Chinese And European Ivory Puzzle Balls

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Abstract: This article discusses some objects made of ivory, consisting of nested spheres which can rotate freely inside each other. These objects are known as the “Chinese puzzle balls” and became quite popular in Europe during the 19th century. The methods used by the artists to create them in the carved ivory can be considered as the real "puzzle" of the balls. Actually, Europe had its production of puzzle balls too. During the 16th and 17th centuries, “contrefait balls”, or “contrefait Kugeln”, were carved in ivory with the geometry of a sphere or of a Platonic solid, frequently of a dodecahedron. They were items for the Cabinets of Curiosities, the rooms of wonder that had their roots in the culture of the Renaissance Courts. Today, these European ivory items, which are exceedingly rare, are exhibited by museums and collections. Here we discuss both the Chinese and European objects.

Keywords: Ivory Carving, Chinese Art, Feng Shui, Renaissance Art, Geometry, Platonic Solids, Dodecahedron, Cabinet of Curiosities, Wunderkammer, Leonardo da Vinci, Luca Pacioli, Johannes Kepler, Fra Giovanni da Verona, Domenico Remps, Contrefait, Giovanni Ambrogio Milanese, Egidius Lobenigk, Lorenz Zick, Grollier de Servière.

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In the item of Wikipedia about the Ivory Carving [1], it is told that, by the 18th century, China started to have a considerable market of artistic objects made for the export to Europe. In the later 19th century, thanks to the African ivory, these objects became as large as the material would allow. A speciality was a round ball of openwork that contained a series of smaller concentric balls, which could rotate freely inside each other (Figure 1). Because of the vast expenditure of time and effort required for making them, these “devil’s work balls”, as they are also known [2], became some of the preferred artistic “playthings” of the rich people [3].

Figure 1: Chinese puzzle ball, with openwork and a series of twelve smaller balls, ivory, 19th century. British Museum. Original photograph by Ged Carroll for Wikipedia.

We can find more information on the Chinese puzzle balls in an article discussing the collection at the Sam Noble Oklahoma Museum of Natural History [4]. For what concerns the dates for the ivory ball carvings, Ref. 4 tells that they are usually no earlier than the Qing Dynasty (1644-1911), and that some occurrences of similar products appeared in Canton as early as the 14th century [4,5]. But in Ref. 6 we find that the first puzzle balls appeared during the Song Dynasty, around 1000 AD (this dynasty began in 960 and continued until 1279). Actually, the first reference to a puzzle ball seems to be that given by the Chinese writer Cao Zhao, in his Essential Criteria of Antiquities, first published in Nanjing in 1388. He tells the following: “I have seen a hollow-centred ivory ball, which had two concentric balls inside it, which can both revolve. It is called ‘witch ball’. I was told that it was made for the Palaces of the Song dynasty” [7].

The process for making a puzzle ball is very difficult. The preferred material for them is the ivory, but other materials (jade, wood, or soapstone) were used too [4]. “In ancient times the balls were carved completely by hand. In more recent times, a lathe was used to shape the balls”. First, cone-shaped holes are drilled towards the centre at varying depths. Once the holes are made, an “L” shaped carving tool is used to separate the layers which are creating the balls within the balls. As explained in [4], the artist starts with the smallest core ball and then carves out spherical layers slightly larger than the previous one. Then the balls are decorated with micro-tools to pierce their surfaces and to decorate the outermost ball.

The puzzle balls are considered as symbols of good luck and are decorated with a variety of feng shui elements. In [3], we find mentioned that the outermost layer has usually the features of the phoenix and of the dragon, which are symbols of yin and yang. "The phoenix represents the wife while the dragon is the husband and emperor, and balls decorated with these symbols are thought to bring good luck and happiness to a marriage" [3]. So we have that almost all of the symbols that we can find decorating the puzzle balls are associated with ensuring a long and happy marriage. "Some balls even have different symbols on different layers, though the most common is a highly decorative outer ball and ‘latticed’ balls inside (with geometric patterns of holes).” [3]

An example of inner latticed spheres is given in the Figure 2.

