International Congress of Aesthetics 2007
"Aesthetics Bridging Cultures"

The Digital Aesthetics of Space Research

André Nusselder, Erasmus University Rotterdam, The Netherlands

Introduction

According to Sean Cubitt, who wrote a noteworthy book called *Digital Aesthetics*, the Hubble space telescope, though built for momentous reasons of science, is a special effects movie.[1] In order for you, the reader, to sense this yourself you may take a look in Hubble's Movie Theater, and watch the movie *Revelations*.[2] However, Hubble's movie contains more than its similarity to cinema. It also reveals a crucial aspect of this branch of science that deals with distant or even fully absent objects that resist mere reflection or detection, and thus of all sciences that depend on technological media for the relation to the object and on the processing of the gained data into images. Of course, such movie-clips are made for the spectator, and probably with educational, commercial and political motives. But the question is whether the scientific researcher perhaps also ends up in the position of the spectator: not the detached spectator observing the object quietly, but the excited one enjoying the images that it has made the object into.

Another movie-clip on the Hubble site shows a researcher submitting a proposal to Hubble's scientific team for doing research with the space-telescope. His proposal is accepted and at a certain moment the people at Hubble's control center direct the telescope to a specific location in the sky, and the researcher after many days gets the data he desires. At the end of the clip we see him behind his computer monitor with beautiful images of a cluster of galaxies on it. Mission accomplished, the project was successful and the result is images.

This is, think, a pivotal and necessary process in computerized sciences of objects beyond human perception: our human brain cannot handle such an amount of raw data: it must, and wants, to introduce order into them, interpret and give meaning to them, and – not the least - create an attractive representation. This is quite a blow for the ideal of 'pure' scientific knowledge. But on the other hand, what is the meaning of this kind of knowledge when we cannot make any sense of it? This shows the importance of the human mind in the process of knowledge acquisition. I will try to exemplify this by the Hubble telescope and by the use of color by its scientist.

Figure 1. The Hubble Space Telescope, from the Space Shuttle Discovery during the second servicing mission

The Hubble Space Telescope is both a spacecraft and a telescope. It was launched into space by Space Shuttle Discovery in 1990, as the solution to an ancient problem in astronomy, namely that of atmospheric distortion meaning that the atmosphere distorts view of telescopes based on earth. Besides that, the atmosphere also absorbs or blocks certain wavelengths of radiation. As Hubble orbits above the atmosphere it can also detect for instance in ultraviolet and in infrared. Because of these capacities it has transformed the way scientist, and also the lay public, view the universe.

Origins

Now, why is space research so relevant for philosophy and digital aesthetics? First of all because the objects, the stars, galaxies, black holes that are studied, and eventually the Big Bang itself, are absent: they are not present for observation. So the material object is absent, or even lost, and all we are left with are the quanta of energy that they have emitted a long time ago. At the present, they might already have extinguished – in the case of stars and galaxies – or inevitably belong to the past – as in case of the supposed Big Bang. Secondly, because we necessarily perceive those objects by means of technological devices, which are now to a large extent digital technologies. Thirdly, because those objects are the objects of the most intense and deep human fascination. We want to know where we come from, where we might go to, and where we belong to. And the answer is largely written in the stars. So space research brings together three dimensions: the religious dimension of ultimate objects, the scientific and technological dimension of gaining knowledge of them and extending our grasp on things, and the dimension of the human mind with its cognitive patterns and fantasmatic desires. The combination of these dimensions brings forward the spectacular movie clips as we can find them for instance on the Hubble site.

It also results in the attempts to represent aspects of our cosmic roots, as can be witnessed in the spectacular images that can be found at the website of NASA's Origins Program.[3] The name of the program is very adequate as it seeks to give an answer to the ancient questions of human existence: where did we come from, are we alone in the universe? In order to formulate an answer the program uses the Spitzer telescope that collects energy

in the infrared spectrum, and later will be using the James Webb Space Telescope that should be launched in 2013 as the successor of the Hubble telescope.

