Digital image: a bridge towards mental images?

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How we see things depends on our education and our cultural pre-suppositions. This does not allow to convey some logical form, but nevertheless makes possible a more global and less formalized understanding of the objects, their environment and their physical proprieties. In architecture, the digital image acts according to two directions :
- representation the fine images are a means of communication between the different parties implementing building projects.
- modelization in addition to its iconic qualities the layers of different models simulate the most different aspects of the image and the environment caracteristics.

At this level our vision is directly concerned with the design of the studied object ; it acts both in the design process and in the expression of our conceptual images. How does modelization work ? Infographical representation deals with a more or less schematic and conceptualized world the reading of which is more typified than particularized. It deals with a schematization nearly 'ideographical" of the mental image thus is produced "synthetism", a neologism similar to such expressions as realism or abstractionism.

It is easy to identify the primary synthetic style thanks to its thick edges, its pixel texture of surfaces and its bright colours. Fundamentally, numerical image is a generation process. In a computer-aided design process, conceptual imagery deals with concrete applications and though the basis is the same, synthetic imagery is art-oriented. The "line" image works with facets and lines while synthetic image works with pixels. When the image memorization happens through an external process,

namely digitization, the only known description is that of the zero level. Numerical processing consists in building up interpretations of higher levels starting from this zero level. This occurs through processes in which some hypotheses on image are at work. The most common consists in substituting the linear coding of the coloured elements by a two dimensional description which enables to define the plane neigbourhood of a point. It is then possible to proceed to the following manipulations filtering, use of false colours, extraction of outlines and scene analysis. Measure is a notion which can then be introduced in a field therefore reserved exclusively for intuition. Synthesis is concerned with the successive hierarchical levels of description. In that case the highest level is an automatic and/or interactive process with no reference to a pre-existent image then we talk of numerical synthesis of image. Creation process versus photography (1).

It becomes necessary to define the spaces of a figure attributes and their semantic interpretation, as well as a command language which convey those notions in terms of procedures in data processing. An iconic model is not just simply a logical system ; its graphical interpretation must be coherent with another interpretation of the semantic type and which the user will have related to the generated images. Before starting the building up of an iconic model, it will be necessary to precise what type of image is to be created in defining the dynamics structures fitted to represent complex phenomena such as the physical proprieties of the object and its environment. It becomes then possible to modelize more and more complex processes like fire ou bursting. Synthetic image is multi-coded. Doubtlessly it is not totally unrelated to earlier techniques, yet the notion of code appears at two levels tools of creation on the one hand and description on the other hand.

SYNTHETIC IMAGE : HOW AND WHY ?

Prior to the building of an iconic model, it will be necessary to precise what type of image is to be chosen ; it comes to define the style. A plane image for example will have but a limited data structure with algorithmic generations. A full

figurative image will require a much larger data base and also an automatic or interactive generation procedure. Automatic generation of images from text data is possible : helicoidal stairs can be built from a description of a step and its movement, for example. As for the three dimensional image, it needs both an even larger data structure and a three dimensional modelization of space refering to cartesian marks. This allows to describe with geometric primitives an object looked at from a certain position of the eye, with parameters (opening, window, frame...) ; different types of perspectives, of even a binocular vision, are possible. The synthetic image of realistic type is a good example of how the three dimensional image structure is used as a skeleton, with other iconic models simulating the visual appearence of the real objects ; those iconic models simulate the physical proprieties of the elements which are part of the object and its environment. Naturally the hidden parts can be obtained as depth is a notion necessary to the understanding of our environment. Lighting iconic models, as the objects are unevenly lit, simulate relief. The scenes can be transparent, translucent or opaque with the most subtle gradations. Reflection emphasizes the realistic effect and gives the objects its physical consistency. According to the simulated iconic models, computation grows increasingly for each pixel. The shape rendering microstructure affects the degree of realism ; smooth and unbroken surfaces are at first simplified approximations. Structures synthesis can be achieved either through a determinist model with pattern mappings or stochastic models ; it can also be achieved with fractal (1). Objects built with fractal models can only have broken appearence and are perfectly fit to simulate irregular objects such as rocks or leaves. Shape, hazard, dimensions are fundamental notions. Shape represents a single whole, an object immediately perceived. In working from a basic figure, hazard operates during the simulation and the form synthesis process. Dimension is prominent with regard to fractal objects. Physical dimensions must be distinguished from mathematical dimensions the former is related to an object whether the latter is related to its modelization ; what precedes concerns modelization of definite realistic objects.

How to acquire data is still an unperfectly handled problem, particulary with regard to 'free" shapes ; it is extremely difficult to input data associated with the body in order to animate it. The description of an object is made in terms of structure yet iconic model is a notion to be acquired first then the associated descriptions are to be discussed. Computer is a creation tool ; therefore the operating process must be thoroughly grasped. Those processes are simulated through a model which logically expresses their interactions and existing conditions

It is necessary to write a specific program to make the iconic model work. For the model to be operational a data structure must be built. Testing comes down to the tridimensional and elementary work of the artist applying painting with his brush. The numerical image gives the artist the entire command of the process of creation be it at the detail level or at the whole composition level. He has a right to blunder and may retrace his steps for corrections. He can at leisure explore various scenarii or hypotheses. The final stage consists in applying the iconic model to a particular context in which the interacting artist and program will give birth to a production.