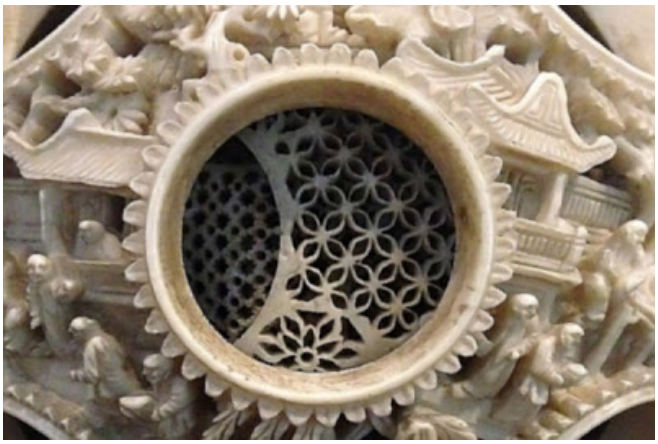

Figure 2: Detail of an ivory ball on show in the Rautenstrauch-Joest Museum, Köln. It has 16 layers, which can spin. Courtesy :Till Niermann, Wikipedia.

In the Figure 2 we see a detail of an example of Canton ivory carving. In the item of Wikipedia on the Lingnan culture, or Cantonese culture [8], we read that the ivory woodcarving is a well-known product from Lingnan. “With a history of 2000 years”, it traditionally uses ivory as raw material to make sculptures, with a style renowned for being delicate and detailed without being brittle.
Also Ref. 9 is giving further information about the Chinese puzzle balls. "These detailed works of art are usually made up of at least 3 to 7 layers, but the world’s largest puzzle ball is actually made of 42 concentric balls all enclosed one within the other". And also: "Although the inner balls can be manipulated to align all the holes, Chinese puzzle balls got their name from people who, through the ages, pondered the mystery of making such objects" [9].

If we consider just the Wikipedia item about the Chinese ivory balls [1], we could conclude that Europe knew such concentric spheres only through the Chinese products of the 19th century. But this is not true. Puzzle balls were produced in Europe during 16th and 17th centuries too. Here we can see an example of European production given in the Figure 3.

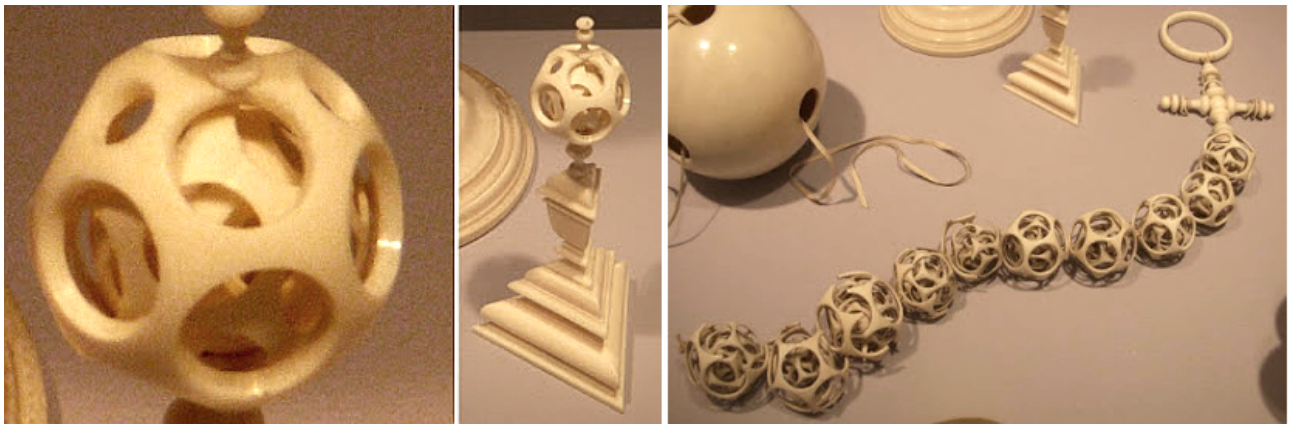

Figure 3: European puzzle ball and Rosary, 16th-17th century (Image Courtesy: Maureen and Renato Bucci, Italy, 2014). These objects were exhibited in Stuttgart.