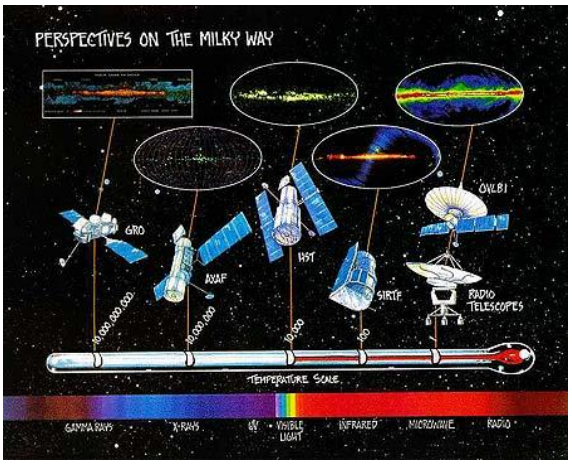


Figure 2. NASA's Great Observatories

Hence the Hubble Telescope studies the birth of planets, stars and galaxies, and also of the entire universe itself. What we see in this project, which represents man's deepest desire to know himself, are the fantastic and fantasmatic images of supposed answers to the riddles.

The Screen: art and science

The data and images provided by NASA's four great observatories have significantly shaped our view of the universe, and in that they have created our sense of reality. But the question remains: is it real? How, actually, are the objects *really* that we perceive through the windows upon the universe that the observatories have opened? As I think that Kantian philosophy and Lacanian psychoanalysis are highly relevant tools for understanding this difference between reality and the real, I will take the opportunity to make a few remarks about them.

My thesis, developed in my dissertation *Interface Fantasy* (to be published at *MIT Press*) is that the search for impossible things, also the scientific search, leads to the production of fantasmatic images that have a constitution or structure that is similar to those of the objects of the imagination in Kantian philosophy and Lacanian psychoanalysis. There imagination functions as both an opaque screen that defends us against the shivering absence of the object, and as a window through which we can catch a glimpse of it. As there *is* a relationship to the object as it is in-itself - and I think of this relationship now in terms of digital data - it does not lead to a sort of postmodern idealism or subjectivism where no connection whatsoever to the object is left (as for instance in the work of Baudrillard). But this relation of the digital interface object to the code-object is one of construction – therefore notions like resemblance and representation fall short. This construction takes place at the computer screen, at the interface of man and machine, subject and object. Because of this, the position of the object on the screen is simultaneously a scientific and an artistic one.[4]

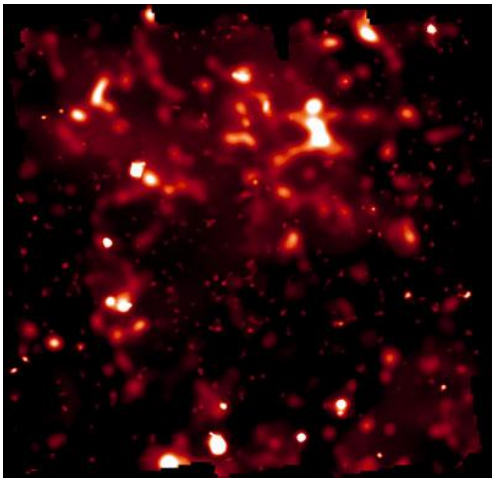


Figure 3. Cosmic Evolution Survey –Visible (Baryonic) Matter

Also the scientists who are involved in image processing at NASA and ESA acknowledge that they are working at the border of art and science. Stressing this connectivity is very important, and goes beyond some well-known ideas. It is more than the idea that 'artists reveal the world in different way' (which is nice but not scientific), and more than the notion that 'also in science the aesthetic dimension is important' (for instance, mathematicians finding "joy and beauty" in constructing the most simple proofs and propositions possible). On the screen as I understand it, which is also the screen as we see it operating in space research, art and science can no longer be thought of as opposites.[5] The object of study is absent and all that we are left with are traces of electromagnetic energy, and it is the human subject that must give form to the data-signals and thus construct the object. In research areas like that of space, where we relate to the object by means of electromagnetic waves, the goal of rational science of an adequate representation of the object is impossible.

