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Planet Earth Seen From Space: A Very Brief Visual History

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Abstract: *The article proposes a brief visual genealogy of scientific whole Earth imagery from the beginning of the nineteenth century until today. It shows in particular that imagination played and still plays an absolutely central role in this history. Indeed, all whole Earth views from outer space – whether these are engravings from the nineteenth century, photographic recordings from the twentieth century, or digital images from the twenty-first century – invoke necessarily imaginative processes. Although data-gathering and visualisation technologies have dramatically modified the accuracy of the scientific knowledge and information that feeds into whole Earth imagery, imagination still has a very strong grasp on how we represent, visualise and finally conceptualise planet Earth.*

Keywords: *whole Earth images, space history, art and science, history of scientific images, space photography*

Planeta Terra visto do espaço: uma breve história visual

Resumo: O artigo propõe uma breve genealogia visual das imagens científicas da Terra inteira desde o início do século XIX até hoje. Mostra, em particular, que a imaginação desempenhou e ainda desempenha um papel absolutamente central nessa história. De fato, todas as visualizações da Terra inteira do espaço exterior – sejam elas gravuras do século XIX, registros fotográficos do século

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XX ou imagens digitais do século XXI – invocam processos necessariamente imaginativos. Embora as tecnologias de coleta e visualização de dados tenham modificado drasticamente a precisão do conhecimento científico e das informações que alimentam as imagens da Terra inteira, a imaginação ainda exerce um forte domínio sobre como representamos, visualizamos e, por fim, conceitualizamos o planeta Terra.

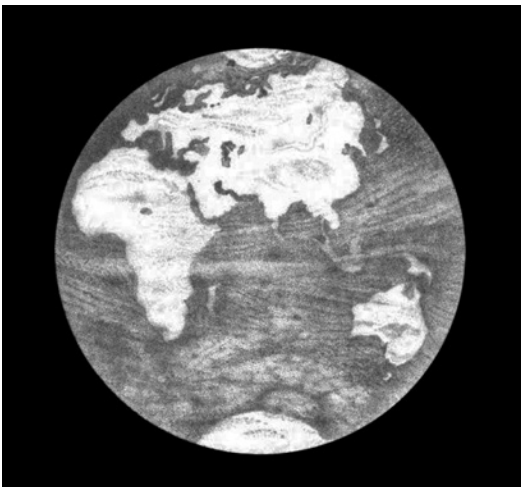
Palavras-chave: imagens da Terra inteira; história da exploração espacial; espaço, arte e ciência: história das imagens científicas; fotografia espacial.

If we think of "planet Earth" today, some of the images that cross our inner eye are in many cases the spectacular visual outcomes of space exploration. To put it in other words, our Western, collective imagination of what we call "Earth" today is fundamentally structured by the visual. Yet the views of Earth as seen or imagined from space did not stay immutable over time but evolved considerably over the past two centuries. Indeed, according to philosopher Hans Blumenberg (1997: 384), whereas Westerners, when thinking of "planet Earth", imagined in the past an artificial globe suspended in space, we think of Earth today mainly in function of the visual outcomes of the large space programmes. Although globes are still part of what may be called an "iconography of power" (allowing to express, for instance, the global commercial ambitions of multinational corporations), globes were never really able to surpass mostly decorative or rhetoric functions. This is (at least partly) due to their insufficient scale, which proved to be in many cases not very useful in practice, and the important production costs that were in most cases far too high to allow globes to become objects of everyday use. As we all know today, it is representations drawn in the plane, i.e. maps that have become the dominant, privileged visual mode to represent geographical knowledge of planet Earth. However, next to globes and maps, one particular visual mode stands out, also because it has its very own history, a history that is tightly bound to aerial and space exploration: the figure of the terrestrial sphere of which I would like to propose in the following a very brief visual history.