The balls shown in the images of the Figure 3 are remarkable because they look like Roman Dodecahedra. Renato Bucci, who served as honorary inspector to the Soprintendenza Archeologica of Tuscany, was so kind to send me the pictures because of the similarity to the archaeological object [10,11]. The objects depicted in the Figure 3 were probably some of the items of a Wunderkammer, that is, of a Room of Curiosities and Wonder (in Italiano, camera delle meraviglie o gabinetto delle curiosità o delle meraviglie), a depository (or simply a cabinet) for the items of a collection. The Wunderkammer had its origin from the rooms used to contain the encyclopedic collections of remarkable and exotic objects, which were assembled under the patronage of the Renaissance courts. In [12], it is told that a Wunderkammer or (Kunstkammer)

was like a “microcosm or theatre of the world”, which was conveying symbolically the “patron's control of the world through its indoor, microscopic reproduction” [12].

In a modern web Kunstkammer [13], we find told that it was the Chinese work of the puzzle balls, which fascinated the European travellers, and that consequently stimulated the German craftsmen to create their own ivory puzzle balls. This hypothesis is also mentioned in [2]. However, after comparing Chinese and European works, we have to note the following facts and differences.
For the Chinese balls, the aesthetic appearance is fundamental and the geometry just necessary to create them [14]. Their surfaces are full of decorations and symbols, whereas the European balls have a smooth surface and a polyhedron-like shape. As a consequence, the beauty of the European works comes explicitly from their perfect geometry [14]. Another feature of some of the European balls is the presence of radial spikes, which are passing through the holes, having origin from the innermost core ball [14] (see Figure 4). These spikes are missing from the Chinese balls.

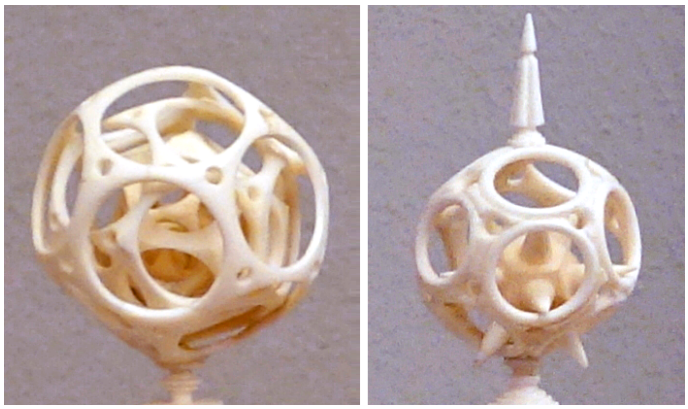

Figure 4: Ivory balls from German workshops, Bode-Museum, Berlin, Germany. 17th century. Lorenz Zick, c. 1650, Courtesy image: Daderot for Wikipedia.

The perfect geometry of the European balls is not surprising. The artists who made them were the heirs of those Renaissance artists that were deeply attracted to the geometry of solid shapes and, in particular, to the Platonic Solids. Also Leonardo da Vinci considered these Solids and drew them for a book of the mathematician Luca Pacioli [15].
In a nested form, the Platonic Solids became the famous representation of the macrocosm in the Mysterium Cosmographicum written by Johannes Kepler (1596) (see the Figure 5). This is the book which explains Kepler's cosmological theory based on the Copernican system. Kepler started from the five Pythagorean regular polygons as dictating the structure of the universe, according to a God's plan achieved through geometry. After doing further calculations he realized that he could not use the polygons, but that he had to use the five Platonic solids, nested in the form figured as in Fig. 5, to represent the solar system [16].

