

Malcolm Forbes, Fabergé Eggs and *OptoClones*TM

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Introduction

A new 3D imaging technique for the recording of *Ultra-Realistic Images* is so amazing that people who have seen these new images can't believe that what they see is an image and not a real object. What happens is that one records an object by capturing the light reflected off it and stores that light in a recording medium. Later it is possible to re-generate the stored light so that a 3D color image of the object can be seen even if the object is no longer present. Such an image has been named by the *Hellenic Institute of Holography* (HiH) an *OptoClone*TM and it represents the most realistic-looking 3D image of an object that can be recorded today. The extensive field of view adds to the illusion of beholding a real object, rather than portraying a mere image. Because of the extremely high image resolution, these images cannot be transmitted and displayed on any electronic display device.

An Ultra-Realistic Image has the following characteristics:

- It looks “identical” to the real object observed by the eye
- A full-parallax 3D image with very accurate color rendition
- Same scale – no magnification
- Resolution corresponds to the eye resolution
- No detectable image blur
- No field of view limitations
- Image light reflections move as they do on the object
- In principle – recording light waves reflected off an object, stored and recreated later on

The possibility to record an *OptoClone*TM is actually based on the *interferential imaging sciences*, (Lippmann photography and holography) which means that the information is stored as an interference structure in a recording medium. The panchromatic recording medium is a silver-halide emulsion coated on glass which contains nano-size light-sensitive silver-halide crystals. The resolution is $\approx 10,000$ lines/mm. To introduce this imaging technique to the world, we have selected to record the most beautiful artefacts we could think of, namely the *Imperial Fabergé Easter Eggs*. The jewelled eggs with enamel and painted details were made by Carl Fabergé (1846–1920) in his workshops in St. Petersburg, Russia. Between 1885 and 1916 extremely beautiful Easter Eggs were made. One egg could often take a whole year to complete. The Eggs can be divided into two categories: *Imperial* (those Eggs presented to the Tsarinas Maria Feodorovna and Alexandra Feodorovna) and *Fabergé big Easter Eggs* (Eggs made for, e.g., the Kelchs, the Duchess of Marlborough and the Rothschild family). The first *Imperial Egg* was the *Hen Egg* which was a gift to Empress Maria Feodorovna from the Emperor Alexander III. The surprise of the egg was a hen figurine with tiny Imperial Crown and a gemstone pendant inside. Another famous egg is the *Coronation Easter Egg* which was given to Empress Alexandra Feodorovna in 1897 by Emperor Nicholas II as a memory of the coronation in 1896. This egg has a surprise inside: a model of a tiny gold carriage. There were only 50 *Easter Eggs* made. Ten are in the Moscow Kremlin Collection, five are displayed at the Virginia Museum of Fine Arts in Richmond, Va., and Queen Elizabeth II in United Kingdom owns three. The whereabouts of seven eggs are unknown. The others are in the United States, Switzerland and Monaco. Malcolm S. Forbes, shown in **Fig. 1**, the forefather of the present generation of the Forbes Magazine owners, had been assembling the *Forbes Collection* of Fabergé Eggs for several decades. In **Fig. 2**, Malcolm Forbes' four sons are depicted behind the Fabergé Eggs.

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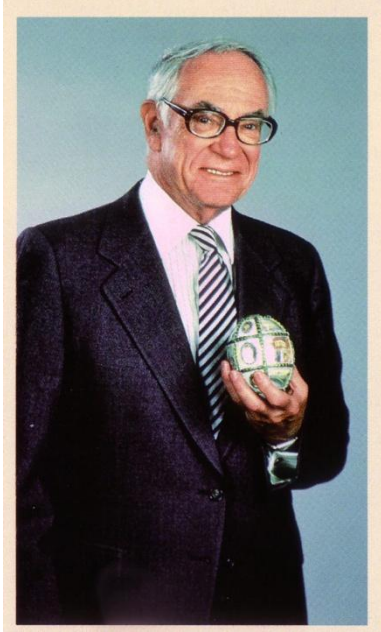


Figure 1. Malcolm S. Forbes (1919 –1990) with the *Fifteenth Anniversary Easter Egg*



Figure 2. Malcolm Forbes' four sons: Timothy, Robert, Christopher and Steve with the Fabergé Egg Collection



Figure 3. Viktor Vekselberg

In 2004 these eggs were acquired by *Viktor Vekselberg*, shown in **Fig. 3**, with an intention to bring the collection to Russia to be displayed to the general public in St. Petersburg. Vekselberg is Chairman of the Board of Directors, Renova Group of Companies. It is believed that he paid about \$100 million for the Fabergé Collection. The collection was put into the *Link of Times Foundation* which was established by Vekselberg to ‘search for, acquire and bring back home to Russia historical significant works of art.’