Amongst the first images claiming to show Earth "as one would see it from outer space" figures an engraving which is the frontispiece of an influential book in geology, published in 1834 by Henry De la Beche, a respected member of the Royal Society in London (figure 1). Several aspects make this image a remarkable contribution to early Earth views from space. First, Henry De la Beche decided to commence his geological treaty with a view that is normally reserved to astronomers. Indeed, Earth is shown here as a cosmic object, a planet floating

in black space, clearly detaching itself from the dark background. Moreover, the Earth's atmosphere is also rendered visible through cloud bands which subtly mask landmasses and the world oceans. Finally, De la Beche insists on the rigorous scientific exactness of this representation: Earth is drawn to scale and represented slightly flattened at the poles in order to support the (at the time) very popular thesis of its formerly fluid state. Considered together, all of these elements show that geology, which is at the beginning of the nineteenth century starting to become an autonomous scientific discipline, can successfully occupy a field of inquiry that was formerly reserved to astronomy (Rudwick, 2014: 152). And maybe more importantly, the visual argument allowed scientists outside of astronomy to conceptualise planet Earth in global term as a planet amongst planets and the visual realm, just as this frontispiece from Henry De la Beche, contributed in decisive ways to these new conceptualisations.

Figure 1 – "The Earth Supposed to be seen from Space", as imagined as early as 1834 by Henry De la Beche



Source: Henry De la Beche, *Researches in Theoretical Geology*. London, Knight, 1834, frontispiece.

However, despite the popularity of the image in geology and outside of its field, this did not imply that astronomy would simply drop this important visual terrain. Indeed, quite the opposite was actually the case. With the rise of illustrated press and in particular popular science during the nineteenth century, one can identify a large number of visual examples staging spectacular

representations of Earth views from space, often invoking novel and innovative elements. For instance, with the help of the inversion of the most classic astronomical perspective, many engravings and illustrations offered the curious reader a perspective of what imagined "Selenites", i.e. lunar inhabitants would see from the lunar surface. One famous, very early example (probably the first) is a hand drawn magic lantern slide, realised in 1849 by Carpenter and Westley and entitled "Imaginary View of the Earth as Seen from the Moon" (figure 2). Astonishingly, the compendium that accompanied this early visual example had nothing at all to say on the striking appearance of Earth as a planet seen from outer space, with the oceans drawn in vivid blue colour and parts of the white continents veiled by cloud formations. Rather, the authors insisted on the foreground of the image, i.e. the supposedly rugged lunar surface, underlining in particular the absence of an atmosphere and water, and the rough topography which, according to Carpenter and Westley (1849: 25), is the outcome of "violent volcanic activity".

Figure 2 – "Imaginary View of the Earth as Seen from the Moon" (1849), hand painted magic lantern slide, from Carpenter and Westley

Source: Image reproduced in Elsa de Smet, *Voir l'Espace: Astronomie populaire et science populaire illustrée*. Strasbourg, Presses universitaires de Strasbourg, 2018: 105.

In his famous *Astronomie populaire,* Camille Flammarion successfully picked up on this visual tradition and proposed in 1880 an engraving picturing also planet Earth as seen from the lunar surface, showing once again a mountainous lunar landscape dominating the picture's foreground (figure 3). And

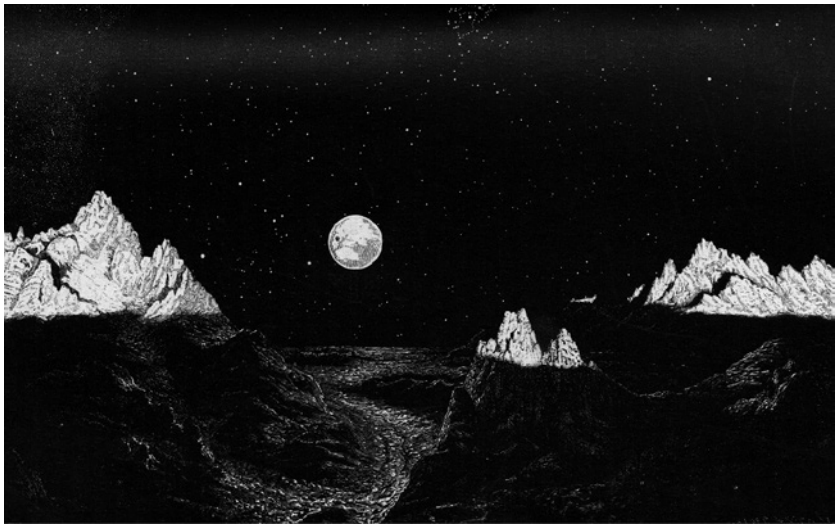
here again, we find an important scientific ambition just as in the two former examples: in trying to offer a highly "realistic" space view of our home planet, Flammarion pictured the Earth as a planet with an atmosphere, clearly distinguishable due to the austere, black background of outer space. This distinct element, present in all three examples, is important to note because it marks a break with another (much older) visual tradition where Earth is depicted as a simple globe, an artefact without atmosphere or any other signs of biospheric activity. Moreover, contrary to Carpenter and Westley who had nothing to say in their *Compendium* on the Earth view, Flammarion noted that his imagined "Selenites" would be truly fascinated by the view of Earth from space. And he was equally convinced that these images would have a lasting impact on society. Indeed, especially during the second half of the nineteenth century, popular astronomers were very attached to the idea of educating the public, in particular the belief that they can help "exercise a stimulating influence on even the simplest mind, especially on the growing youth" (Mayer, 1892: 152).