There are different levels of description. Coding numerical image in the graphical processor allows to measure light intensity at the pixel level. The art of programming comes to develop in parallel both the computer program and the interpretation for the user (semantics) ; in fact it is more a graphical language than an ordinary computer program (1). Each geometrical form possesses an appropriate description in the associated data structure so that any manipulation modifies the other one as a result. It is but a problem of description, of language and levels therefore of translation from one language into another one. It is all designed so that one level can give a suple, transparent and interactive description of the man/machine communication.

Detail and scale are primordial. For example a distant moulding is seen as a line, then it appears as a steped line, then as a moulding with all its details the closer our point of view grows. Contrary to what it looks like, numerical image

is basically discontinuous, made up of pixels lit up on the screen. Researches are carried on which aim at achieving the description of indefinite objects (such as clouds). They are defined in space by probability laws ; this concept cannot be applied to indefinite objects as there exists no surface separation between the inside and the outside. Indefinite objects such as clouds, flames, fluids may be modelised by means of system of particles. In those cases the volume separator, namely a polyhedric surface or a curve, no longer exists. Modelisation is achieved through clouds of primitives of particles the spatial distribution of which defines the volume. This representation is dynamic as each particle fills a precise space-time position at a given time. Each particle birth or death in space is commanded by a stochastic process. As the generation algorithms are recursive and stochastic it is possible to build objects without manipulating large data bases. Thanks to those dynamic structures, it has become possible to represent complex phenomena; fire or bursting have been efficiently modelized. The iconic model of the object is always associated with a data structure which is but the space-object. The generation process introduces a new type of relationship between the creator and his work the dynamics of which is as much centred on action and experience as on reflexion and know-how. In order to modelize the space of an object, two types of information are necessary metrical concerning its geometry and topological precising the connections existing between the primitives of the description.

Our vision in space is partial and limited and needs filtering. Depth is perceived by means of hierarchical object visibility. Perception models do not aim at producing perfect objects but at using the perspective illusion. Physical laws and empirical laws of space representation are at work. The creator cannot possibly claim to be an objective observer as illusion takes into account subjectivity and interpretation. Physical simulation is necessary but not sufficient to achieve illusion.

Iconic models are connected to semantics as simulation concerns the result rather than the phenomenon. Numerical image whose appearance looks discreet and finished, can be assimilated to a rectangular picture made up of pixels ; yet it is subject to

loss of information particulary in low and medium resolution systems ; this is caused by sampling, that is aliazing. Quantification implies colour grading for each pixel as well as other parameters linked to realistic image processing. Numerical image programming is more the result of a dynamic process than of a creation memory. At any time simulation fixes temporal cross-sections of the generation process. Those models should bear a precise significance with the help of an appropriate language.

DIGITAL IMAGE TOWARDS WHAT ?

To make synthetic images is to bring into a continuous struggle realism and illusion.
And if it is true that "image can produce architecture" (P) therefore ought we to be afraid of beautiful images in architecture ? Not to my mind if this beauty is founded on a structured spatial modelization of the object and an aesthetic purpose. How could we bring forth "the masterly and correct effect of volumes under the light" if the latter has not been appointed ? Should it not be all pervading 7 By means of composition operations the rhetoric discourse shapes are translated into a vocabulary allowing to assemble architectural patterns recognized by computers. This vocabulary is enriched by "intelligent images" potentialities ; those "self-informed" images are able to "self-animate", to act upon themselves and their environment. Therefore, from a single representation of the world, we progress towards a true re-creation of a universe through a verbal description. Under the influence of stimuli released by an operator, such images can evolve spontaneously. A new notion is introduced the "acting-objects" whose presences and proprieties have an action on the other objects and set on stage dynamics.

This is equivalent to the use of knowledge in small quantities in the synthetic image. Reacting on the image internal mechanisms a knowledge base superimposes on the scene representation. By means of an appropriated expert system, artificial intelligence acts upon the scene composition to deal with regulations or the artist's narrative description. How far from the building must the luminary stand in order to keep the

required lighting 1 Which can the various standing points be in order to keep eight of the building entrance ? To manage the reactions of various components at the environment stimuli can be achieved according to a description by means of a language. This language enables to outgrow the classical opposition convergent/divergent description. Synthetic image is told before existing ; its design depends on a written text, a computer program or "macro" in which it pre-exist , loaded with all potentialities. Words which are no longer confined to evocative or descriptive functions are endowed with a creative power. The ancient opposition sensibility/rationality is then outgrown to the benfit of an image/discourse dialectics.

Plastic-oriented infography introduces a distance between an architect an his work materiality which the computer program mediatizes. Compentency of mathematical models underlying synthetic image and the artistic expression performance -a twist in a way- are the field of a new writing. The image creation language becomes double first a text revealing its plastic composition rich with significance and ordering image design ; second the ordering of the physical production of texts, its construction.

The plastic production language derives from two registers concepts and conceptual systems from the one hand and units linked to the various categories such as forms, colours, light on the other. The architect proceeds tentatively in order to achieve convergence between his conceptual and his plastic representations.

A research has recently outlined a typology of the operators and studied the main figures of rhetoric concerning synthetic image. It reveals the direct links existing between those figures and the various images which are produced (3). The "acting objects" are under study and we can forecast that the way we simulate our mental images will be thoroughly disrupted in the near future towards a more flexible iconic model representation.

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