XIV – SESSÃO DE COMUNICAÇÕES – TEMA III – "DIVULGAÇÃO, MUSEUS E ARQUEOLOGIA CIENTÍFICA E TÉCNICA"

Presidente da Mesa:
Eng. Francisco Machado de Campos – MTSP

Prof. Francisco Machado de Campos:

Senhoras e Senhores, tenho a grande satisfação e a honra de presidir esta reunião. Eu acredito que os trabalhos que vão ser apresentados aqui são merecedores do melhor acolhimento do auditório. Eu quero alterar ligeiramente a ordem prevista.

Inicialmente dando a palavra em primeiro lugar a Profª Sra. Irmgard Zept que fará a sua palestra em Inglês mas que terá uma pessoa que vai fazer comentários em Português, para facilitar o entendimento do assunto.

Os debates serão proferidos depois que todos pronunciarem seus trabalhos. Tem a palavra a Sra. Irmgard Zept.

Drawing: a normative technique (A mediun for both art and science)

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Ever since the recent Venice Biennial of Autum 86, at the latest, the considerations of the relationship between the arts and science has become accessible to an open public. In the most disparate disciplines, like mathematics, biology, architecture (to name just a few), new ways of cooperation with the arts are being established: the computer being, in many instances, an integrating and evidencing medium. The discussions concerning epistemology, initiated by Th. Kuhn, suddenly make us realize, that there is a mutation in the relationship between the arts and science. In Antiquity there was no separation between the arts and science, as it permeates Modern Times. Up to and including the Renaissance there is an umbroken continuity among knowledge (cogitatio), vision (contemplatio) and shaping (fabricatio). As for Modern age (illuminism) and up to Hegel's concept of a Spirit of the World which identifies with itself through discoursive understanding, it did not only distinguish between arts and science, so that they could only be conceived as opposite poles, but modern age assigned to the arts a position inferior to the one science was to occupy.

With the early 2oth century various restructuring processes may be observed. The one initiaded during Modern age was the polarization and establishment of two mutually exclusive disciplines the arts and science. Furthermore a new one which had science approach the arts. And yet another one which had the arts approch science. An example of science approaching the arts: Darwin's tree image. An example of the arts approaching science: the role of optics in impressionist and expressionist painting(1).

As people became over more conscious concerning the historicity and cultural dependance of scientific thought and practice, common roots and common features in both the arts and science became ever more evident, which implies a complementary way of thinking.

The disciplines, which result from those different ways of thought, permit now to involve the art's point of view and the scientific point of view, both implying differences and congruences in a game with and against each other.

According to this, that concept has been conserved within the desiderata of the arts, which would then turn the arts into a special type of science. "Savage thought" does not mean thought by savages, nor does it mean thought of a society which in some way is savage or primitive, but it means thought itself in a state of wildness. Such savage thought is different from domesticated thought as wild plants are different from agricultural ones, which have been domesticated for the expres purpose of rendering specific results mostly profit. Lévy-Strauss stresses that we now know of the necessity of those two kinds of thought, the savage and the domesticated one, not only to coexist, but to intermingle. And he observes that at present, domesticated plants and animals menace the savage ones with extermination. As for thought (the creative aspect of it), it would appear to find itself in a desperate state,were it not for the existence of "zones" within which savage thought is relatively protected.

> "Such is the case of the arts which are being allotted by our civilisation a kind of "natural reserve park" with all those advantages and disadvantages implied in such artificial zoning"(2).

Lévy-Strauss sees the chief impact myths and rituals have in their resulting in "forms of observation and cognition" which are still existent, although even now residually extant, and he goes on:

> "a specific way of discovery that was allowed by nature, and which supposes that the organisation and reflexive interpreta-

tion of the sensible world is feasible, is such a result of savage thought. This sort of a *science of the concrete* is quite different from the one exact natural sciences have elaborated. But it is not less scientific. And its results are not less true. This way of discovery preceeds the exact one by tens of thousands of years, and it has been acquired and verified, and continues to form the very basis of our civilisation"(3).