Figure 3 – The Earth with a well visible atmosphere as seen from the rugged lunar surface and imagined by Flammarion in 1880

Source: Camille Flammarion, *Astronomie populaire*. v.1, Paris, Marpon et Flammarion, 1880: 201.

By the end of the nineteenth century, one thus finds many examples in Europe of popular astronomers mobilising this particular type of iconography during their public lectures and in their written work. One other, iconic example for this educational mission is popular astronomer Wilhelm Meyer's view of Earth from the Moon (figure 4), used in his show in Berlin at Urania "From the Earth to the Moon". With the help of this view, Meyer invited especially the uneducated spectators to experience a solar eclipse "as seen from the Moon", with the Earth clearly identifiable at the rugged horizon.

Figure 4 – A solar eclipse observed from the lunar surface, a view imagined by Meyer in 1892 for his talk "From the Earth to the Moon"



Source: Max Wilhelm Meyer, *Illustrierter Leitfaden der Astronomie, Physik und Mikroskopie in Form eines Führers durch die Urania zu Berlin*, Berlin, Paetel, 1892:153.

Growing out of this tradition, the illustrator and astronomer Lucien Rudaux is a key figure that definitely stands out amongst science popularisers at the beginning of the twentieth century. His naturalist paintings, often infused with great theatricality, allowed a large public – at least with the help of their imagination – to experience and explore the distant worlds of outer space. Figure 5, showing planet Earth as a star amongst others, is a great example for his work on planetary landscapes, and it marks the beginning of nothing less than a new genre in painting, the art of depicting outer space landscapes. This new genre inspired the movement of Space Art where Rudaux's influence still can be felt today (De Smet, 2018 ; 2015). Indeed, by transposing highly familiar perspectives

(such as landscapes as seen by the human observer) into outer space, Lucien Rudaux successfully demystified the space experience thus making it accessible to a large public. Moreover, as art historian Elsa De Smet has convincingly shown, the theatrical aspects of his work make him an important precursor of cinema because his paintings and drawings contributed crucially to the development and establishment of a new aesthetic paradigm. The seventh art was greatly inspired by Rudaux's visual imaginary where one finds during the afterwar period, especially in science fiction movies, many visual connections to his seminal work, such as for instance in *Destination Moon* (George Pal, 1950) or in the widely celebrated *Space Odyssey*, directed by Stanley Kubrick (1968).

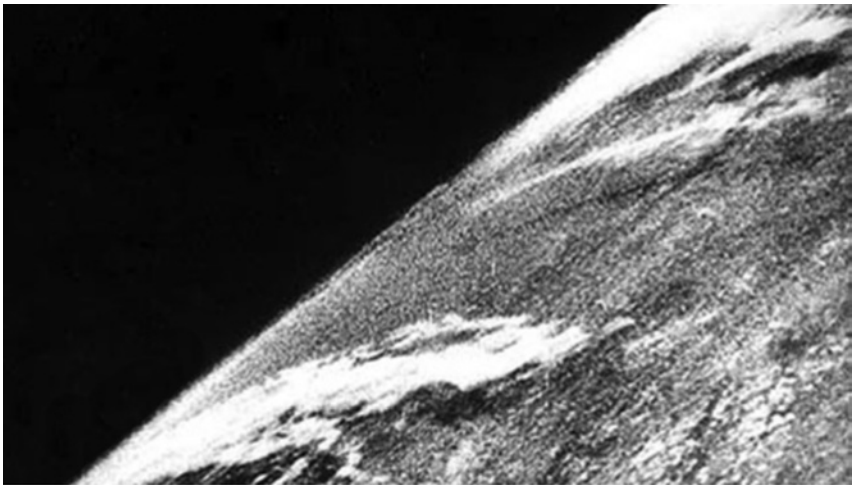
Figure 5 – The Earth as a star amongst others by Rudaux in 1937

Source: Lucien Rudaux, *Sur les autres mondes*. Paris, Larousse, 1937: 1.

