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Art and Technology has had as one of its first premises
the assumption that it is possible, and perhaps valuable,
to effect a practical interchange between artists and
members of the corporate-industrial society. The various
cultural attitudes surrounding such a premise are deeply
ambivalent. On virtually every level, including the popu-
larly shared ideas and fears about the influence of "ad-
vanced technology" on the life of the masses, as well as
the many subtle analyses of writers and critics evaluating
the relationships between art, or the humanities, and
technology, qualities of emotionalism and partisanship
prevail.

Without delving extensively into recent historical ante-
cedents to some contemporary aspects of the art/tech-
nology issue, one or two skeletal observations are called
for. The attempts to embrace a socialist technology by
the Russian Constructivists and by the Italian Futurists,
during the early part of this century, were guided by a
Utopian (if nominally iconoclastic) view of progressive
technology, but did not fully succeed in transcending a
romantic and somewhat anachronistic level of awareness
on the part of its exponents. The Constructivist and
Futurist artists seldom achieved *internal* stylistic mani-
festations of new technology, but instead represented
the appearances of industrial/mechanical things. A seri-
ous ideological limitation holds also for the Bauhaus
precept regarding the relation of art to technology, in as
much as technology was equated with *craft;* one might say
that the Bauhaus theorists were aiming to *reduce* art to
craft, in a sense, and reversing the proposition, that the
role of organized technology would be to elevate craft to
art. The impulse which informed the Bauhaus rationale
and its antecedents in European Constructivism toward a
socialization of art in a public context has developed to
the present time, but insofar as it survives in its original
spirit has to an extent continued to remain identified
with a European sensibility. Victor Vasarely's conviction
that art should evolve out of its traditionally aristocratic,
"unique object" framework and be mass-produced for
public consumption is an extension of a classically
Bauhaus idea. (A certain reaction to the "precious object
syndrome" has certainly become a part of the American
art scene in the 60's and early 70's, but is manifested in
approaches which generally differ in kind from that of
Vasarely.)

To some extent, artists currently are discouraged from
engaging in "collusive" relationships with organized
technological concerns by pressures from the intellec-
tual/critical circles of which they are inescapably a part.
The contemporary pressures, both internal and external,
against collaborative activity between artists and indus-
try are of two sorts: first there is antitechnological senti-
ment on political grounds and second, there can be
argued substantial precedent militating against common-
ly held images of "technological art" on esthetic

grounds. I shall deal here more extensively with the sec-
ond than the first factor. My thought is to point selec-
tively to a few components of what is an intricately
complex subject. With reference to the overtly political
question, the fact is that, despite a certain amount of
reluctance by some of the artists we dealt with through
Art and Technology to participate with "war-oriented"
industries for reasons of moral objection, there were no
final refusals to participate in the program on this
ground alone.

The question of esthetics in relation to technological/in-
dustrial art works is bound up with certain attitudes
about collective artistic activity. These attitudes devolve
naturally upon several definable antitheses.

One of the fundamental dualisms inherent in the ques-
tion of technology's uses in a humanist context has to
do with the conflict between the belief that, in a word,
technology *is* the metaphysics of this century, and there-
fore has to be accommodated from within, and the view
that technology is somehow self-perpetuating, implac-
able and *essentially* inhuman, and that therefore human-
ist and artistic endeavor must function separated from it
and even in opposition to it. Nearly all the positions
taken by artists and by their scientific counterparts with
respect to the art/technology relationship are condi-
tioned by one or the other of these antithetical beliefs.

An increasingly prevalent concern of many artists and
scientists is to overcome the traditional and presumably
obsolete separation of academic and professional disci-
plines. Systems analysis, with its assumption that only
by starting from an interdisciplinary or total-context
approach can social institutions be made to operate pro-
ductively, provides procedural methods and models for
such reform. In principle, the espousing of a *systems
esthetic*—illustrated preeminently under Art and Tech-
nology in the Irwin/Turrell/Garrett Corporation endeav-
or—represents a less rhetorical theory than any (includ-
ing the Constructivist, Bauhaus and "socialized art"
manifestations) which has preceded it. It implies the
grasp of a powerfully efficacious means for revolution-
izing art within the total cultural setting. (Jack Burnham
gives an extended analysis of what I am terming a sys-
tems esthetic throughout his book *Beyond Modern
Sculpture,* Braziller, 1969.)