Lévy-Strauss calls the process of myth production "bricolage". In its original meaning the word "bricoler" is applied to things like ball games, Billard, hunting and horse back riding. What is implied is an unmapped motion, like the one a ball follows when it bounces, a dog when it takes by-passes and so forth. The tinkerer as compared to an enginer is one who handles things and applied means which are considered to be devious by the technician(4). It is here that the germs of creativity proper to mythical thought are found, and which continue to exist in modern experimental arts(5).

As for Leroi-Gourhan, the palaeontologist(6), interest in art as a different form of thought resides in the fact that that mythical thought, being an imagine-like one, has taken refuge from the predominance of linear writing into the special domain of the arts.

The philosopher Bateson distinguishes between "loose" and "strict" thought, which he combines in order to achieve a new kind of productivity. However we want to name it: "image-like", "savage", "loose" thinking (as this way of thinking is called by Lévy-Strauss, Bateson and Cassirer), have all common features which may be resumed as follows: In all those kinds of thinking a high degree of playful behavior is involved: playing as an action free of purpose, one that imposes its own rules which can be infringed at any instant, and where the player measures his game against reality without ever identifying it with reality. He simultates the real world in his game, he discovers ordens, patterns and meanings, and he destroys all of this whenever he feels like it (like in children's plays of in Picasso's picture series); that was what occured originally within mythical thoughts and continues to do so in the arts. This artistic playful way of thinking shares with science its high degree of abstraction, its indirectness and its mirror-like reflexivity. Images too need to be deciphered and read as playgrounds which they are. This is, at any rate, what modern art teaches us. Game as far as it invents new world visions is *theory,* and as far as it abstract from the real it is *utopia*. The arts, being a game, may permit itself to be a *totality,* it may present a whole, an integrated work of art. Science, being subject to the real, cannot do so.

Most sciences, as they go on at the universities, believe they can go on without such open playgrounds, and thus get themselves into ever more narrow bottle necks: they tend to become pragmatic, to aim at quantifyable results, to restrict themselves to ever more special fields, and to become regid and sterile.

My purpose here is to suggest to you how in the medium of drawing scientific and artistic ways of thinking may meet and even overlap. It is my hope, that this contribution may come to advance toward an aesthetic reflexion about new forms of scientific mediation.

Let me ask: what is a drawing?

The creation of signs, sounds and drawings have always been a form of a technical gesture. Just like the production of comparable signs (for instance vocal ones). A drawing is a shape composed of lines which visualizes an idea, a representation, an object or an algorithm on obeyance to special procedures. Defined thus, a drawing may be a geometric figure or a sketch made by free manual motion. *It may pertain both to the realm of science or the one of the arts*. Those two realms may overlap, and they may imply each other. There are drawings which express exact mathematical calculations and still are artistic, results of a creative imagination, for instance some of the ornaments in Barroque art, or in architectural drawings, or in the sketches by Leonardo. Geometrical drawings, if looked at closely, are free of subjective impulses and subjective interpretations, it is true (they are pure visualized calculations) still, each and every exact geometrical figure is a figure, which means that it points to a qualitatively sensitive perception of form in its beholder.

This is the reason why in cultures anterior to our own it is precisely in the domain of mathematical figures that reflexions on beauty of proportion were made: for example the notion of the "golden section", or the one concerning the "harmony of the spheres".

Geometrical drawings are made in the basis of calculations, and are therefore capable of exactly identical reproductions, whilst artistic drawings are based on a sort of intuition, which renders them unique and nonrepetitible. The lines in a drawing made by hand are just as abstract sign inventions as are the lines of a mathematical drawing, however. And both are different from linear writing in that they may be associated freely, that they are not subject to a fixed sound scheme, and need not adhere to a fixed line. Thus hand made drawings perit various methods of representation. They objectify during the process of shaping both visual and motoric-haptic sensations. They are pluridimensional, connotative, and they testify articulations of a high developped imagination.

But if it is true that geometrical scientific drawing shows off a formative quality, it is just as true that artistic drawings require a calculations and gauging process. In their case we speak of *composition*, whereas with geometrical drawings we speak of *construction*. Both are variations of computations (Flusser).