Figure 4. The Fabergé Museum in St. Petersburg located in the renovated Shuvalov Palace

Since November 2013 the masterpieces from the Imperial Easter Series are on display at the new *Fabergé Museum*, located in the completely renovated Shuvalov Palace in St. Petersburg. The museum, shown in **Fig. 4**, maintains the largest collection of the works by Fabergé, including cabinet gifts, lapidary art, object de fantaisie, silver, enamel. Russian icons with jewelled decoration all produced in the Faberge workshops.

The **Table** on page 4 lists the twelve recorded Fabergé Eggs and an additional Fabergé masterpiece, all illustrated with photographs in **Fig. 5**.

Table of Recorded Fabergé Eggs

Easter Egg	Description	Artist	Gift to
<i>Hen Egg</i> 1885*	Egg covering is made of white opaque enamel and the yolk of brushed gold. The egg contains a hen made of mosaic gold.	unsigned	Empress Maria Fyodorovna from Emperor Alexander III
<i>Renaissance Easter Egg</i> 1894*	The egg is cut from agate and has a gold frame partly covered in polychrome enamel with lion mascarenes, interspersed with rubies and diamonds. The year in diamonds is on the top of the egg.	M. Perkhin	Empress Maria Fyodorovna from Emperor Alexander III
<i>Rosebud Egg</i> 1895*	The egg is covered with bright red strawberry transparent enamel on a guilloche background and is decorated with diamond arrows, leafy garlands and wreaths of gold with a miniature portrait of Nicholas II on the top.	M. Perkhin	Empress Alexandra Fyodorovna from Emperor Nicholas II
<i>Coronation Easter Egg</i> 1897*	The egg consists of two halves linked by a hinge. The egg is covered with transparent yellow enamel put on a guilloche background using carved beams, while the enamel eagles are connected with branches of gold. Inside was a miniature absolutely exact copy of the coronation carriage.	M. Perkhin G. Stein Paintings: J. Zehngraf	Empress Alexandra Fyodorovna from Emperor Nicholas II
<i>Lilies of the Valley Easter Egg</i> 1898*	This egg is made in the Art Nouveau style. The egg shell is covered in transparent rose enamel on a guilloche background, decorated with stripes of diamonds and braided with lilies of the valley at the bottom on golden stems with enamel leaves and pearl flowers. On the top of the egg are three miniature portraits of the Emperor and his daughters Olga and Tatiana.	M. Perkhin Paintings: J. Zehngraf	Empress Alexandra Fyodorovna from Emperor Nicholas II
<i>Cockerel Easter Egg-Clock</i> 1900*	The egg face is covered with a white clock dial in guilloche enamel, equipped with Arabic diamond numerals and gold hands. The egg is supported with rectangular columns with white oyster enamel and interlacing golden décor. When clicking on a button a lid on the top opens and a cockerel appears, he crows, flips his wings and goes back inside the egg again.	M. Perkhin	Dowager Empress Maria Fyodorovna from Emperor Nicholas II
<i>Bay Tree Easter Egg</i> 1911*	The leaves of the tree crown shaped like an egg are made of Sayan nephrite. They are covered with amethysts, citrines, pink diamonds as well as small white enamel flowers. A bird with iridescent feathers is hidden inside the tree and when pressing a lever it appears and starts singing.	House of Fabergé	Dowager Empress Maria Fyodorovna from Emperor Nicholas II
<i>Fifteenth Anniversary Easter Egg</i> 1911*	The eggs golden shell is covered white iridescent guilloche enamel. It is divided into 18 segments by raised enamel garlands with diamond strings. There are seven miniature portraits of the Tsar's family as well as compositions showing key events from the reign of the Emperor.	H. Wigström Paintings: V. Zuyev	Empress Alexandra Fyodorovna from Emperor Nicholas II
<i>Order of St. George Easter Egg</i> 1916*	The egg is decorated with St. George ribbons in the colors of "powder and flames" which stand out on the background of opaque enamel. When clicking on a button, miniature portraits of Nicholas II and Tsarevich Alexei appear. A monogram of Maria Fyodorovna and the date of the gift are found at the top and bottom of the egg.	House of Fabergé	Dowager Empress Maria Fyodorovna from Emperor Nicholas II
<i>Kelch Hen Egg</i> 1898	This egg repeats the idea of the Imperial Egg but was executed far more richly this time. Inserted in the egg is a folding easel with a miniature picture.	M. Perkhin	Presented to A. Kelch to his wife Varvara Kelch on the Easter of 1898
<i>Duchess of Marlborough Egg Clock</i> 1902	This elegant Easter egg clock with a rotating dial is covered with gold silver diamonds, pearls and guilloche enamel.	M. Perkhin	The Duchess brought this egg back to England as a souvenir from Russia
<i>Chanticleer Egg Clock</i> 1904	This egg clock, decorated with gold, silver, diamonds, pearls and enamel, has a cockerel that rises up at each full hour from beneath a golden grille.	M. Perkhin	Presented to A. Kelch to his wife Varvara Kelch on the Easter of 1904
<i>Desk Timepiece with a Globe</i> 1908-17	Table clock with jade body and a dial painted in enamel on a guilloche background, crowned with a globe of rock crystal, which is engraved with the world's major shipping routes.	H. Wigström	This object, not an Egg, was also recorded as an <i>OptoClone</i> TM