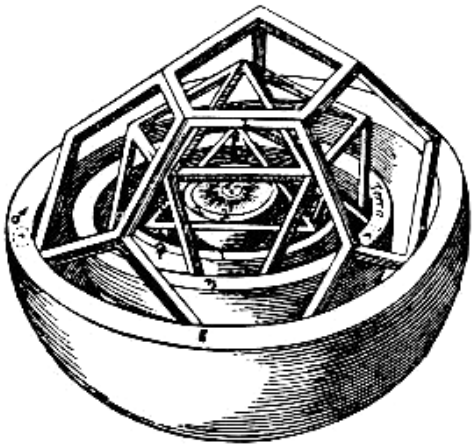

Figure 5: The Kepler solar system.

Besides attracting the studies of philosophers and artists, the Platonic Solids and the related geometrical forms attracted the interest of collectors too. Therefore, we find them depicted in the images of the period reproducing the Cabinets of Curiosities (see Figures 6 and 7).To the images of solids shown in these Figures, let us also add four of those proposed by Wenzel Jamnitzer (1507/08 – 1585) in his book on the Perspectiva Corporum Regularium (Figure 8). Probably, these images were used to create some real models for the cabinets of artists and collectors.

Figure 6: Fra Giovanni da Verona. Detail of a tarsia showing a cabinet with polyhedra. Courtesy Laurom di Wikipedia in italiano. Fra Giovanni da Verona (1457 circa – 1525) was an Italian artist who worked from the end of the 15th Century and the beginning of the 16th Century.

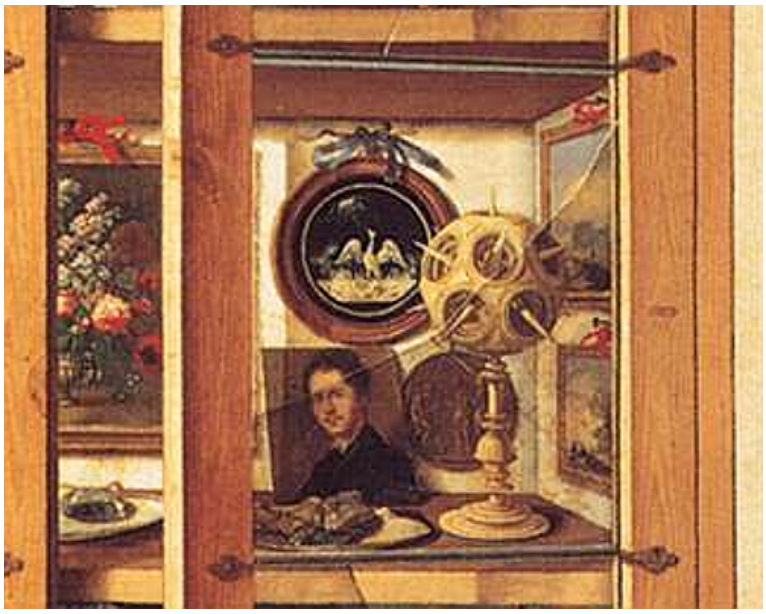

Figure 7: Domenico Remps, (1620–1699), Cabinet of the Curiosities, Painting, Detail, Date 1690s, Current location: Opificio delle pietre dure, Firenze. Note the spikes inside the spheres, a real puzzle.