It is the sheet of paper which serves so to speak as playground for a creative game. Drawing as art is a special case: hand drawing is originally a preliminary stage toward artistic products of all kinds: it is, chiefly, a project or a program for instance for architecture, sculpture, or painting. It being a projective drawing, it is a king of scaffold for the composition or configuration to be made. Thought which diverges and branches out materializes as a multiplicity of projects, of which a single one is finally chosen (or a small number among them), to become drafts for a piece of word to be elaborated. Thus the playful activity shows already through the multiplicity of provisional projects. Drawings as drafts, they being hypothetical ones, are seen, as a rule, as a sort of fragmentary essays. What characterizes them is that they are drawn and redrawn again and again, that they are corrected, improved upon, but just as much by the fact that they can also be traces of a quick, lightening-like projection of a sudden insight. The catching on to an idea is a gesture which is called sketching. The word "sketch", just like the word "scheme" derive from a common root "sche", wich implies catching, as Flusser suggests in his new essay called "Die Schrift".

A sketch is the most condensed and the most spontaneous form of a drawing. Ever since hand drawing became individualized and autonomous in the Renaissance, drawing and sketching became ever more interesting, which is an opposite tendency to the one aiming at machine like techniques, but, to quote Flusser again, but parallel both tendencies underly the development of hypothetical and schematic thinking in modern science (for example: Volta, who sketches a cramp in a leg of an electrocuted frog, in order to draw a schema to visualize a theory in the electric field).

A sketch is deciphered as a trace left behind by a creative process. Within the sketch, much more clearly than within the perfected artistic product, the specific and very original hand writing of the artist, the genesis of his idea, his "eidos", may be detected. Within the drawing after nature, for instance in Renaissance sketches, the process of perceiving and finding structures by the artist is clearly discernible, "the plucking out of art from within nature"? (A. Duerer). See also Leonardo's drawings.

By juxtaposing a drawing of exact science and one of spontaneous hand drawing the following differences and coincidences may be resumed: while the hand drawing is spontaneous, rhythmical, connotative or even without significance (see for instance arabesques and minimal art), the geometrical drawing is calculated to be denotative. While hand drawing is objectified subjective expression of individual sensations (for example Cèzane), geometrical drawing is objective and unpersonal. Geometrical drawing constructs spaces and structures, hand drawing composes spaces and structures.

Geometrical drawing is reproducible at any moment, hand drawing is unique, ungeneralizable and irrepetitible. Geometrical drawing is free of intuitive intentions and of deciphering, whilst hand drawing means and depends on being interpreted.

The medium of drawing is an expression of a sensual activity in a much as it is an elaboration of a mental process, and it is a medium of exceptional unicity, because it shows off two different kinds of human mental productivity in one: the strict, exact thought of science, and the spontaneous, intuitive thought of the arts. Within the medium drawing, i.e. in the "plotter", both forms of human processing are visually accessible, both forms of thinking stay related to the corporeal condition of man, even though both forms of thinking attest, in equal intensity, to the human capacity to abstract, and to perceive in a priori categories (see H. Plessner: "Anthropology of the senses"). The fact that both forms of thinking overlap (see ornaments, architectura, blueprints and so forth), suggests that a neat distinction between them is unfeasable, and that they ought to be seen together as two methods of human creative reason. It should be noticed that Flusser calls this overlap by the name "grey zones", and that he attributes a high degree of pertinence to them.

In both these forms of thought it is the blank sheet of paper which provides a Playground for a purpose-free game. To incentivate drawing in scientific discourse would thus imply an extension of such a playground, which menaces otherwise to shrink under the pressure of increasingly utilitarian criteria provoked by economic restrictions.

To enlarge the playground of science implies furthermore to give more space to theory (vision). To draw is to render visible the network which arises from perception. By doing so, to draw shows neatly the limits of perceptibility, for instance the imperceptibility of micro and macro structures. The medium of drawing is capable of rendering evident complex relations. (For instance those researchers and discoverers like Einstein and Darwin who achieved their new insights by visualizing their ideas).