These views imagined and invented by astronomers, science popularisers, illustrators and artists were rapidly confronted with the actual reality of space exploration, thus making increasingly room for documentary recordings which gave birth to yet another, new visual tradition. Indeed, aerial and space photography occupy a central place in the formation of a new terrestrial imaginary all along the first decades after the Second World War. After almost fifty years of research on the possible fusion of photography on the one hand, and balloons, kites, rockets and even pigeons on the other, aerial photography definitely moved out of an early experimental phase during the First World War, thus becoming a central, visual planning aid within many military headquarters

(Grevsmühl, 2014; Newhall, 1969). During the Second World War, this function was further expanded and even industrialised (Babington-Smith, 1958). This strong strategic, military function of aerial and high-altitude photography stayed all along the Cold War an absolutely central function. Even the birth of the space age, well before Sputnik, is closely connected to photographic images. Although a serendipitous outcome of early missile trajectory investigations, the first known Earth photograph taken "from space" (i.e. beyond the symbolic altitude of one hundred kilometres) was realised in 1947 with the help of a captured German V-2 rocket (figure 6). Used during extensive scientific tests in the desert of New Mexico where university researchers and scientists were invited to join the military, the V-2 rockets and their successors, i.e. Aerobee rockets, were the first important vectors of early space photography[2].

Figure 6 – The first known documentary recording from outer space, a photograph realised with a V-2 rocket on October 24, 1946 at White Sands, New Mexico



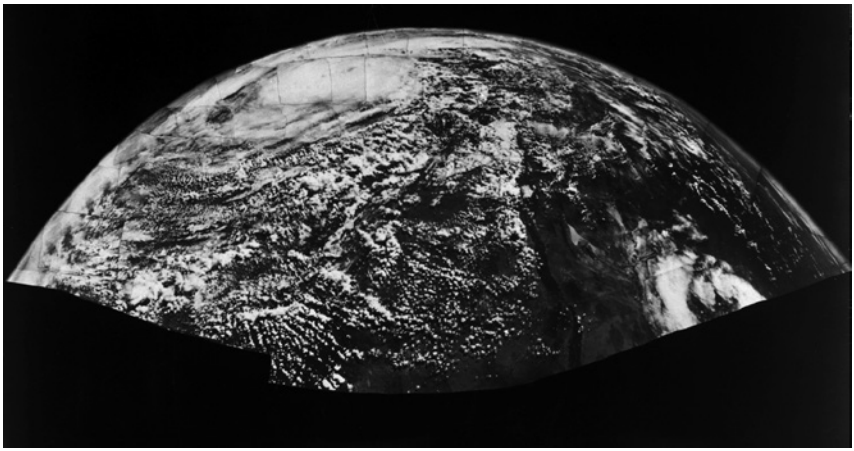
Source: Johns Hopkins University Applied Physics Laboratory.

Although the first experiments were designed to better understand the movements and the exact trajectory of the missile through the atmosphere, the resulting photographs of Earth and its atmosphere quickly stirred the interest of many American meteorologists and the photographs had a decisive impact on their community. Indeed, large meteorological systems, clearly visible on some

2 See in particular the important work of DeVorkin, D. *Science with a Vengeance: How the Military Created the US Space Sciences After World War II*. New York, Springer, 1992.

of the early photographic mosaics and reproduced in many magazines and news outlets, showed the enormous potential of high altitude photography (figure 7).