Although the "systems-conscious" attitude is increasing-
ly felt to influence artists of various persuasions, cer-
tainly including some of the artists who worked in Art
and Technology, it is not by any means a shared attitude
among all or most artists. One of the characterizing sen-
timents expressed by both those artists and scientist/en-
gineers who are resistive to an information or systems
esthetic, has to do with a suspicion harbored by virtually
everyone at times that we are all victims of a techno-

cratic macrostructure over which no one or no institution has real control. In the light of this inescapably sinister possibility, the traditional privilege enjoyed by the artist to function independently, and to remain, in a sense, one of the last freelance agents in society, is not easily relinquished.

A natural outcome of an artistic/technological endeavor which employs a systems philosophy might be an art which conditions human sense perception and radically sensitizes people. Along with this might develop possibilities for esthetic forms that would in effect cultivate and enrich the "man-made" nature which has already replaced nature to such a remarkable degree. For those who firmly believe that society is undergoing a gradual but radical reshaping of patterns of consciousness, the changes predicted as issuing from a generation of drug-users and the increasing body of Western initiates into the various Eastern meditative practices appear to represent an inevitable and potentially corrective metamorphosis. Artists who wish to explore the means and consequences of perception-expansion need specialized information; and, reciprocally, scientists gain insight from artists in this enterprise. Both parties might maintain that anything less than directly "manipulating" human sensory response to advance new esthetic terms constitutes merely a superficial elaboration of existing esthetic conventions.

Again, in reaction to this kind of pursuit, with its potential for subliminal coercion, there are many artists who unequivocally eschew this kind of activity. I have heard the area of "systems" or "information" esthetics dismissed as a "Fascist game."

Seen against most recent efforts in the area of technological art, which are generally identified with electronic light and sound media, the results of Art and Technology are unlike anything we could have predicted. They far transcend the genre of work ordinarily called to mind by "tech art." Owing to the great variety of techniques and processes and materials made available by the corporations contracted with us, the program issued in not one esthetic type of work, but in several.

On reviewing the development of Art and Technology, three kinds of collaborative experience seem to me distinguishable. First there is the approach taken by those artists interested basically in industrial or industrial-mechanical fabrication. Second is that relating to the use of more esoteric technological media; and finally, that marked by a participatory, informational esthetic without primary regard for object-making.

A longer tradition attaches to the first category of activity than to any other manner of endeavor undertaken through Art and Technology. Sculptors have for centuries enlisted the assistance of heavy industrial methods and materials to make monumental works. Yet we have observed a significantly greater sense of anxiety and discernibly more recalcitrance on the part of those artists engaged in industrial execution than has been conveyed by the artists using advanced scientific media. Oldenburg, Kitaj, Fahlstrom and Tony Smith all experienced some amount of frustration, and expressed occasional skepticism, during the course of their projects. (Oldenburg's enumeration on page 269 of "comparative attributes" between the qualities required of the studio versus the technological artist distills the substance of these doubts.) The special difficulty for artists depending upon industrial execution relies on the fact that they have usually in the past worked alone and thus carefully controlled every stage and every nuance of their works' making; thus the intervention of middlemen, not only handling the components but making occasional technical decisions, is difficult to accept. The artist under these circumstances is automatically placed at a greater remove from the process of execution than would follow if his esthetic end required a process of developmental research in close communication with a technical counterpart. These artists found themselves coping rather frequently with a command chain of bureaucratic procedure. Possibly for just the reason that neither the artist nor the Museum was a paying client of the various corporations, the art projects were not given especially high priority, and thus often moved forward at an exasperatingly slow pace. In short, a definite cumbersomeness attended the several ambitious industrial collaborations. But even given these natural adversities, something remarkable happened. Smith, Oldenburg and Fahlstrom all saw the realization of artistic inventions of the grandiose type which generally never exist beyond sketches or models. Oldenburg's *Icebag* and Smith's cave sculpture especially represent critical milestones in their respective careers. Fahlstrom and Kitaj both established rapport with the specialized craftsmen who built their tableaux. One would not expect these artists necessarily to make a career of collaborative endeavor, but unquestionably they and other artists would utilize more often than has been possible the resources of industry were they more readily available.

In the context of heavy industrial fabrication it is worth considering the approach taken by Richard Serra at Kaiser. Serra regarded the availability of Kaiser's steel-producing plant as an opportunity basically to experiment in huge scale. In using the company's formidable scrap resources and men and equipment he did not attempt primarily to come away with a permanent, or a transportable art work, but instead to learn what he could in a few weeks' time about making sculpture com-

prising thousands of tons, rather than pounds, of material.