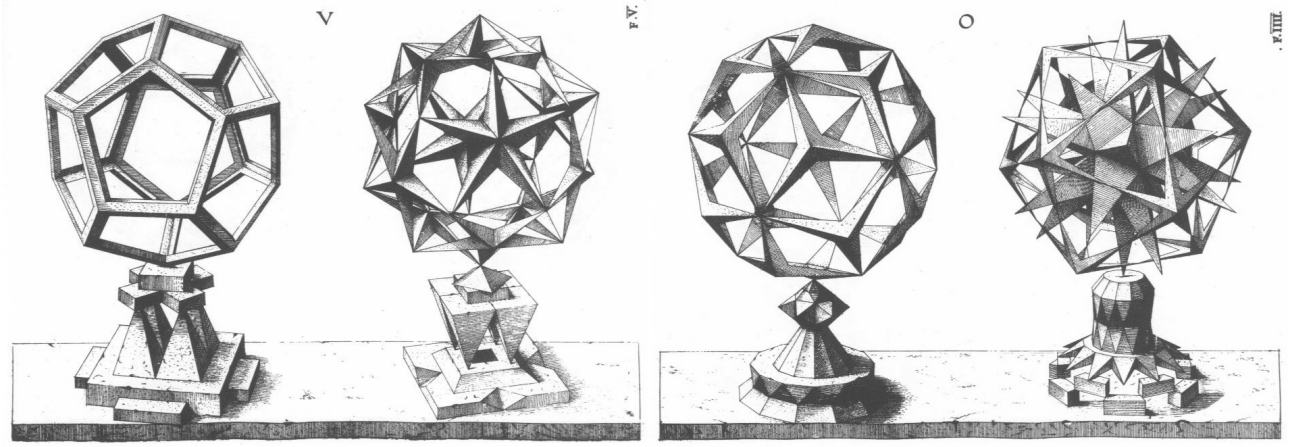

Figure 8: Dodecahedra and Icosahedra from Wentzel Jamnitzer's Perspectiva Corporum Regularium.

Let us continue the discussion on the puzzle balls. After the analysis of their geometry, we can tell that many of the European puzzle balls were inspired by the Platonic solids. We find many balls having the geometry of nested dodecahedra, such as those created by Egidius Lobenigk (1581 – 1584), or of spheres and other solids as shown in [14] (some Lobenigk dodecahedra, made of ivory, are exhibited at the Staatliche Kunstsammlungen in Dresden [17]). As we can see from the Figure 4, which is showing two balls from works by Lorenz Zick (1594-1666), the representation of nested dodecahedra was a favourite subject during 17th century too.

Lorenz was a member of the Zick family [18,19], the son of the turner Peter Zick and grandson of the turner Martin Zick [19]. Lorenz Zick was called to Vienna in 1642-4 to instruct Emperor Ferdinand III and was appointed Kammerdrechsler of the imperial court. Peter Zick was the

teacher of Emperor Rudolph II in Prague. Because “Turning was considered a noble hobby, and many gentlemen and kings worked lathes as a leisure activity” [18].

Figure 9: Ivory cups in the Grünes Gewölbe, Dresden. Courtesy: Heidelberg Historische Bestände. From [20] at the following link: http://digi.ub.uni-heidelberg.de/diglit/sponsel1932bd4/0063

From the Figure 9, which is showing three cups at Grünes Gewölbe, Dresden, we can see that the European puzzle balls were usually paced at the top of very complex turned pieces (see also Figure 10 for other solids). Besides in the Grünes Gewölbe, European puzzle spheres are exhibited in Vienna (Kunsthistorisches Museum), in Berlin (Bode-Museum, Figure 11), in Florence (Museo degli Argentieri), by the Royal Danish Collections, in Oxford (Ashmolean Museum) and in Paris (Musée des Arts et Métiers). However, they are present also in private collections. On July 2017, a Sotheby’s auction proposed the sale of some of these treasures.