The jump from the act of drawing as a theoretical game toward the act of drawing as a practice is not a wide one. This goes both ways,

for starting from geometrical drawing just as much as for starting from hand drawing. The philosopher Paul Valéry suggested that within the act of drawing the abstract conception becomes linked in a unique way to shaping. This is true both for utilitarian geometrical drawing as for free drawing. In as far as it visualizes a "Gestaltung", drawing points as a project at architectures and structures of our cultivated surroundings. In drawing projects render visual environmental shaping (theory), but they also permit to perceive existing structures and patterns by reducing them and abstracting them (practise). Scientists should develop not only logico-discoursive thought, but a kind of simultaneous thought as well, which would enable them to perceive even unusual configurations like pattern/structure. This leads up to admitting that they acquire the capacity to decipher drawings and if necessary to make them themselves. Drawing, it being a project for cultural living strategy, interferes within the realms of practical action. Drawing is an autonomous medium, it is applied art, it is applied graphics, and in disciplines like Geography and biochemistry, like publicity design, like blue prints it becomes a model. No longer does it illustrate texts, but it may stand on its own feet. The text no longer prescribes the way the image is to be received, but the image speaks for itself. The text thus becomes an explanation of the image.

To present such scientific and/or artistic drawings is to produce evidence that linear literal texts are becoming more and more redundant, but to present them is also to provoke speech acts. One may ask whether by having recourse to drawings on floppy discs and cassettes one might not reduce occidental linear writing and whether this origin of a new image culture shall not replace writing al togheter and provoke oral communication (see Flusser: *Schrift*).

One may glance to Oriental cultures at this point: overthere a more playful and more experimental attitude with regard to the new information techniques my be observed. This difference may be due to a less orthodox writing code which results in a behavior more multidimensional and divergent than is ours which is bound to a code which is rigidly linear because it adheres to spoken sounds. The mental attitude of Zen Buddhism may be close to that free and playful behavior which Lévy-Strauss considers to be typical to the "bricoleur". This is why in the Western world the pursuit of drawing might be a good point of departure for experimental handling of computers and videos. Free hand drawing and geometrical drawing thus offer themselves as alternative codes to overcome the linear system.

Drawings propose mental projects for the shaping of images which might then be produced by computers. My own pedagogical and didactic reflections have led me to formulate the teaching of drawing as follows:

1. As communications coded in computer languages become articulations of human communication, man will need ever more a training in bodily languages in order to bring his body into play if he wants to keep his sovereignty and creativity in his relation with machines.

2. The didactic effects of hand drawing are: development of motor intelligence, the visualizing of abstraction capacities (conception and shaping as one single process), development of spatial thinking, of imagination, and of thought in multiple dimensions (surface, space, space time).

3. The teaching of drawing by hand is different from other teaching methods within the realm of science in as much as it links cognitive learning with sensual emotional learning and most importantly with the process of shape giving.

4. To teach drawing is to teach how to measure (even the ancient Sumerians were taught at school this way). It teaches measures, proportons, sizes dimensions in short it teaches topology. The fact that in our context of overproduction of objects and information people should be taught as a sort of alphabet and knowledge in childhood, becomes over more evident. To quote Flusser: "Humanism implies measure and man is he who does not confound levels of order of size".

Thus, to teach the art of drawing appears to be a necessary complementation to the teaching of the art of speaking. It is only after having dominated such arts that people can master machines and techniques which are the results of scientific endeavor, that they can apply them productively.

It may be that the art of drawing by hand has become unnecessary for science, but no doubt it is indispensable if the development of a scientific mentality is the goal.

NOTES:

(1) Welsch, Wolfgang: Kunst und Wissenschaft – Gegengedanken zur Bienale in: Kunstforum, Kunst und Wissenschaft, S. 124-126

(2) Lévy-Strauss, Claude: Das wilde Denken (frs.: La pensée sauvage), Frankfurt 1973, . 253

(3) a.a.O., S.29

(4) a.a.O., S.29

(5) a.a.O., S.44f.

Prof. Francisco Machado de Campos:

Meus prezados companheiros, eu devo advertí-los que o tempo é limitado, de maneira que nós temos que apressar as apresentações dos trabalhos para que todos tenham tempo de poder fazê-lo normalmente. Mas a próxima leitura, o próximo trabalho conformne a descrição feita aqui, será de Dna. Elizabeth Santos de Almeida. Pedimos a Dna. Elizabeth que pudesse expor durante uns 10 minutos no máximo, para que possamos ouvir todos os demais. (pausa)

Tenho a impressão que a Dna. Elizabete não está presente. Mas, como sua comunicação foi enviada antecipadamente será publicada nos Anais. Então, eu convocaria neste momento o Prof. Gilberto de Souza Almeida para fazer a sua palestra.