* Imperial Eggs from the *Forbes Collection*



Hen Egg 1885



Renaissance Easter Egg Jewelry-Box 1894



Rosebud Egg 1895



Coronation Easter Egg 1897



Lilies of the Valley Easter Egg 1898



Cockerel Easter Egg-Clock 1900



Bay Tree Easter Egg 1911



15th Anniversary Easter Egg 1911



*Order of St. George
Easter Egg 1916*



Kelch Hen Egg 1898



*Duchess of Marlborough
Egg Clock 1902*



*Chanticleer Egg Clock
1904*



*Desk Timepiece with a Globe
1908-17*

Figure 5. The twelve recorded *Fabergé Eggs* and the *Desk Timepiece*
[Photos: The Fabergé Museum]



Figure 6. Sarakinos behind the HIH ZZZyclops™ recording equipment



Figure 7. The HiH recording tent in the museum basement

The recording of the *OptoClones*™

The recording of the *OptoClones*™ of the Eggs took place in the Fabergé Museum. Actually the technique of recording such ultra-realistic images can be traced back to the Russian Scientist Professor Yuri Denisyuk who invented in 1963 a technique for storing images as an interference pattern in a super-fine grain recording material with the help of a laser. He worked in St. Petersburg at the Vavilov Institute of Optics. This means that there are many Russian connections to the Fabergé *OptoClone*™ project. Not until the last few years there appeared small, powerful solid-state lasers and nano-scale panchromatic recording materials which could be used to record ultra-realistic images. HiH in Greece has developed equipment that can be moved to a museum for recording *OptoClones*™, which is absolutely necessary in order to record rare and expensive artefacts. It would be very difficult or almost impossible to move such artefacts like the Fabergé Eggs out of the museum to record them in a remote laboratory.

The mobile equipment from Greece was sent to the museum in St. Petersburg with the local assistance and logistics support of ITMO University. During several weeks in the spring of 2015 the recording took place in the basement laboratory of the museum. A recording tent was installed there and outside the tent the ZZZyclop™ equipment (**Fig. 6**) was positioned, sending “white” laser light, generated from three RGB (red, green and blue) lasers, into the tent, shown in **Fig. 7**. Inside the tent was a tripod with a front-silvered mirror positioned to send laser light down at a platform with a box in which the Eggs were placed. In **Fig. 8** and **9**, the *1911 Bay Tree Easter Egg* is positioned for the recording to take place. The excellent quality of the recordings was achieved thanks to Andreas Sarakinos, Chief Holographer and Scientific Director of HiH. He spent long hours every day recording a total of about sixty-five *OptoClones*™. Next to Andreas Sarakinos, in **Fig. 10**, is curator Alexey Pomigalov with the Egg in his hands after the *OptoClone*™ has been recorded in the tent. **Fig. 11** shows two of the authors, Andreas Sarakinos and Hans Bjelkhagen, holding the *OptoClone*™ of the *1900 Cockerel Easter Egg-Clock*.