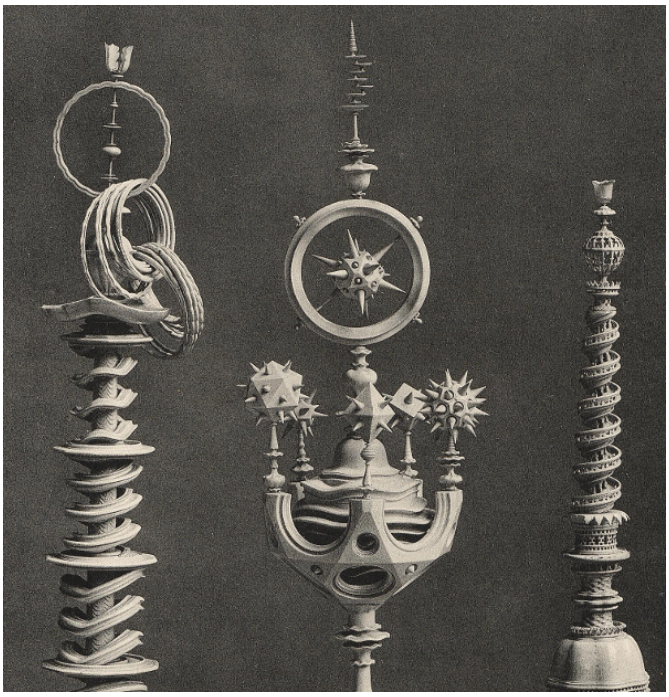

Figure 10: Detail of the spires of three ivory vases in the Grünes Gewölbe, Dresden. Courtesy: Heidelberg Historische Bestände. Page from [20] at the following link: http://digi.ub.uni-heidelberg.de/diglit/sponsel1932bd4/0067/image

Images and detailed discussions of ivory items are given in the catalogue of the sale, which is available at [21].The Sotheby's catalogue contains also a general discussion on the "extraordinary turned ivory works of art of the late Renaissance and Baroque periods", at page 36.

"The great masters of turning and their pupils, who were often sovereign rulers, employed the most advanced machine of their day: the lathe. ... Lathe technology originated at least as early as the eighth century BC, and simple lathes were used through the middle ages in Europe for the production of wooden cabinet elements and small decorative items. It was not until the 16th century, however, that technical and artistic advancements brought the practice into a realm far above the ranks of craftsmen. Turners such as Giovanni Ambrogio Maggiore, Georg Wecker, and Philip Senger began to exploit the more responsive medium of ivory". These artists were able of "inventing fantastic forms" according to the spirit of the scientific and philosophical exploration of their day. These remarkable objects, which are exceedingly rare today, are showing both the wealth and intellect of their past creators and owners.

"Perhaps the highest accomplishment of the art of turning ivory – continues the catalogue - are the hollow spheres containing internally-turned capsules and nesting spheres known as contrefait. These were among the most difficult forms in the turner's repertoire, with almost eggshell-thin ivory walls and complex forms turned within through a small aperture. The attempt to understand the technique by which these spheres are created is baffling to the viewer, and in this astonishment lies their intellectual appeal." That is, these spheres were the analogue of the Chinese puzzle spheres that we have discussed at the beginning of this article.

And here, it is strongly required to note what Ref.7 is telling about the Chinese nested spheres. "To our knowledge [of the author of Ref.7, Tibor Tarnai], there is no trace of "Devil's work ball" in the 15th, 16th and 17th centuries. In the 18th and 19th centuries, these balls were made in the Canton region for the European trade, after the first European lathe was imported in 1722. (Shih Ching-fei 2007)." (see also the articles [22] and [23]).

As Shih Ching-fei is telling in [22], the Chinese puzzle balls, so representatives of Chinese civilization, "are rarely the subject of academic inquiry". The study in [22] begins with an important question: "Do the concentric spheres represent nothing more than an ingenious style of ivory carving?" This question is proposed by the author, because of the existence of the concentric balls made in Europe during the 16th and 17th centuries. As a consequence, to Shih Ching-fei the concentric ivory spheres are not simply "objects of wonder or emblems of China for Western imaginations", but are objects that need to be considered in "a full-fledged re-examination of both the general relationship between Europe and the Ch'ing court".

It seems therefore that it was the import from Europe of the "rose engine lathe" that stimulated the production in Canton of the puzzle balls. To have specific information about lathes and techniques, the reader can use the Manuel du tourneur by L.-E. Bergeron [24].

Figure 11: Ivory objects from German workshop, XVII century. Lorenz Zick, c. 1650. Bode-Museum, Berlin, Germany. Courtesy image: Szilas for Wikipedia. The puzzle spheres are those in the Figure 4.

For what concerns the history of the European ivory spheres, the Sotheby's catalogue [21] tells that "The earliest known example [of contrefait] is a sphere turned by Giovanni Ambrogio Maggiore of Milan in 1582 now preserved in the Museo degli Argenti in Florence. Egidius Lobenigk

of Dresden was another innovator of the form, and in the Grünes Gewölbe there are four signed spheres of the early 17th century by Georg Friedel". It seems therefore that Lobenigk was the artist who introduced the dodecahedron in the nested form of the contrefait.

