Thorbjørn Lausten ORBIT

"But to change semantic systems means *to change the way in which culture 'sees' the world."*
Umberto Eco.

ORBIT is a two-year Internet project which visualizes data from four National Oceanographic and Atmospheric Administration (NOAA) satellites – the so-called polar satellites – which are part of a larger system of satellites orbiting the polar areas at a height of about 800 km.

The data which is visualized is from two infra-red channels and is received by two antennae. One positioned at Kangerlussuaq (Greenland), the other just north of Copenhagen (Denmark). This means that the data is received from an area which stretches from roughly north of Alaska right across to Central Europe. As data is being used from four satellites (NOAA 15, 16, 17 and 19) - all transmitting data at different times and from different positions - we are dealing with quite a very large geographical area. The collected data is visualized as soon as it is received; each satellite's orbit takes 100 about minutes.

As already stated, infra-red data is utilized, i.e. *temperature*, *land/water* and *cloud/non-cloud*. To this must be *added position*, *time* and the *satellite identification*. The amount of data is simply too vast for an artistic project – it would be impractical to use all the data – therefore each visualization only utilizes a predetermined amount of data. In all about 1,000 pixels are used. One pixel is equal to 1 x 1 km. As the measurement/numerical value of each pixel go from 0-255, the visualization process makes use of 256 colours. There is, therefore, a defined relationship between the numerical value and the colours utilized.

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When registering data from satellites, we use instruments which record and transmit data from great distances, data which we would not otherwise be able to obtain (at least not without enormous difficulty). This data is often a recording of objects or phenomena which is unavailable to our senses either because of too great a distance, minimal size or electromagnetic radiation which we can not perceive.

These kinds of recordings are often known as visualizations and they have become increasingly necessary in order for us to understand the vast amount of data and concepts we are dealing with. Even if we have an image of a the phenomenon we cannot call it a true image of the phenomenon but the result of a combination or construction of data which looks, or sounds, as if we are dealing with a true picture or sound of a sensory phenomenon. As we are used to basing our understanding of reality on data we can perceive, we tend to overlook the fact that at the base of the technically reproduced data there isn't any perceived object (percepta) – that is to say, no 'natural' data. We are, therefore, highly dependent on indirect cognition which has also been termed *instrumental cognition*. (1) When we are also dealing with data without a reference the understanding is dependent upon some form of visualizing, as Latour has pointed out. (2) It is important to remember that even if the visualizations received from the instruments *look like* images of sensory perception there is an essential difference in the *ways* in which instruments and human senses function.

As we cannot understand data from a phenomenon that we cannot perceive through the senses, is unknown or not yet defined – unless, that is, it has a form which can determine its content - then we are in a situation which forces us to invent a form in order to determine the content. This is, naturally enough, something of a paradox, but may well be the case, especially when within in the arts or sciences. In this way we can see that the content's form/meaning of an unknown phenomenon also becomes determined by the form which is utilized, as we have to invent a code for a particular case. (3)

It is perhaps surprising that one talks of *inventing* instead of *discovering* but this tends to be the case when the phenomenon's existence is dependent upon instruments and the models or rules, which gives the not-yet instrumentally produced data its form and meaning/significance, "-thereby implying that code-making and invention are aesthetic activities". (4) Aesthetic activity is characterized by the symbol, which ultimately – along with the function of signs – is an intellectual "invention", a precondition for (new) knowledge.
Instruments, of course, do not function neutrally but follow(complex) theories or concepts. By changing the technology and by changing the theories and concepts then the contents/our knowledge of the observed phenomenon also changes.

As already mentioned, the visualizations in ORBIT have a definite relationship between number and colour values which, among other things, means that besides the artistic 'function' it relates to numerical function and this is usually something one doesn't connect with the visual arts. Exact science often regards numerical function as a precondition for 'objective' knowledge and a correct definition of reality. This reality functions – naturally enough – only as a relation between the signs which represents numbers and concepts and gets its meaning by the function of the signs. In this way, we can see that the numerical functions which are applied in science and technology, to a great extent, can also be used within art when the numerical values are seen as operational symbols; in the case of ORBIT there is equivalence between number and colour. (5)

What we are really seeing is that numerical and alpha-numerical constructions – no matter which connection they exist in - can be used as subjects for an artistic construction, that is to say that (formal) knowledge, calculation and combination can thereby satisfy the criteria not only for aesthetic production but also for the production of (exact) science. As art is an automatic semantic 'system' it is familiar with construction in the widest sense of the term - combination calculation, changing of codes, etc, and one can expect that such artistic activities will be more prevalent in the future than is presently the case. One can, in this connection, talk of *numerical constructivism.*

Numerical constructivism can actually be used by other non artistic disciplines – or at least disciplines which are not yet considered artistic - and it, therefore, cannot be ruled out that professionals within such disciplines might be better able to understand how to create art and cognitive models than artists, just as it is possible to create hybrid artistic-scientific cognitive models. The philosopher and media theoretician, Vilém Flusser, was quick off the mark in taking in interest in so-called technical images. He believes that there is a crucial and not yet fully understood difference between normal pictures and techno- images. (6) The essential difference resides in the fact that *techno-images* are not pictures of 'something' but are images/visualizations of *concepts* and, as we have seen, knowledge is the relationship between perception and concept whereas technical images have already blurred the usually sharp line between art and science. (7)

Furthermore, according to Flusser, we have not understood the complex relationship which exists between the observed phenomenon, the instrument and the observer – the 'apparatus-operator-complex' to use his terminology – and he believes if we want to understand this/these relationship/s we need to develop a *techno-imagination* in order to fully comprehend technically produced images, whose real meaning is *concepts*. The ones who are most qualified to understand these images are the scientists who use the instruments that produce the images. However, this is no guarantee that the specific specialist knowledge will not be used in some doubtful ideological context, for example, by suggesting that technology is somehow ideologically neutral. Even the construction and function of a chip can serve many different purposes.