Convivendo com as Radiações

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É da natureza do homem o temor pelo desconhecido. No entanto, esse temor se transforma em curiosidade a partir da compreensão, e daí se parte para o estudo sistemático e, portanto, conhecimento.

Atualmente, diversos segmentos da sociedade sentem um temor natural pelas radiações nucleares, especialmente devido a fatos e notícias, nem sempre completamente verdadeiros. Muitas pessoas já estão no estágio da curiosidade, e o fato da radiação não ser visível nem sensível imediatamente pelos sentidos humanos, ainda leva a inúmeras confusões como, por exemplo, a crença que os danos causados desapareçam espontaneamente. Para muitas outras o que existe é a necessidade de adquirir rapidamente conhecimentos precisos sobre o uso, para fins pacíficos, dos materiais radioativos e/ou radiações ionizantes, dentro dos padrões de segurança estabelecidos por organismos nacionais e internacionais vinculados à Proteção Radiológica e Dosimetria. O que é inegável é a irreversibilidade da utilização da energia contida no núcleo atômico.

Para o público que começa a conviver com as radiações ionizantes, é necessário que o estímulo se faça de forma a aguçar a curiosidade, sem esquecer que o conhecimento transmitido deve ser o tema relevante. Deve-se destruir o temor infundado, e colocar em seu lugar dados e fatos, sem fazer qualquer julgamento de mérito.

Hoje em dia é inegável também a utilização do microcomputador como um meio de ensino. Começa-se então a imaginar a forma de utilizar esse recurso para o ensino das radiações nucleares, sua utilização e suas regras de proteção.

Sem muita ambição, começa-se o software sobre radiações nucleares na forma de uma aula tradicional, mas que conta com o recurso da animação. Naturalmente, esse não será um software definitivo, uma vez que a literatura indica que a interação entre alunos e software, com o professor, tende a aprimorar o que já existe[1]. O aumento de recursos, que gradualmente aparecem no mercado para os micros, fará do problema da construção de software um processo dinâmico, não só em conteúdo mas também com elementos de "mass media" paulatinamente introduzidos[2].

O microcomputador foi escolhido para o desenvolvimento desse projeto com o objetivo de se adquirir conhecimentos na área de programação para a elaboração de um CAI e, também, na medida que os recursos permitirem, buscar a abertura de um novo mundo de ensino através dos computadores dos demais países.

Através da conjugação de texto e desenho, e de forma rápida e acessível, o micro leva o iniciante a se interessar pelo assunto das radiações nucleares.

Tendo isso em mente, a idéia do projeto gira em torno de 3 pontos básicos:

1) RADIAÇÃO[1] – O primeiro passo é estabelecer que radiação é energia que se difunde de uma fonte, e procurar fazer uma distinção entre radiações mais familiares como calor, luz visível, ondas de rádio e TV, e as radiações nucleares;
2) MEDO – Você tem medo de andar de carro ou de avião? Você tem medo de atravessar uma rua? Essas atividades são parte rotineira do mundo em que se vive. As radiações nucleares também são parte rotineira do mundo em que se vive, e estão presentes em: TV à cores, cimento, alimentos, mostradores luminosos de relógio, tubos de raios X, etc. Como resolver esse dilema?
3) SEGURANÇA – Assim como ao se lidar com a eletricidade, diversas regras de segurança devem ser observadas, o trabalho com materiais radioativos e/ou radiações ionizantes deve ser feito tendo sempre em mente os 3 princípios básicos da Proteção Radiológica: Tempo, Distância e Blindagem.

Finalmente, descrevendo os efeitos imediatos e tardios[3] das radiações sobre o corpo humano, o que realmente se faz é, de forma simples, estabelecer os fatos significantes e fundamentais sobre as radiações nucleares e a Proteção Radiológica.