First of all this is the result of the nature of light itself: we always have a partial visualization of the object (our eyes can only detect less than 1 % of the electromagnetic spectrum). We do not see, for instance, another person in the infrared spectrum – something which is only attainable in technological media.

Figure 4. Infrared image of person holding burning match

Seeing the object in its full spectrum is impossible, or would require an unimaginable cybernetic extension of our vision. With technological instruments like Hubble we seek to extend our vision. But this still covers only a part of the spectrum and not all of it. Even this vision that goes beyond that of the 'natural' human being, a cybernetic vision, is still partial.

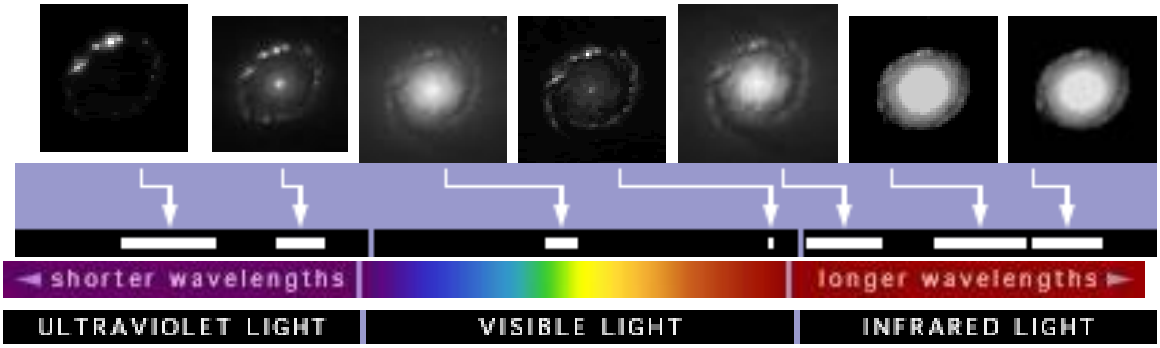


Figure 5. The seven pictures depict galaxy NGC 1512 in different kinds of light. Note how the individual images differ in appearance.

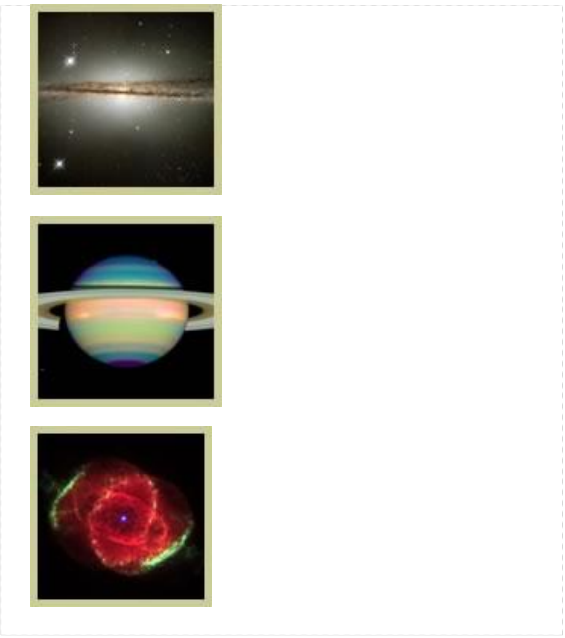
Adequate representation is impossible, secondly, because the cybernetic vision of the object takes place by a construction of the object out of digital data.[6] And this is a construction process according to the principles of selection and composition. Right from the start, from the moment Hubble sends its data to Earth there is a selection of which data-sets are going to be used, which are, at the end of the track, composited into new, meaningful wholes. These two basic principles of digital representation, selection and composition, are also the basic principles of the functioning of the unconscious mind according to Freud. On the computer screen, which in this manner also functions as a mental screen, the information coming from the object is made by the human subject into a screen-image. It is hence the human subject that attributes to the form of, let's say, a galaxy – he helps to design it. A design that is both artistic and scientific and which shapes our reality.

