TECHNIQUE AND EDUCATION

By

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The scientific-technical revolution entrained significant social changes. A few years ago, the SNOW polemics raised the question of segregation between society and technique, or better, between the human and technocratic sides of society. The SNOW polemics raised a vivid interest both between philosophers and between natural scientists, hence engineers. Even extremist views have been ousted by various international spheres, especially manifested by representatives of technocratic or technicist ideologies worried about mankind exposed to injurious effects of civilization considered as a parasocial force on the way to independence such as the rule of a djinn out of his bottle. This tendency is represented by MUMFORD who refers to the actual period of technique as "posthistoric society", and to its inhabitant as "posthistoric man", stating the posthistoric society to be simply perfect establishments conceived by utopists as benefactions, perfectly smooth and uniform but dehumanizing lives.

The subsequent ideas are based on the outcome of SNOW's polemic, reflecting the public opinion of wide social ranges rather than that of interested scientists, specialists alone. Essentially, "technical progress does not interfere with the creativity of man". Scientists, engineers engaged in scientific or engineering research activity have to rely also on humane science results, their ambitions have to be subjected to common interests of society. On the other hand, philosophers, humane scholars, writers, artists may rely on possibilities, means offered by civilized society, on scientific-technical results.

Technique and education

Education means creative incorporation of general cultural wealth of society in one's personality, involving various forms and institutions etc. In our educational system, a phenomenon exactly due to the excessive technical development has to be reckoned with. If programs, modernness of educational institutions lag much behind the structural changes of economy, then the resulting gap badly reacts on national economy. Namely, school education (secondary, vocational, higher) can only provide specialists for a national economy at a given level. The actual division of life according to periods of knowledge implication is likely to be dispensed with. To now, educational system aimed at an average education attempted to achieve success with 100 per cent of participants at any cost. This attitude is, however, in contradiction with human creativity, with the really adequate labour management. Actually, stress is laid on human qualities, on retrieval and development of talent, abilities. An up-to-date educational system has a certain self-sufficiency, no direct subject to the needs of production. It may be formulated as the retrieval of possibilities in man, as individual achievements of civilization. An education system has to be aimed at, where technical development contributes to the maximum use of students' abilities.

The function of technique in education

For man growing up in an atmosphere of developed technique, new ways of civilization have become a necessity, and continuous education a life style factor. Teaching aids and telecommunication systems are decisive in this process, both in secondary and higher education, and in adult education. Irrespective of the high costs involved, *technicity of the educational process is decisive for its efficiency. Without assuming the costs for teaching aids, study times would soon grow to 15 to 20 years.* Traditional, backward schools are alien from the spirit of youth, and fail to meet the requirements of up-to-date knowledge.

Actually, oral transmittance of some regularities, phenomena, is simply not feasible any more, and exactly to realize the many-sided relationship between man and nature, introduction of technical means at any level is a must, and an indispensable tool for man to assert himself, hence to develop. A many-sided development is, however, not understood as a simple transfer of existing knowledge, but as its access, as an opportunity for an activity to acquire it, to be possessed in a creative way.

Alongside with the development of technical civilization, education cannot be conceived any more as acquisition of a given type of special knowledge, but as a wide range of preconditions for the selection of a speciality. Thus, culture becomes a continuous acquisition of knowledge.

Primary product of human existence is human consciousness. A trend of education aiming at encyclopedic information is confronted by that built on independent, logic thinking, and enabling one to a life-long assimilation of knowledge. Education, involving training, needs the solid bases of wordly orientation. Utilization of technique must not be thought of mechanically but as a new form, accessory to the acquisition of knowledge, human relations, introspection.

Correlation between man, cognition and technique

In cognition, technique acts else than in economy or industry. Conscious recognizance as an educational system is not based on the use of technique. Because of its importance, however, it is indispensable for the education, namely:

1. The everyday life of students is intimately connected with the simplifications of technique, leaving them no alternative; often it is indistinguishable from other aspects of life. This is at the origin of expectations to the institution likely to impart views on life and ways of transforming it.

2. Technical devices can transmit phenomena inaccessible to other means. To be complete, factors of education need reproduction and demonstration systems, leading to correlations between one technique and the other, between man and technique, teacher and pupil, in final account, between man and man.

3. Technique as a factor of education gives the graduate an idea originating already from the study time on technique as active factor of development, rather than as a machinery.

Social and technical development certainly counteracted a comprehensive knowledge of technical details but this is no reason for an other than creative approach. Although given technical systems are constructed by highly specialized experts and mostly applied by others, these latter have to be induced to be interested in relevant technical creativity.