Roy Lichtenstein's film project certainly does not belong in the class of industrially fabricated art works, but neither was it conceived in a spirit of philosophical commitment to the principles of technological or industrial coaction. He expressed even more strongly than the foregoing artists an attitude of real doubt and hesitation about his very association with the Art and Technology program. Lichtenstein, like many other artists in Art and Technology, has repeatedly worked in a collaborative manner in his various printmaking and multiple sculpture series. The making of a lithograph, for example, is an operation requiring an intensive cooperation between at least two people. Lichtenstein's engagement in the cinematic project undertaken with us was not, it seems to me, very different in essence from his manner of working to produce prints and multiples. It is true that he (or indeed any other artist) has never before utilized cinematic technique in precisely the way he did in this endeavor; and certainly the technical difficulties and expense inherent in his Art and Technology film project were far greater than are ordinarily entailed by printmaking methods. Nevertheless, Lichtenstein determined early exactly what he was after in the cinematic works, and once he had established his criteria he strove mostly to refine and perfect the quality of the images much as he would in making lithographs.

A second general category of work done under Art and Technology includes those artists, like Robert Whitman, Newton Harrison, Rockne Krebs and Boyd Mefferd who sought to exploit the kinds of techniques ordinarily regarded as typifying advanced technology. The approach taken by such artists necessarily depends to a greater or lesser degree on a working relationship with engineering specialists whose expertise they themselves could not acquire without years of research and training; it often depends as well on the equipment and laboratory facilities available only in large corporations. In using media such as lasers, advanced mirror optic systems or gas plasmas, artists are venturing into areas which are without much esthetic history. However, in evaluating such art works, it seems to be the case that the more directly and the more purely the medium is handled, and the less the artist relies on extraneous housings, the better the result. It was our conscious intention to include in Art and Technology artists whose past production specifically in the domain of advanced technology conformed to this evaluative guideline and the works accomplished by them with us are commensurately remarkable.

There was an important element of simple luck involved in locating individual scientists and engineers, within the vastness of all these companies, who desired to enter into prolonged collaboration with an artist. Art and Technology was not, after all, a situation like the one structured by E.A.T, through which engineers so inclined voluntarily make themselves available to consult with artists. Once those fortunate connections were made, the several advanced technology projects set in motion were characterized by a strong sense of mutual commitment. The artists consistently demonstrated qualities of pragmatism, efficiency and singleness of purpose toward the end of realizing their projects. We sensed in these exchanges very little communicative difficulty on the practical, one-to-one level of exchange.

There are by now several American artists who can be considered fairly experienced in the field of collaboration with engineers. Robert Whitman stands out in this connection; so does Robert Rauschenberg, though he has of course continued to work "traditionally" as well. Experience in dealing closely with technical personnel in making art probably does give an artist a certain advantage in expediting the progress of a given undertaking. But interestingly enough, those artists inexperienced at collaboration with scientists, such as Harrison, Jesse Reichek and Jackson MacLow, worked equally effectively.

It should be noted that the use of technological media by artists has not by any means always implied interdependency with scientists or engineers. Both Krebs and Mefferd, for instance, have in the past accomplished much of their work unassisted, finding out on their own about their equipment and its potential by reading, experimenting and consulting only occasionally with manufacturers or engineers. One of the principal benefits of Art and Technology for an artist like Krebs was the great *speeding up* of information accession made possible by his contact with corporation personnel; he conveyed great excitement about the "luxury" of being offered instant access to data and expertise it would have taken years to acquire on his own. This sort of advantage was given similarly to Harrison, Whitman, MacLow and Reichek, but has so far been largely denied Mefferd for whom we never really found the fortuitous personal connection.

There is little doubt that a number of serious artists will continue to assimilate technical knowledge and will evolve an increasingly sophisticated and refined body of technologically-oriented works of art. It is, however, open to question whether or not this development will find sustained impetus from organized corporation support or must tend to rely perennially on the contingencies of sporadic intervention by scientists and the determined self-education of artists.

In considering a third order of artist-corporation interchange in Art and Technology no inclusive term or con-

cept suffices to define the situations being encompassed. A few artists shared an attitude which is distinguishable from the ascendant, short-term concerns of the others. These artists from the outset wished to investigate a psychological or experiential mode of activity *primarily,* instead of occupying themselves fixedly with technics. Two assumptions are, in retrospect, implicit in these artists' projects. One is that the function of gathering and exchanging information is important as an end in itself; the other is that *participation should be made self-aware and be used as a form of esthetic endeavor.* Behind these assumptions may lie another one—that there potentially exists in any collaborative situation between scientists and artists a special dynamic, and that if the particular conflicts and sympathies inherent in this dynamic can be made to surface, one can learn and state and do something with them. The artists referred to here further may be said to have regarded the people with whom they dealt as *themselves* "media," rather than viewing them as *personnel,* or as simply parts of a larger machine dedicated to the end of engineering and fabricating systems or objects.