As the screen-object is both subjective and objective, one can no longer sharply draw the distinction between the subjective and the objective. And herein it resembles the screen of imagination in Kant and Lacan.[7] Both consider reality as fundamentally interwoven with imagination: there is no 'real reality', separate from its appearance (which is not to say that everything turns out to be illusory, for illusion takes place where we take the appearance for the object itself – so it's important to remain aware of the gap between appearance and the real: that's also the gap where desire originates). This understanding of reality, as something in which we are dealing with screened appearances of objects that we cannot reach as they are in themselves, is not a plea for subjectivism. It must make us aware of the difficulty or even impossibility of appropriating reality and of assuming objectivity, and of the enormous impact of our physiological, psychological and cognitive constitution in its construction.

Now some remarks on the position of color in this construction of reality.

The color screen

Hubble is a type of telescope known as a Cassegrain reflector. Light hits the telescope's main mirror, it bounces off the primary mirror and encounters a secondary mirror. The secondary mirror focuses the light through a hole in the center of the primary mirror that leads to the telescope's science instruments. Subsequently, images are produced, not in full color, but in black and white. The color is added during image processing. Therefore the color that we see in the images is most of the times not quite what we would see if we were able to visit the objects in a spacecraft. Color is often used by the scientist as a tool.



- NATURAL COLOR
- *The colors in this image of a galaxy were chosen to simulate the colors that our eyes might see if we were able to visit it in a spacecraft.*
- REPRESENTATIVE COLOR
- *Representative color helps scientists visualize what would otherwise be invisible, such as the appearance of an object in infrared light*
- *ENHANCED COLOR*
- *Enhancing the visible colors in an image often brings out an object's subtle structural detail.*

Figure 6. Color as a tool.

It is used as a tool to enhance details of the object, or to visualize what ordinarily cannot be seen by the human eye. Color is a tool to highlight features of the object that the scientist is interested in. The scientist, we could say, is thus at the same time an artist, in the sense that his specific interests in the celestial object construct a certain appearance or image of it. And this is not, to use the Kantian terminology, the object as it is in itself. It is the object as it appears *to us*. Colors – for instance the galaxy shown here – are used to *simulate* what the object might look like if we were able to visit it in a spacecraft. Color closely relates to simulation, by the nature of the processes that underlie it.

The first thing to know about color is that it is not a simple objective thing (for a good description of color models see Colour Order Systems in Art and Science[8]). Color is the way that we perceive the interaction of light on substances. Objects are not really colored but they absorb, transmit or reflect particular wavelengths of light. Plants, for instance, appear as green because they have pigments which absorb wavelengths from the red and blue parts of the visible spectrum and only allow the 'green' wavelengths to be reflected onto a viewer. Red, green and blue are the wavelengths to which our eyes are particularly sensitive, and therefore most of the natural colors that we see in the world around us are capable of being simulated by different intensities of just these three fairly narrow bands of the spectrum. This is a crucial process for the reproduction of color in the images we see on the Hubble site, and also for the recreation of colors on televisions, computer monitors and video cameras: a particular color is described in terms of the strength of red, green or blue required to reproduce it.

Hence none of the individual colors that we name – red, purple, and orange – are real. They are *categories* that we create in order to describe and control the experience that we call color. In that sense they function in a way similar to the categories, or maybe rather to the empirical concepts created by the application of those categories on sensations, that Kant attributes to the human mind. Therefore it is noteworthy that color nonetheless plays almost no role in Kant's Critique *of Theoretical Reason* and in his *Critique of Judgment*, where he was unwilling to include color among the aesthetically relevant properties of an

object. Color, in his view, was mere decoration; design and composition are what really matter.[9]

Color may thus be considered in both its cognitive function and its affective function. Through color, as we see in the Hubble images, we can gain knowledge of the object, and it also makes the object attractive or beautiful. Color attributes to the sense of beauty, and beauty closely relates to desire. Therefore it may also be remarkable that color does not play a relevant role in Freud's analysis of dreams, or in Lacan's analysis of vision. Probably because both consider color as merely subjective.