Figure 7 – Composite image showing a tropical cyclone, published in colour on a double-page in *Life Magazine* in 1955



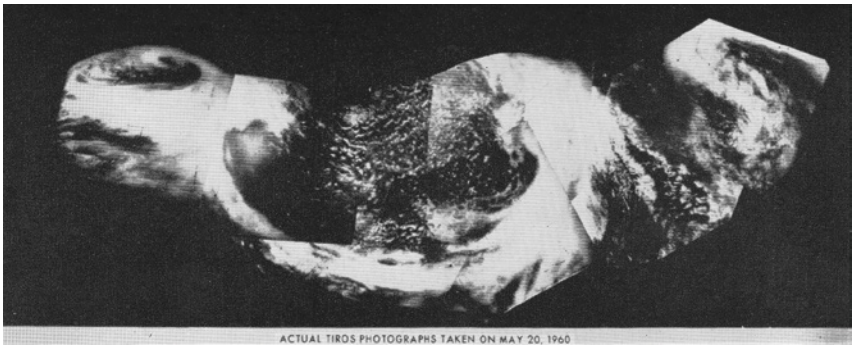
Source: US Naval Research Laboratory.

Harry Wexler of the US Weather Bureau lobbied from the early hours of space photography for the construction of a meteorological satellite as a "storm patrol" (Wexler, 1954: 269). This use was indeed confirmed only a few years later in 1960 when the TIROS satellite (Television Infrared Observation Satellite) started to make the first meteorological observations. The images produced by TIROS were not photographic images in a strict sense but rather television images, composed of five hundred lines transmitted by radio signal to ground stations, visualised on TV screens and finally photographed in order to allow better handling and more easy distribution. Most of the TIROS images were not perpendicular but rather oblique images of the atmosphere favouring large atmospheric volumes, and it was these kind of images that became iconic in the public sphere. However, the poor image resolution of all TIROS images did not allow to profoundly revolutionise meteorological practice in North America, also because a large meteorological ground station network was already available. These images rather had an imaginary and highly symbolic impact[3]. After all, most of the TIROS images allowed to place an almost banal, commonplace

3 See especially: Mark Monmonier, *Air Apparent: How Meteorologists Learned to Map, Predict, and Dramatize Weather*, Chicago, London, University of Chicago Press, 1999.

phenomenon – the Earth's meteorological conditions – into an entirely new context. The overlay, in many cases, of these images with gridlines and political boundaries clearly helped for the interpretation and the large public distribution of these images, which circulated well beyond the scientific meteorological community (figure 8).

Figure 8 – Composite image composed of several images from the first meteorological satellite TIROS-I



Source: NOAA image spac0019.

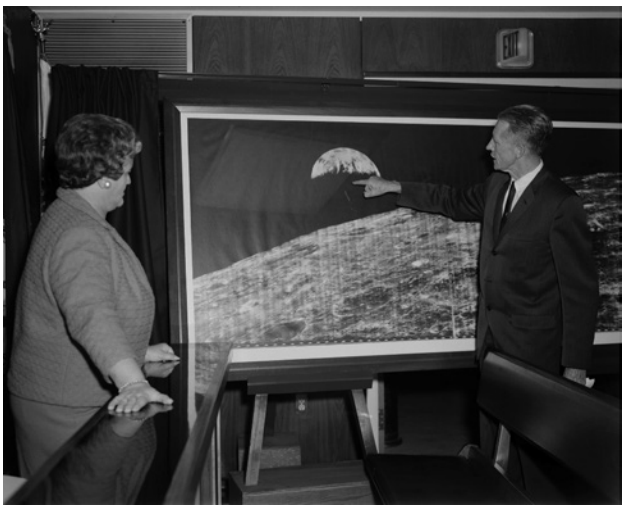
The 1960s were not only influenced by the first satellite programmes but also by many manned space flights, i.e. the Mercury, Gemini and Apollo missions, that produced a steady, continuous and in many ways increasingly spectacular flow of widely circulated images. Although far less known, many unmanned space missions produced during the same period, all along the 1960s, spectacular Earth images, many of which were realised during missions to identify a potential Moon landing site in order to safely place the first American on the Moon, an objective that President Kennedy famously formulated as a key objective to be achieved before the end of the decade[4].