Experiment to technicize certain creative processes

Architecture is a peculiar product of society, the same age as mankind. Much discussion is raised by its "Janus face", its affinity to both technical sciences and arts, both being responsible for its value but to a degree varying from case to case. The term "technique" comes from the Greek "techné" equally meaning handicraft and arts objects, arts, abilities, skill. *Vitruvius* ranges not only buildings with architecture but all machines, tools, implements of architecture by that time.

Obviously, architecture is a most peculiar domain of technique. Accordingly, also architectural education needs a peculiar form likely to resolve the mentioned duality from the aspect of architecture as science, technique on one hand, and artistic creativity on the other hand. Both are needed to conceive the product as a complex, and the process as a unity of integrate fields of activity.

Architecture is an art of moulding and space. An inherent contradiction of architectural education is that the designed space is only meaningful after being constructed. Its engineering characteristics can be grasped but emotional effects cannot be predicted. (In other fields of engineering, this is less manifest:

the constructing engineer of e. g. the particle accelerator of a nuclear reactor will never see it from inside; otherwise, this latter influences human life less than do architectural creations, utility objects doubling as environment.)

Architecture ranks both among engineering sciences and visual arts. For the sake of advancement of architectural education, this doubleness has

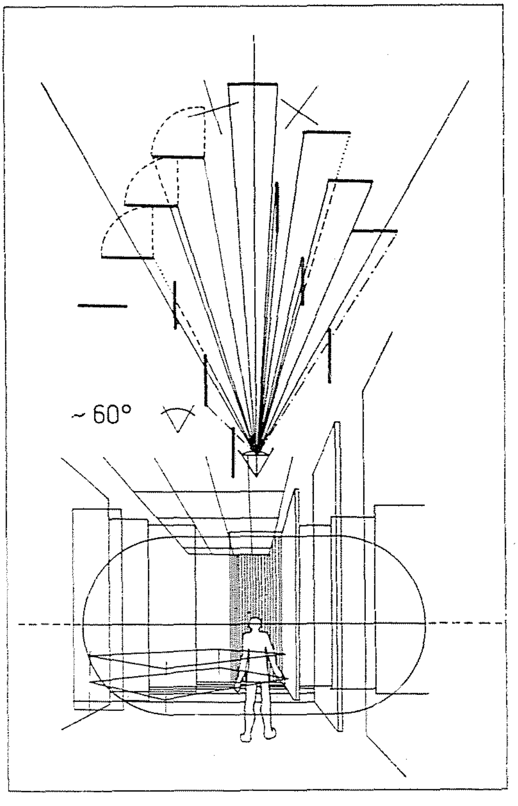

Fig. 1. The onlooker is inside the model with adjustable surfaces and variable spatial proportions

to be reckoned with, without, however, allowing to partition. On the contrary, *expansion of architectural aesthetics, visuality must not be considered as a factor independent or alien of engineering, neither must a theoretical, engineering researcher deny an approach based on visuality.*

Many years of experience showed instruction in drawing to be the only means considered by teachers to develop visual abilities. These teachers belong to those with a Latin erudition, to the humane intelligentsia, artists who are worried for arts, culture to be spoiled by engineering logic. This psychic motivation is responsible for the negative acceptance of engineering in the artistic-aesthetic sphere.

The question may schematically be formulated as whether the visual, aesthetic education in architecture is a must or not, whether it should follow the traditional lines of education in fine arts or not. Of course, it is a must. *But while drawing is both a tool and an objective in fine arts, for architects it is one of several methods.* Its actual efficiency had to be determined by experiments.

These experiments started from the recognition that actually, the conventional subject of freehand drawing induces attempting to grasp an object in its naturality but spatially separated from the onlooker.