The Robert Irwin/James Turrell/Garrett Corporation project is the preeminent example under Art and Technology of an endeavor based on a directly systems-conscious premise. Irwin, Turrell and the scientist Dr. Ed Wortz have not only made it their business to explore and assess the dynamics of their interchange, but were explicitly engaged in researching aspects of perceptual psychology. Their mutual investigations were not terminated at the end of an arbitrarily set time interval, but have continued organically to develop. John Chamberlain at Rand and James Byars at the Hudson Institute set about to establish participatory events; both in a high spirit of "unofficial playfulness" proclaimed themselves as gatherers of information. They made themselves subtly effective catalysts in a process of evoking attitudes. The compilations of actual "data" resulting from their efforts, in contradistinction to those accumulated in the course of the Irwin/Turrell/Wortz researches, are poetic and inconclusive: they do not at all reveal the dense complex of occurrences stimulated through the respective processes of obtaining them. Both Byars and Chamberlain treated their periods of residence in two of the nation's leading think-tanks as self-validating, purely participatory events. The work accomplished together by Jesse Reichek and IBM's physicist Jack Citron represents a consummate prototype for a truly informational exchange. Reichek and Citron succeeded in organizing a computer program which functions as a powerful image-producing tool. Both would confirm that the principles involved in their discoveries transcend any immediate results materializing from them.

With Andy Warhol at Cowles Communications, the

element of participation came to issue in a startlingly literal way. Warhol agreed to design a work incorporating Cowles' 3-D printing process. But he ended by acting really as a kind of legitimizing aegis for the enterprise rather than its sole author and designer. Although he conceived the work's basic structure, he then proceeded to function as an agent, prompting crucial involvement in actual esthetic decision-making phases by his technical colleagues and even by ourselves. Despite the fact that his piece at Expo was a distinguished, if somewhat bizarre, work of art, the object itself was in some ways less important than what it represented of the multilateral esthetic participation behind its creation. In a sense Warhol has not done anything fundamentally unprecedented through the program: he has for years used technique unofficially, as it were; it is after all Warhol who, more than any other artist, made respectable commercial methods for art making such as inexpensive screen-printing techniques.

The concept of *unofficialness* in the artist's mode of working with corporate technology is of pivotal consequence to the overall dynamics of Art and Technology. It corresponds immanently to the notion of what may be termed a participatory esthetic.

Wylie Sypher, in his book *Literature and Technology: The Alien Vision,* (Random House, 1968; pp. 177; 216; 249) speaks of the state of "alienation" and "maladjustment" faced by technological personnel on every level in our society. He suggests that the goal priorities assumed within the corporate job structure run counter to the positive nature of technological endeavor, which is innately a form of *play* and *participation.* The artist, who has maintained his traditional "prerogative to use science and technique unofficially," might become a catalyst toward the end of humanizing technique. Though Sypher's contentions in the abstract too far overreach the practical sense of what occurred through Art and Technology to extrapolate here *in extenso,* his hypotheses offer the single point of correlation uniting every artist who worked with us. Each of them—some more overtly than others—approached their various projects with a sense of *playfulness,* or "unofficialness." It was their option to serve in multifarious ways as humanizing agents.

One thing none of us foresaw when we embarked on Art and Technology was what now amounts to a nearly unanimous disregard for permanent, officially installed art monuments. If many of the corporations initially hoped their participation would result in an icon representing their products and able to be owned and displayed by them, those hopes were unfulfilled. The signif-

icant fact is that the companies did *not* insist upon proprietary rights to the works made—and usually the proposals accepted by them for realization were known beforehand to be inappropriate for such purposes. The program did not become or even threaten to become a vehicle for commissioned works of art. If anything, the artists were more concerned than the companies to come away with a finished work—yet most of the artists made works transitory by definition.

The development of the various experimental interchanges in Art and Technology was on the whole a polymorphous, discursive and nonorganic process. Indeed it now appears simply that the relationship between artists and technological corporations is an intrinsically nonorganic one—at least on an *a priori* basis. The circumstance of corporation involvement in Art and Technology failed to embody a unified patronal ethic comparable to that kind of already "humanized," and standardized, morality inherent in past systems of Academic sponsorship. Concomitantly, the artist—in the by now established absence of either academic or avantgarde provinces—is startlingly free from imposed sanctions. Contrary to the myth of the "corporate image," there is seen to be no programmatic framework in the present condition of corporation patronage to support an official art of any description. A situation allowing room for play and participation—the latter term denoting a mode of activity in which inheres a self-sufficient esthetic statement—is established through the paradoxical *open-endedness* of the present state of corporate life. The artist retains his options.