For example, the Lunar Orbiter I spacecraft realised during one of these unmanned missions the first "Earthrise" image in 1966, thus making it an important precursor of the far better known Earthrise photograph of the Apollo 8 mission. The many individuals who were following closely at the time the rapid American progress in lunar exploration were certainly impressed by the advanced picturing capacities of NASA's unmanned lunar spacecraft. Indeed,

4 Scans of the speech manuscript may be consulted online here: http://www.jfklibrary.org/Asset-Viewer/Archives/JFKPOF-034-030.aspx . Last consulted: January 11, 2019.

as the first interplanetary photographic laboratory, Lunar Orbiter I was carrying highly advanced imaging technology initially conceived for a top secret military reconnaissance programme and it thus was the result of an early, yet successful technology transfer from the military (the National Reconnaissance Office) to the civil domain (NASA) (Hall, 2001). The Lunar Orbiter I camera, fitted with two different objectives, allowed for producing images on 70mm black and white film which was after each shot developed and scanned, dot by dot, and the resulting luminosity signal transmitted to a tracking station on Earth, before being reconverted and distributed as individual 35mm black and white photographic prints. The result, after a cumbersome reconversion process, was nonetheless truly remarkable, although one clearly could see that this was not a high-resolution photograph but a complex composite image composed of lines and dots. However, once NASA's press service reoriented the image to give the impression of an "Earthrise" (figure 9) observed from the Lunar surface, the image could actively contribute to the highly symbolic lunar landing objective. Indeed, in this first Earthrise image, planet Earth visualised in some detail in black and white, does not play the leading role. The main objective stays the Moon and the image thus effectively announces the spectacular manned missions that were to follow.

Figure 9 – The first Earthrise image from Lunar Orbiter I, presented at a press conference in 1966 by the director of Langley Research Center



Source: NASA image L66-10055.

During one of those missions, the Apollo 8 mission in 1968, the astronaut William Anders took the far better known photograph "Earthrise" (figure 10) which benefited from quite a different reading and reception, even though the image followed a very similar mode of cultural construction and staging. Presented, once again, as a perfect inversion of the classic landscape view, the change of the technological setting out of which the image was born modified its reception and interpretation considerably. The reader's attention is no longer drawn to the surface of the Moon which appears in the colour photograph as a grey, inert and even hostile environment. Rather, the attention is now directed towards our blue planet, authenticated by photographic realism and accompanied by widely circulated astronaut interviews, thus effectively reinforcing the myth that we can see what is shown in the very same way as if we were in outer space. More importantly, planet Earth itself becomes the true discovery of space exploration and henceforth the Moon no longer appears to be a target of interest and even less a potentially habitable world[5].

Figure 10 – The famous Earthrise photograph realised by William Anders on December, 24, 1968

Source: NASA image AS08-14-2383.

5 This "insight" will be confirmed once and for all only seven months later.

NASA's choice to present the image according to the conventions of central perspective may appear as something rather trivial and banal. However, this powerful gesture marks the starting point of the meticulously orchestrated staging of holistic images. The second icon of the Apollo missions, the so-called "Blue Marble" from 1972 (figure 11), thus represents only one of many steps in a long process of a search for an ideal visual form of planet Earth. The Blue Marble is certainly not the first image showing the "totality" of the terrestrial sphere from outer space (the ATS-III satellite, for instance, produced in 1967 an earlier version of a whole Earth image in 1967), nor is it the last one. Indeed, several programmes that followed the Apollo missions produced updated versions of the Blue Marble. However, where the Blue Marble from 1972 did make a true difference is the fact that it actively contributed to the creation of what may be called a "visiotype"[6]. If we, Westerners, think of planet Earth we often think precisely of that visual form.

Figure 11 – The iconic Blue Marble photograph from Apollo 17, 1972

Source: NASA image AS17-148-22727.

6 In short, a visiotype is the visual equivalent of what Lippmann famously called in 1922 a stereotype. It describes the type of image that crosses your mind when we think of something specific. The visiotype concept was coined in: Uwe Pörksen, *Weltmarkt der Bilder: Eine Philosophie der Visiotype*, Stuttgart: Klett-Cotta, 1997. The notion may be compared with Lippmann's definition of stereotype in: Walter Lippmann, *Public Opinion*. New York, Harcourt, Brace and Company, 1922: 89.