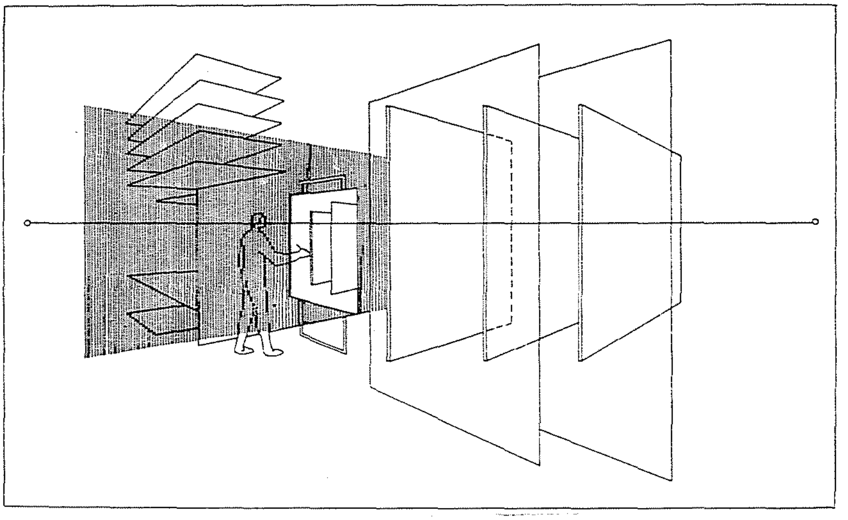

Fig. 2. Materials are either transparent or opaque; there is no preferential direction of viewing, the onlooker may move during perception

According to the new method, i, the object is not detached from its environment of spatial elements. The onlooker may pass the spatial system, touch its elements, from the aspect of recording by drawing the "object" becomes a subject both externally and internally, with modifiable surface and illumination, and with freely variable viewing angle, not fixed to a drawing desk; ii, rather than a final goal, the finished drawing is a continuous resource of creative approach, for instance, a given spatial stair forwards the possibility to indicate spaces by colours; iii, the drawing becomes a model; after an objective evaluation of proportions, colours, surfaces, the real stair elements can be rearranged as needed (Fig. 1). This method introduces technique inconspicuously but effectively.

Beware of the appearance from underestimating the importance of drawing. On the contrary, it should be penetrated to more universal, deeper layers (Fig. 2).

Experimental

1. Preliminaries

Much more efficient methods of visual education than the actually applied ones have been assumed to be possible in engineering higher education and especially in architectural education.

First, the population of boys and girls 16 to 18 years of age has been selected with a view on the actual secondary education (normal or vocational secondary schools supplying students to the university). Of course, rather than representative, surveying was done by model selection. It was rather interesting to see little deviation between ratings of boys and girls.

Second, technical and environmental conditions have been provided.

Third, test subjects have been prepared for the experiment, made acquainted with the tasks and the objective. (By that time, their ratings in drawing were known from earlier lessons made for surveying purposes.)

Fourth, subjects were divided into two groups, one for testing the new method, and the other as control group, taught in drawing according to the traditional method.

2. The test process

a) Test subjects adjust spatial units themselves.

b) They adjust the illumination to create the desired space effect in conformity with the features of the space units to create a rhythm and to define the space.

c) The spatial units will be designed from several directions. After having recorded each position, the spatial effect is changed optically. Surface colour (illumination) can be altered in certain limits from a central control desk.

d) Based on the designed system of units, projections are drawn, then a reduced model to about 1 : 50 scale model is made.

e) A video system has been applied to play back the real space setting, the drawing made of it, and the picture of the reduced model, aligning the different perception processes so as to yield a comprehensive understanding.

3. *Evaluation* was made by comparing pre-experimental and experimental drawings, according to the following aspects:

- recognition and conscious recording of proportions;
- conscious enhancement of the spatially created structure (rhythm etc.);
- recognition and application of laws of appearance;
- conscious recognition of the entity of the process.

Drawings were scored from 0 to 10. Test subjects were by about 40 per cent superior to the control group. The entire experiment lasted twice five months.

Part of the experiment has been processed into a motion picture and a magnetic tape.

To confirm the assumption that drawing as part of an integral process is a better tool to raise many-sided visual effect, and to deepen logical (engineering) thinking than are traditional drawing lessons, a spatial system has been created that doubles as object and environment, with details (colour, illumination, surface) variable during drawing, with the onlooker as integer part,

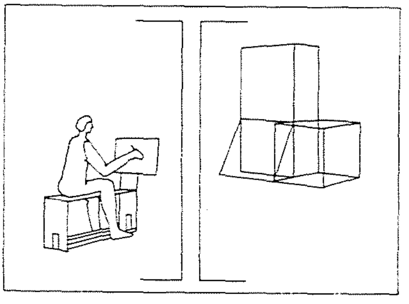

Fig. 3. According to the traditional method, onlooker and model are separated in space

hence the relation between tracer and object is other than conventional (Fig. 3). Perception includes a process of free association, the tracer can participate in space forming, leading to the conscious co-ordination of bidimensional representation and real tridimensional space (Fig. 4). The experiment involved both beginning and skilled tracers.