The interesting aspect of the use of color in Hubble-images is that it functions at the cognitive and the affective level simultaneously. Color is used to bring out certain invisible details, and at the same time this is done in such a manner as to provide us with a pleasant image.

Wavelengths of light are made into color by means of optical instruments, digital media, the neuronal functioning of eye and brain, cognitive patterns and affections. The design is governed by technological, physiological and psychological constraints. The scientist-designer must make the data into an object that we are *able to* see, but also into something that we *enjoy* seeing.

So what then remains of the classical opposition of 'cognitive perception', the object of epistemology, and 'aesthetic perception' aimed at aesthetic enjoyment or the contemplation of beauty? In this case of technological imagination of celestial objects there is no longer a clear division. The human perception of absent objects by means of the medium of light processes parts of the electromagnetic spectrum (the objective side) by means of cognitive categories, by means of the imagination, and by means of the human visual system of eyes and brain (the subjective side). As there is no object in-itself that can be distinguished from its mediation, the object must be situated on the screen that I discussed earlier (see also the contribution of Jos de Mul wherein he discusses the database ontology of objects becoming interfaces, and the contribution of Renée van de Vall on the electronic screen as a place where subject and object interact)

This implies that the rational, supposedly not-deluded and non-affective level of understanding cannot claim to contain the 'true' relation to the object and push the screen of imagination into the position of a nice but, for true knowledge, superfluous makeover. Descartes, for instance, considers the imagination – in his most positive views – as nothing more than such a 'perceptional help' for understanding.[10]

When, as I claim, the screen-images are not merely a 'decoration' of a 'real reality' behind it, color neither is a mere decoration of a 'real object' behind it that could be grasped in a clear manner with other, rational means. Not only are screen-images necessary means for the disclosure of the object, also color is such a necessary medium. When we study the object by means of light, color is an inescapable medium for gaining access to the object. Colors do not reside, as Aristotle thought in something on the surface of objects (which didn't stop him a lot of groundbreaking work in the study of color). Color is on the other hand a medium through which the object communicates itself to us. A quotation of Vincent van Gogh illustrates this. He says, in one of the letters to his brother Theo, that within the colors "hidden things concerning harmony and contrast" could be discovered "which rely, for their effect, on themselves alone, and which cannot be expressed in another medium".[11]

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[1] Sean Cubitt, *Digital Aesthetics* (London and New York: Sage, 1998), 65.
[2] HubbleSite - Movie Theater: http://hubblesite.org/gallery/movie_theater/
[3] NASA's Origins Program: http://origins.jpl.nasa.gov/index1.html
[4] Jos De Mul, , "Virtual Reality. The Interplay between technology, ontology and art," in *Aesthetics as Philosophy. Proceedings of the 14th International Congress in Aesthetics*, eds. V. Likar and R. Riha (Ljubljana: University of Ljubljana, 1999), 165-184.
[5] cf. Zdravko Radman, "Towards Aesthetics of Science," *JLTA* (Journal of the Faculty of Letters, University of Tokyo, Aesthetics) Vol. 29/30 (2004/05): 1-16.
[6] Lev Manovich, 2001, *The Language of New Media* (Cambridge, Ma./London: MIT Press).
[7] cf. Slavoj Žižek, *The Plague of Fantasies* (London/New York: Verso, 1997).
[8] Colour Order Systems in Art and Science: http://www.colorsystem.com/
[9] Kant, *Critique of Judgment* 14
[10] René Descartes, *Selected Philosophical Writings*, eds. Cottingham, Stoothoff, Murdoch, 2 volumes (Cambridge: Cambridge University Press, 1988), 50.
[11] Letter to Theo, 1882

André Nusselder completed in 2006 his dissertation on the human-computer interface as a screen of imagination at the Erasmus University Rotterdam. He currently works as a teacher in philosophy, and prepares via the Erasmus University a research project on the imagination of the past by means of digital media. His main fields of interest are philosophical anthropology, psychoanalysis and new media. Main publication: *Interface Fantasy*, MIT Press (forthcoming).