Tangible proof that it is not exaggerated to speak of a visiotype when discussing whole Earth imagery are the many satellite programmes which allowed to produce more recently updated versions of the Blue Marble (figures 12 and 13). These "updates" generally include not only a far better spatial resolution but also multiple spheres – including now not only the Eastern but also the Western hemisphere – thus striving to overcome any former lack of completeness (since one can never see the whole Earth at a time, but only one hemisphere). In order to create these images, extensive use of imaging software and of modelling had to be made. Although these images move further and further away from analogue photography, they still simulate its aesthetic appearance. And contrary to common belief, imagination still plays a major role within this visual universe. To be sure, these are images that show (according to their creators) far more detail and acuteness in colour, effectively reinforcing the myth of an Earth that has been completely surveyed and that may be entirely controlled. But these are also highly virtual views, fed with data from different moments in time and space, and with different instruments, recomposed in order to create the illusion of a coherent whole.

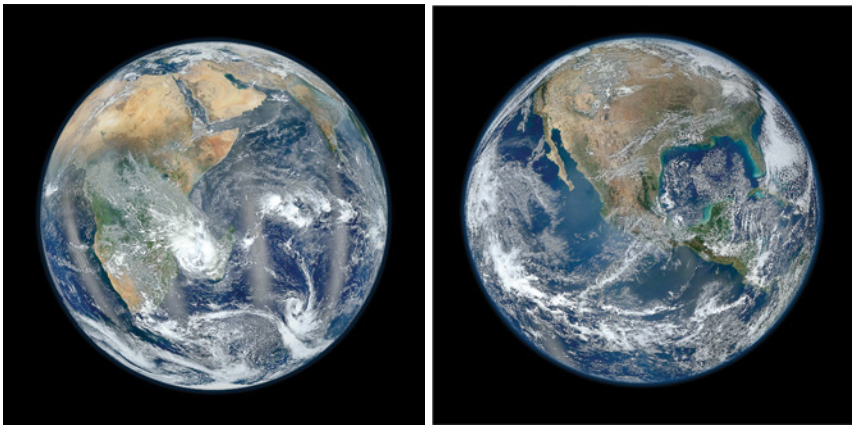
For instance, in order to create the new version of the Blue Marble from 2002, the US Space Agency had to use visual data from different satellites in order to create the now famous satellite mosaic in several steps. Robert Simmon and Reto Stöckli, the data-visualizers and designers at NASA's Earth Observatory that created the new version of the Blue Marble from 2002, described in detail how they constructed step by step, layer by layer the iconic image that even ended up as standard lock screen on Apple's iPhone[7]. Starting with a base map as background, Simmon and Stöckli successively added a blue ocean layer, a white and grey polar region and sea ice layer, a shading layer to better represent Earth's major topographical features, a cloud layer as composite image, stitched together out of views from different days and partially duplicated due to some lacking data, and finally a luminosity layer that allowed to visualise city lights of large urban agglomerations.

7 See: <https://earthobservatory.nasa.gov/blogs/elegantfigures/2011/10/06/crafting-the-blue-marble/>. Last consulted: January 11, 2019).

Figures 12a and b – Eastern and Western hemisphere of planet Earth, created in 2001/2002 by NASA Visible Earth Project

Source: NASA Visible Earth Project.

Figures 13a and b – The Suomi NPP satellite, in orbit since 2011, provided the data for this recent update of the Blue Marble two-hemispheric views in 2012



Source: NASA/GSFC Suomi NPP Marble Collection.

There are thus important lessons to be learnt from this brief visual genealogy of whole Earth imagery that may serve as a brief conclusion. The first lesson would consist in asserting that in any whole Earth image, we can never see the whole Earth but only one hemisphere at a time. In this sense, the global is never a given, but it has to be meticulously composed and assembled at every moment in history. Each image of planet Earth as seen or imagined from space

– whether it's an engraving from the nineteenth century, or a photographic recording from the twentieth century, or even a digital image from the twenty-first century – participates actively in this globalisation process. Imagination always was a central part of this story and despite the new "hyperrealism", and the supposed supreme accuracy of the latest versions of the Blue Marble, imagination still plays a fundamental role in this process. Today, and Simmon's and Stöckli's account is tangible proof for this, imagination thus still has a very strong grasp on how we represent, visualise and finally conceptualise planet Earth. So instead of thinking of imagination as an antithetic category of reality we should rather accept the fact that it always was and always will be part and parcel of the production universe of scientific image making.

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