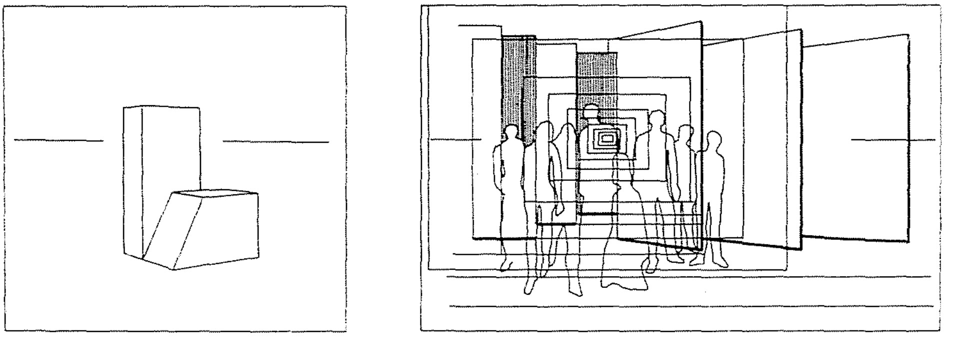

Fig. 4. The traditional method results in an image; the new method records the direct outcome of space creation

The result of the process "*spatial sensation → space formation → representation → creation based on representation → repeated space sensation*" could not be confronted to that of the conventional method but partially, due to their inherent deviations. The new method, however, exceedingly improved the quality of representation, manifest for the same tracers — performing similar tests according to either method — by the improved proportionality, by the more conscious application of the laws of perspective, by the increased importance attributed to the type and message of space units.

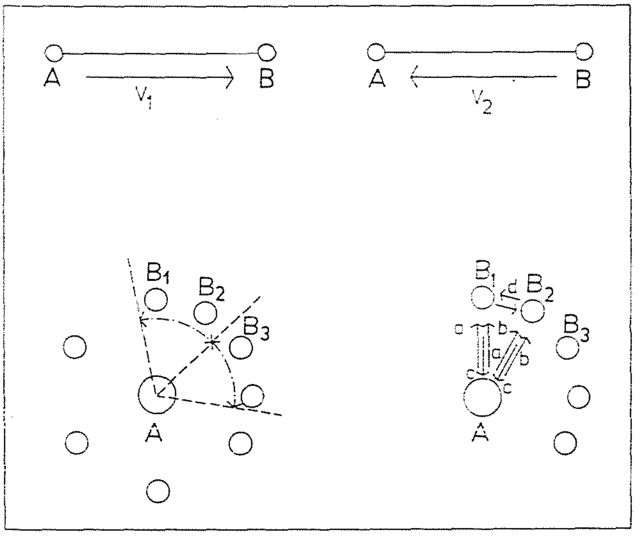

Fig. 5. The onlooker selects his model from the environment
A = onlooker, B = model, $B_1, B_2 \ldots B_n$ = environmental elements, V_1 = process of perception, V_2 = action of object on the onlooker
a = process of perception, b = intervention (shape, surface, illumination, colour etc.), c = = (varying) effects, feedback, d = interaction of elements

4. *Statements*

a) There exists a higher developed form of visual education for architects than the traditional drawing lessons;

b) the objective of representation has to be considered as part of a process; representation itself is improved thereby;

c) the space, the onlooker and the represented object must not be separated for not to incite the onlooker to abstraction, perfectly useless if not for a painter or sculptor;

d) space is perceived as an actively formed living entity of sounds, colour, light, surface etc. impressions;

e) in addition to observing and copying nature, personality is formed with the involvement of quite a number of creative and logical processes; representation is not a mere imaging but a space art.

5. General

All experiments are intended to yield generalizable results, conclusions of use either in theory or in practice.

The classic scheme has been followed to establish a hypothesis, to plan the experiment and to evaluate the results.

Is a transition from a closed to an open system feasible?

Views are grouped around two poles. According to rationalists, the *notion* grasps the essential, a definition corresponds to a fundamental property of the phenomenon, to be measured at a formal rigueur. They are confronted by empirists, denying general validity of the notion if not based on the sum of the experiments.

The problem consists exactly in the omission by advocates of representation of any other research, stating emotional approach to be decisive in visual perception, any technical intervention being contradictory to it. There are less advocates to inevitably technicizing all the processes, hence also the humanities. As a matter of fact, visual education is already inseparable from the actual achievements of civilization, even further applications of techniques have to be attempted, exactly for not to let visual education stick at a level of generalization and research but to let it develop with other fields.

This idea has been developed into an open system of visual perception and reproduction, valid in any field of visuality.

Conclusions

Visual activity assumes unity between man and surroundings. Both theoretical and practical cognition of the world demand a high-standard utilization of technique. The sphere of visuality cannot be alienated from other domains of life.