About Giovanni Ambrogio Maggiore, we find some information in [25]. Maggiore, (Milan 1550 – Rome 1598), was an Italian turner of ivory and wood, active in Bavaria. He or his brother, Dionigi Maggiore, "succeeded in making a rotary lathe that was capable of producing not only the usual round turnings but also oblique forms. Little is known of the early stages of this invention; possibly the brothers based it on a project (now untraced) by Leonardo da Vinci" [25]. In fact, in [26], we find that the earliest illustration of an ornamental turning lathe is dated 1578. This machine was described by Jacques Besson. And Besson was, like Leonardo da Vinci, an engineer to the French court.

In 1573, it happened that a Milanese art dealer, Prospero Visconti, brought Giovanni Ambrogio Maggiore to the attention of Crown Prince Wilhelm, who reigned from 1579 to 1598 as Wilhelm V, Duke of Bavaria. "The Prince, who was interested in the discovery, brought Maggiore to Bavaria to work and to teach the new technique. In Munich, "Maggiore passed on the technique to his pupils, and as early as 1576 Georg Wecker, son of the court turner Hans Wecker, took a new lathe and the new techniques to Saxony". This had the consequence of the development of the Dresden school of ivory turning.

Due to the Prince Wilhelm's unstable financial position, Maggiore received only temporary appointments at the residence at Landshut and later in Munich. However, we know that In 1582 Wilhelm sent to the Medici in Florence a Kontrafetkugel, that is a contrefait made by Maggiore, which was set up in the Tribuna of the Uffizi [27, 28]. It is made of ebony and ivory. As told in [28], this sphere is the first of the contrefait spheres. In the Maggiore's contrefait, the spheres "can be moved independently of each other by pulling on the attached strings. Inside are painted miniature portraits of Duke Wilhelm of Bavaria and his family" [27]. Maggiore's sphere was the model for the spheres with strings that we see in the Figure 11.

Little is known of the later life of Maggiore. From Milan, he thanked the Prince for a gift in 1593. In the book La nobiltà di Milano of 1595, historian Paolo Morigia praised him as a successful Milanese artist. In 1597 Grand Duke Ferdinand I de' Medici recommended Maggiore to Rome, In 1598, Maggiore was still working for the Medici court in Florence.

Today, some European artists are turning ivory again and are making contrefait balls too. We have, for instance, the contemporary puzzle ivory dodecahedra, created by the artists Pierre Meyer, as we can see at the web page [29]. A new production, in polymeric materials, of the ornamental turning ivory of the 17th century is also evidenced by the works of Andrea Pacciani, architect in Parma. As given at the web page [30], a piece was inspired by the masterpieces of the collection of Rosenborg Castle in Denmark [31]. Another Pacciani's work is inspired to the drawings of Grollier de Serviere, (1596–1689), French inventor and ornamental turner.