Figure 8. The recording setup inside the tent



Figure 9. *The Bay Tree Egg* positioned in the recording box



Figure 10. Alexey Pomigalov removing the *Bay Tree Egg* from the tent



Figure 11. A. Sarakinos and H. Bjelkhagen with the *Cockerel Egg-Clock OptoClone™*

These *OptoClones™* were the key exhibit first on display at the 10th *International Symposium of Display Holography (ISDH2015)* organized in St. Petersburg at the beginning of July 2015 by ITMO University and the Hellenic Institute of Holography. Since then, they are on public show as part of the main event in the city of St. Petersburg for the celebration of 2015, the *UNESCO Year of Light* in an exhibition entitled *Magic of Light* running through the end of October 2015 before they travel to other parts of the world.

For the purpose of this exhibition, special RGB-LED illuminants have been developed by HiH, marketed as *HoLoFoS™*. They have been incorporated in a custom-made, free-standing, dedicated display system, shown in **Fig. 12**. The display cases have a window on the side showing that there is no real object inside.

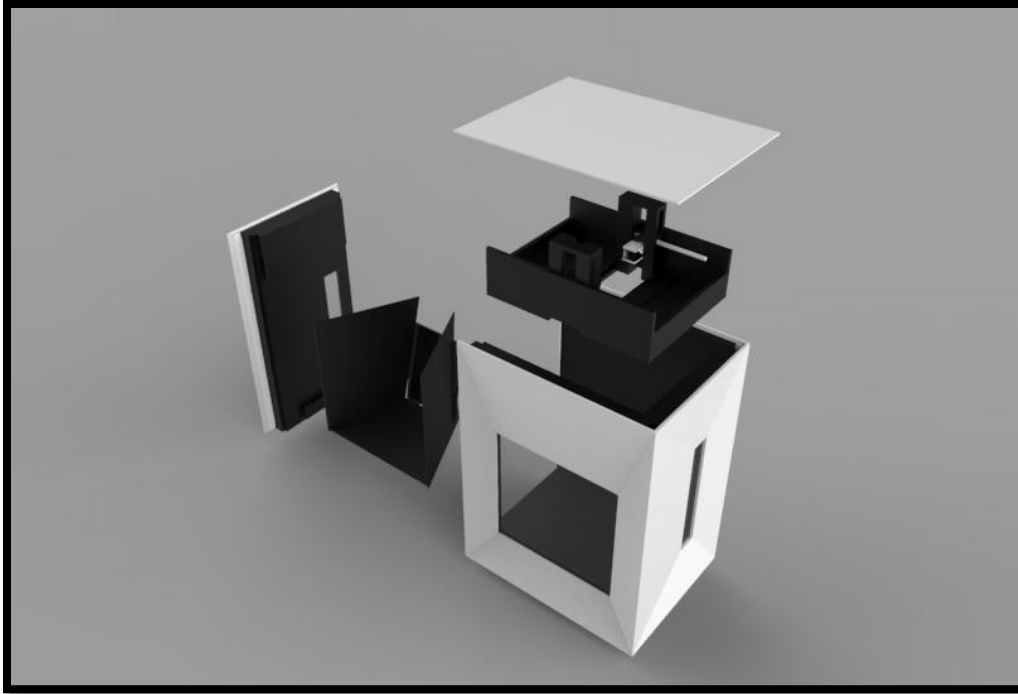


Figure 12. Special display case with integrated LED illumination for the *OptoClones™*