Technique is at home both in the process of sensory and psychological perception and in the course of assimilation, creation and reproduction. Rather than a goal, application of technique is an efficient tool, offering creative possibilities (Fig. 6).

The open system of visual activity presupposes a new approach. Rather than to be a communication system with emittor and receptor units, perhaps without human relation between, rather than to classify paiticipants as active and passive, here the emitter and the receptor are the same person.

In this process, human manifestations and technique constitute one chain where human activity affects technique, giving in turn impulses the participant. Thereby the application of technique permits to spatially expand, and timely shorten the comprehensive visual process.

Technique is understood as involving not only technical procedures,

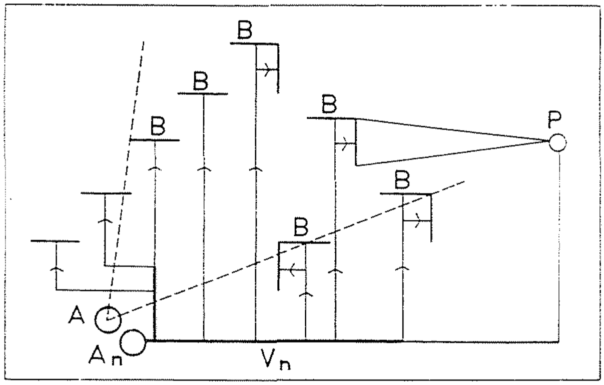

Fig. 6.
A = onlooker, A_n = control (semiautomatic) system, B = space elements, P = projector, V_n = control network

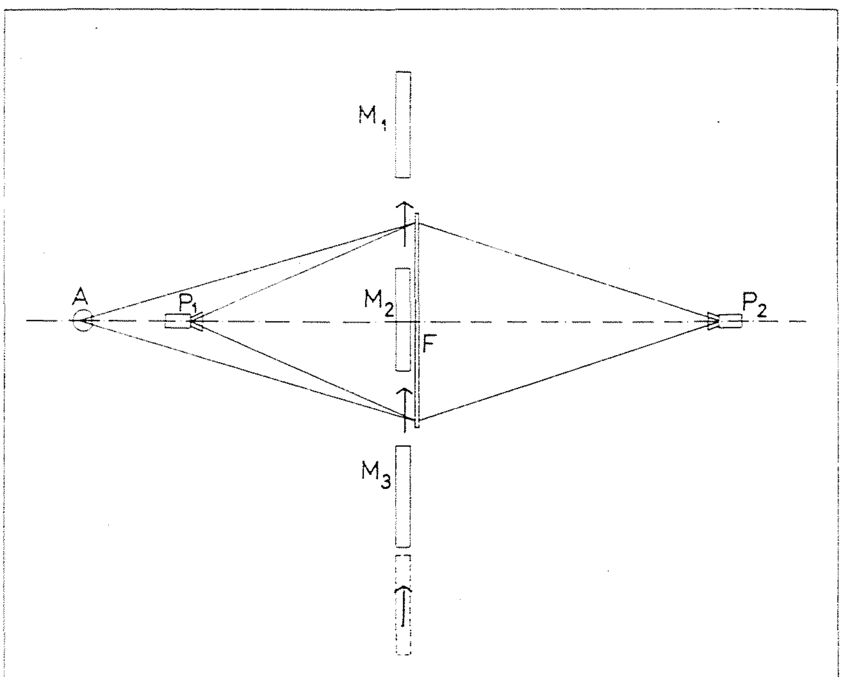

Fig. 7.
A = onlooker, P_1 = movie projector, P_2 = slide projector, M = model varieties in the projected environment

equipment, but primarily their interaction, and the action of man on their operation. Namely technical systems, rather than the use of an equipment, are involved.

The system permits to develop human creativity by accelerating variation possibilities, by urging to new ideas, new phenomena and to interactions between them.

By analogy to the outlined system, several technical series have been composed, with the interception of human activity (Fig. 7). Experiments resulted, in addition to increase the efficiency, in new technical, mental variations unforeseen at the beginning. Ten programs of different objectives have been carried through and proved to be brought in multiple interaction, with an infinity of varieties. This open system may increase human creativity by technique, and may suggest improvement to technical constructors. This experiment is intended, in final account, as a contribution to the interactive architectural design practice.

Summary

Theoretical fundamentals of the relationship between man, cognition, creation and technique are expounded. From preliminary tests, efficiency of this method in several fields of engineering practice and engineering education could be preassessed, where traditional methods are unlikely to help development. The specific relation between "technical chains" and man means in fact the inseparability of technical features of cognition, communication, evaluation from the process as a whole. Results of the experiment have been introduced in the education of visual perception.

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