Flusser never quite succeeded in setting out just exactly what should be understood by the term techno-imagination and how one should understand technically produced images. Furthermore, he doesn't think there *is* a suitable theory for that purpose. However, this should be understood in the sense that one can 'see through it', understanding that such images are necessary in order to develop a level of consciousness able to comprehend and make use of the codes which are used in the creation of the images of concepts but that we actually have great difficulty in developing such a state of consciousness. (8)

The difficulty in understanding technically produced images in contrast to a more traditional pictures lies, amongst other things, in the fact that there is a question of different forms of imagination at work, that is to say, different forms and modes of understanding. It is difficult enough to get technical and non-technical images - different forms of imagination - to work together; it is not made any easier when we also have to calculate in the different transformations which the use of instruments demand.

We have many different forms of imagination which, apparently, cannot function together; this is even true with the visualization of concepts. If we do not already have defined relations for the different form's functions and their relations and no workable correlation then there is not a common code. Furthermore, one must consider that, mainly in connection with technically produced images, it is not made clear whether one is principally aiming at signification or communication. However, if one regards a form of imagination as a symbolic or semiotic form – in Cassier's sense – then many artistic, scientific and technological activities would be easier to understand and, in that way, function together.

Therefore, besides establishing a comprehensive aesthetic and cognitive praxis based upon a numerical constructivism such praxis also allows the possibility to establish praxis whereby different forms/modes of imagination can work together. We know that context and *meaning* are dependent upon form and functional modes, so transformation and correlation of different function modes – e.g. symbolic/semiotic transformations – can, in themselves, be an aesthetic/cognitive functional modes and art-form, which covers both a contemporary and future (instrumental) realization, which, in turn, can give structure and meaning to the enormous energy and information influx which awaits us and whose form and meaning awaits the invention of adequate systems of signs.
Transformations, which may occur when different modes of functioning interact, can not always be dealt with in a digital manner as these modes primarily are of a symbolic character the origin of which is to be found in a whole made up by the "apparatus", or matrices, and do not obtain significance till they have become a form also generated by the apparatus.

"The form as a whole explicates itself in the serial order of becoming. It is a dynamic from which can 'appear' only in the process of becoming." (9)

1. In the essay *Vision and Cognition*, Kryzstof Pomian gives a quick overview of the philosophical problems connected with perception and knowledge and thinks that 'indirect cognition' and 'instrumental cognition' are unavoidable concepts in the contemporary context. In *Picturing Science: Producing Art*, ed. Caroline A. Jones & Peter Galison (Routledge: New York/London, 1998).

2. Bruno Latour, *What Is Iconoclash? Or Is There a World Beyond the Image Wars?* In *Beyond the Image Wars in Science, Religion and Art*, ed. Latour & Weibel (ZKM and MIT Press, 2002), p.34.

3. Umberto Eco, *A Theory of Semiotics* (Indiana University Press, 1979), pp.188, 259. See also: Louis Hjelmslev, *Omkring Sprogteoriens Grundlæggelse*, (Akademisk Forlag, 1976) p.70.

4. Eco, ibid. p.254.

5. With regards to what can be considered as objective knowledge in philosophy and the natural sciences, Cassirer, in the chapter *The Concept of Number and Its Logical Foundation*, gives an overview concerning the function of numbers in modern science and philosophy. In, Ernst Cassirer, *The Problem of Knowledge: Philosophy, Science & History Since Hegel* (Yale University Press: New Haven and London, 1978). The concept 'objectivity' has always stood in sharp contrast to that of artistic activity and what has been regarded as not rationally-based learning In *Objectivity*, Lorraine Daston & Peter Galison (Zone Books: New York, 2007) give an historical overview of what has been regarded as objective within the difference natural sciences, not least of all in connection with scientific visualizing. If one has always believed that 'objectivity' is an immutable concept then this book tells a very different story.

6. Vilém Flusser, *Kommunikologie* (Fischer Taschenbuch Verlag: Frankfurt am Main, 1998). Where the concepts 'technical images' (Technobild) and 'techno-imagination' (Technoimagination) are discussed.

7. Interview with Vilém Flusser in Florian Rötzer, Philosophengespräche zur Kunst (Boer Verlag, 1991), p.163 onwards.

8. Flusser, *Kommunikologie,* p.178.

9. Ernst Cassirer, *The Philosophy of Symbolic Forms*, Vol. 4 (Yale University Press, 1996), p.198. See also Vol. 1, p.85 onwards.

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