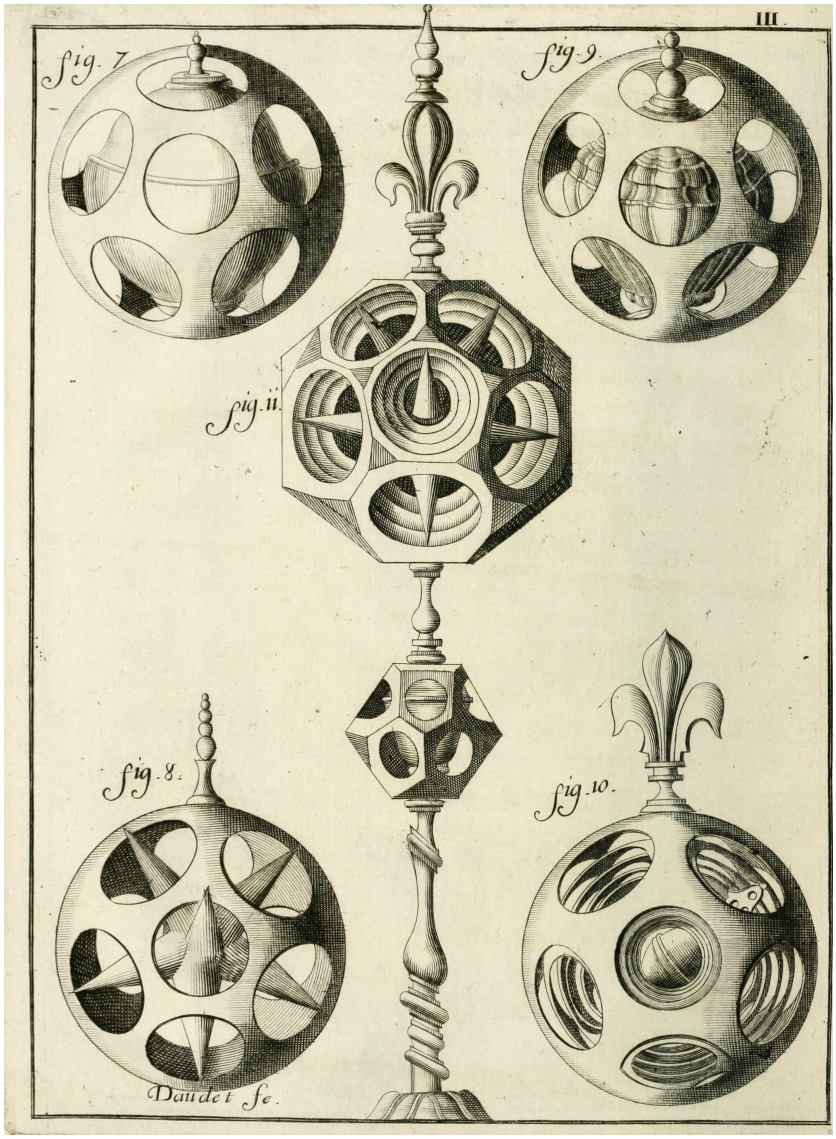

Figure 12: A drawing from the book on the works of Grollier de Servière.

Nicolas Grollier de Servière became famous for the creation of a series of fantastic machines [32]. He was a cousin of Jean Grolier de Servières, Treasurer of France and famed bibliophile. Nicolas was born in Lyon. In his youth, he followed a military career that took him to Flanders, Germany, Italy and Constantinople. As a military engineer, he specialized in movable bridges. After he retired at his home in Lyon, he started creating ornamental objects based on a series of fantastic models, which he displayed in a cabinet that he opened to the public once a week. This cabinet of the wonder became famous enough to attract many visitors [32]. Even the king Louis XIV paid a visit to Grollier de Servière's cabinet.

After his death in 1689, his son Gaspard (1646–1716) and then his grandson Gaspard II (1676–1745) continued to display the contents of the cabinet [32]. Gaspard published a book cataloguing the curiosities: Recueil d'Ouvrages Curieux de Mathématique et de Mécanique, ou Description du

Cabinet de Monsieur Grollier de Servière. An image of the book is shown in the Figure 12: note the spikes in the balls, which look like those depicted in the Figure 7. Probably, Domenico Remps was inspired by the works of Grollier.

In this article we have discussed the Chinese ivory puzzle balls and the European ivory nested solids. Of course, the cultural backgrounds of these objects are different but it seems that, in both cases, it was the use of a modern lathe that determined their success. For what concerns them as philosophical objects, it seems that they were aiming to represent the macrocosm in a microcosm of nested solids. Today, this artistic turning is also appreciated by some European artists. We have objects turned in ivory, as those of Pierre Meyer, or created, as in the case of Andrea Pacciani, by means of the new generation of 3D technologies. As Pacciani is telling, using these technologies we can bring back in vogue a production of objects having a great visual impact [30]; that is, we can create again the amazing objects of Renaissance and Baroque arts, at least virtually, for our modern Wunderkammer.

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