into transverse sections, which can in turn also be disassembled into individual 'pieces of cake'. Parts of a map are glued to the upper and/or outer surface, while the undersides contain information about continents and their inhabitants.

The first of such objects came from a man called [Charles?] Kapp from Nuremberg and were distributed by the publishers Abel-Klinger in Nuremberg and Abraham Nathan Myers in London. Kapp's jigsaw puzzle globes were also produced, for instance, in a French language version for export. Such attractive jigsaw puzzle globes with an educational character were also produced in France itself (fig. 9a et 9b).

Globes with magnetic attachments

An innovative idea from the United States - for which, however, no patent is available - came from Elbert Perce (1832–1869) from Brooklyn, New York. He developed a terrestrial globe, whose sphere was made of sheet iron to which various magnetic attachments (people and animals from different areas of origin, ships, lighthouses, and locomotives) could be attached, moved, and removed in a playful manner. "Perce's Magnetic Globe" was produced by Charles Scribner & Co in New York from 1864 onwards.

Dollhouse globes

Another special type of globe that was also characteristic for the nineteenth century is the so called dollhouse globe. Renowned globe producers such as the Berlin Ernst Schotte publishing house produced terrestrial globes, among other things, as items of furniture for dollhouses. Schotte's miniature globe with a diameter of approximately 2.5 cm has been handed down in several language versions, in addition to German, also in English, French, and Russian (fig. 10). These globes also include elements that go beyond generalized topography to a great extent: besides the depiction of land masses and oceans and their names, a graduated equator, latitudes, longitudes, and an ecliptic are also incorporated. This scientific content links the dollhouse globes with other objects mentioned in this lecture: the cardboard dissected globes, collapsible or folding globes, inflatable globes, umbrella globes, and jigsaw puzzle globes. All these globes and globe-like objects involve educational aspects. They were also relatively inexpensive didactic aids and thus not 'merely' an amusing toy.

Conclusion

In the nineteenth century globes lost their exclusive meaning as scientific instruments and as valuable objects of representation. Globes became more and more simple teaching devices, used not only in schools and other educational institutions but also in the private and semi-private environments of the bourgeoisie and of the bourgeois middle classes.

New developed science-based cartographic expression forms, as relief globes and thematic globes, but also much simplified inexpensive globe-like models for teaching purposes, like dissected globes, collapsible or folding globes, inflatable globes, umbrella globes, and jigsaw puzzle globes, enabled globe makers and publishers to attract new customers. The growing demand for globes and the application of modern cost effective industrial production methods were the preconditions that globes became commercially successful mass products. The Berlin globe manufacturer Ernst Friedrich Moritz Schotte (1828–1895) owed his rise from a simple bookseller to a wealthy entrepreneur, who had an extensive real estate property and an ostentatious family grave, to his economically successful globe production.

9 Darstellung neuerer Forschungen, Ideen, Entdeckungen und Erfindungen, in Morgenblatt für gebildete Stände (Stuttgart et Tübingen) 27 (1833) p. 482f, 483.
10 Rapport fait par M. Jomard, au nom du comité des arts économiques, sur un Globe Terrestre imaginé par M. More, in Bulletin de la Société d'Encouragement pour l'Industrie Nationale - 1857. 56e année. 2e série, tome 4 (1857), p. 208-210.

Figure 9a.A jigsaw puzzle globe : La Terre en morceaux:jeu de construction, Paris, P. Perret, 1901.
Source : Austrian National Library, Globe Museum: Gl. 554.
Figure 9b. Cartouche of La Terre en morceaux:jeu de construction, Paris, P. Perret, 1901.
Source : Austrian National Library, Globe Museum: Gl. 554.

Figure 10. Terrestrial (dollhouse) globe (with matchstick), [Berlin, Ernst Schotte, 1870-1900].
Source : Austrian National Library, Globe Museum: Gl. 548.

Bibliography

The specialist literature on 19th century globes is now almost unmistakably rich. This very pleasing circumstance, however, prevents a more or less complete bibliography at this point. Therefore only publications from which contents were directly incorporated into the present text are listed. In particular, the only one journal dedicated to the study of globes *Der Globusfreund. Wissenschaftliche Zeitschrift für Globenkunde* (formerly with other subtitles; since 2002 also in an English version under the title *Globe Studies. The Journal of the International Coronelli Society*) contains a large number of special studies with numerous references to the present text whose reading is expressly recommended by the author.

Anonyme (1858), „Erläuterung des klimatisch-magnetischen Erdglobus und des optische Ringe erzeugenden Saturnglobus verfertigt", in *A. Köhler's Atelier in Berlin unter der Leitung von P[ierre] Beron*. Berlin.

Dekker E. (2004), *Catalogue of Orbs, Spheres and Globes*. Firenze.

Dekker E (1999), *Globes at Greenwich: a Catalogue of the Globes and Armillary Spheres in the National Maritime Museum, Greenwich.* Oxford.

Dekker E. et Van der Krogt P. (1993), *Globes from the Western World*. London.

Lehmann R. (2010), *Erde, Sonne, Mond und Sterne. Berliner Globenhersteller 1790—1970*. Berlin.

Mokre J. (2008), *Rund um den Globus. Erd- und Himmelsgloben und ihre Darstellungen*. Wien.

Monmonier M. (2017), *Patents and Cartographic Inventions: A New Perspective for Map History*. Cham (Palgrave Studies in the History of Science and Technology).

Muris O. et Saarmann G. (1961), *Der Globus im Wandel der Zeiten. Eine Geschichte der Globen*. Stuttgart, Berlin et Beutelsbach.

Novotna E. (2017), *Jan Felkl & syn, továrna na glóby / Jan Felkl & Son, a Globe-Making Factory*. Praha.

Sumira S. (2014), *The Art and History of Globes*. London.

Taylor K. (2009), "Mogg's celestial sphere (1813): the construction of polite astronomy", *Studies in History and Philosophy of Science* 40, p. 360-371.

Van der Krogt P. (1985), "Two Peculiar 19th Century Globes", *The Map Collector* 33, p. 29-31.

Warner D. (1988), "The Geography of Heaven and Earth" (4 parties), Rittenhouse, *Journal of the American Scientific Instrument Enterprise*, vol. 2/n° 1, p. 14-32 ; vol. 2/n° 2: p. 52-64 ; vol. 2/n° 3: p. 88-104 ; vol. 2/n° 4: p. 109-137.

Wohlschläger H. (1997), "Globen der neueren Zeit", in Peter E. Allmayer-Beck (ed.), *Modelle der Welt. Erd- und Himmelsgloben. Kulturerbe aus* österreichischen *Sammlungen*. Wien, p. 198-223.