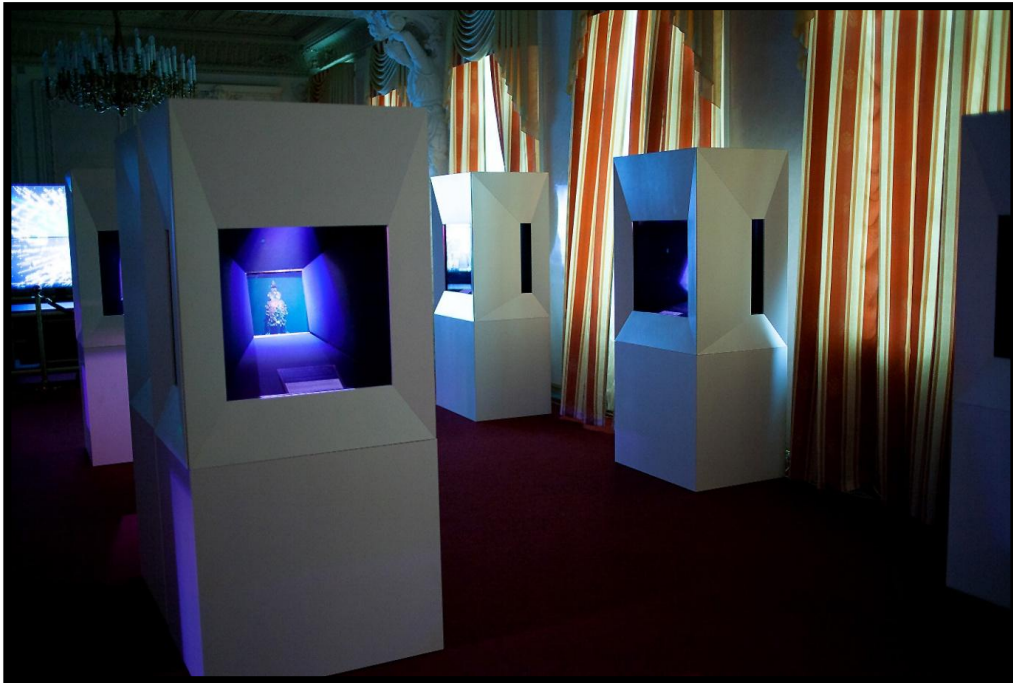


Figure 13. The display cases with the Fabergé Egg *OptoClones™* at the *Magic of Light Exhibition*, ITMO University

Some of the display cases with the recorded Fabergé Egg *OptoClones™* are shown in **Fig. 13**. This photo is from the *Magic of Light Exhibition* at the ISDH2015 at the ITMO University in St. Petersburg.



Figure 14. The recorded *Coronation Easter Egg* and the *Rosebud Egg OptoClones™*



Figure 15. A conference participant is admiring the *Bay Tree Egg OptoClone™*

In **Fig. 14** photographs of two of the recorded *OptoClones™* are reproduced. The Fabergé Museum Annual *Int'l Conference on Lapidary Art* took place October 8-10, 2015. From this event the *Bay Tree Egg OptoClone™* was on display at the museum, as shown in **Fig. 15**.

The virtual color image behind an *OptoClone™* represents the most realistic-looking 3D image of an object that can be recorded today. The extensive field of view adds to the illusion of beholding a real object rather than portraying a mere image. Good color rendition can be achieved by choosing the optimum recording laser wavelengths within the visible spectrum. The application of *OptoClones™* in museums and the tourist industry alike could exploit this new 3D imaging technique. Mobile holographic recording equipment is a necessity for recording artefacts like the Fabergé Eggs. The museum *OptoClones™* can be transported to any place, increasing the number of people who can experience the history of the object and its place within our culture. For example, since the Fabergé Museum does not have all the existing Easter Eggs, it should be possible to permanently exhibit all of them in one place as *OptoClones™*. It is even possible to simultaneously display all the Fabergé Eggs in several places around the world, provided that several *OptoClones™* exist of each Egg. Such *OptoClone™* exhibitions are easy to arrange since there is no need to worry about the artefacts themselves, for example that they will be lost, damaged or stolen, which means no need for expensive insurance policies. The Fabergé Museum is very interested in this new display technique and wants to arrange exhibitions of the *OptoClones™* in different places around the world.

Acknowledgements

The *Fabergé Egg OptoClones*[™] were recorded by *The Hellenic Institute of Holography* in Athens, Greece, in collaboration with the *ITMO University* in St. Petersburg, Russia. The interest and support of the Fabergé First Deputy Museum Director *Mikhail Ovchinnikov* was essential for this project. The *OptoClones*[™] were recorded on materials from both *Colour Holographics* in London, United Kingdom, and *Ultimate*, Bordeaux, France. The project was financially supported by rector *Vladimir Vasilev*, ITMO University and by *James B.V. Bowater*, Group Executive Chairman of Bowater Industries and Founder of Bowater Holographics. The collection is referred to the *Bowater Collection of Fabergé OptoClones*[™]. **OptoClone**[™] is a registered trademark of the Hellenic Institute of Holography (EU-013865951). All rights reserved.

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