During the last few years a great deal of attention has been given to the problem of design methodology, and to the process of design as a branch of the wider process of problem solving.

Many people believe, not without reason, that the intuitive methods of design traditionally used by architects are incapable of dealing with the complexity of the problems to be solved, and that without sharper tools of analysis and classification, the designer tends to fall back on previous examples for the solution of new problems — on type solutions. One of the designers and educators who has been consistently preoccupied by this problem is Tomás Maldonado. At a recent seminar at Princeton University, Maldonado admitted that, in cases where it was not possible to classify every observable activity in an architectural programme, it might be necessary to use a typology of architectural forms in order to arrive at a solution. But he added that these forms were like a cancer in the body of the solution, and that as our techniques of classification become more systematic it should be possible to eliminate them altogether.

Now it is my belief that beneath the apparent objectivity of these ideas there lies an aesthetic doctrine. It will be the purpose of this paper to show this to be the case, and, further, to try and show that it is untenable without considerable modification.

One of the most frequent arguments used against typological procedures in architecture has been that they are a vestige of an age of craft. It is held that the use of models by craftsmen became less necessary as the development of scientific techniques enabled man to discover the general laws underlying the technical solutions of the pre-industrial age.

The vicissitudes of the words “art” and “science” certainly indicate that there is a valid distinction to be drawn between artifacts that are the result of the application of the laws of natural science and those which are the result of mimesis1 and intuition. Before the rise of modern science, tradition, habit and imitation were the methods by which all artifacts were made, whether these were mainly utilitarian or mainly religious. The word “art” was used to describe the skill necessary to produce all such artifacts. With the development of modern science, the word “art” was progressively restricted to the case of artifacts which did not depend on the laws of natural science, but continued to be based on tradition and the idea of the final form of the work as a fixed ideal.

But this distinction ignores the extent to which artifacts have not only a “use” value in the crudest sense, but also an “exchange” value.

The craftsman had an image of the object in his mind’s eye when starting to make it. Whether this object was a cult image (say a sculpture) or a kitchen utensil, it was an object of cultural exchange, and it formed part of a system of communications within society. Its “message” value was embodied precisely in the image of the final form which the craftsman held in his mind’s eye as he was making it and to which his artifact corresponded as nearly as possible. In spite of the development of the scientific method we must still attribute such social or iconic values to the products of technology, and recognise that they play an essential role in the generation and development of the physical tools of our environment. It is easy to see that the class of artifacts which continue to be made according to the traditional methods (for example paintings or musical compositions) have a predominantly iconic purpose, but such a purpose is not so often recognised in the creation of the environment as a whole. This fact is concealed from us because the intentions of the design process are “hidden” in the overt details of performance specification.

The idolization of “primitive” man, and the fundamentalist attitude which this generated has discouraged the acceptance of such iconic values. There has been a tendency since the eighteenth century to look on the age of primitive man as a sort of golden age in which man lived close to nature. For many years, for instance, the primitive hut or one of its derivatives has been taken as the starting point for architectural evolution, and has been the subject of first-year design programmes, and it would not be an exaggeration to say that frequently a direct line of descent is presumed to exist from the noble savage, through the utilitarian crafts to modern science and technology. The whole edifice of art, certainly since the end of the mediaeval period, is often thought to be corrupt and unnatural, and based on some sophisticated “horror vacui” or the need to aggrandize a ruling class. In so far as it is based on the idea of the noble savage, this notion is quite baseless. The cosmological systems of primitive man were very intellectual and very artificial. To take only kinship systems, the following quotation from Claude Levi-Strauss will make the point clear: “Certainly”, he

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1The word is used here to mean the imitation of a tradition and not in the Aristotelian sense of the imitation of nature.
The relation of this notion to Spencerian evolutionary theory is very striking. According to this theory the purpose of prolonging life and the species must be attributed to the process as a whole, but at no particular moment in the process is it possible to see this purpose as a conscious one. The process is therefore teleological. In the same way, the biotechnical determinism of the modern movement was teleological, because it saw the aesthetic of architecture form as something which was achieved without the conscious interference of the designer, but something which none the less was postulated as its ultimate purpose.

It is clear that this doctrine contradicts any theory which would give priority to an intentional iconic form, and it attempts to absorb the process by which man tries to make a representation of the world of phenomena back into a process of unconscious evolution. To what extent has it been successful, and to what extent can it be shown to be possible?

It seems evident, in the first place, that the theory begs the whole question of the iconic significance of forms. Those in the field of design who were — and are — preaching pure technology and so-called objective design method as a sufficient and necessary means of producing environmental devices, and persistently attribute iconic power to the creations of technology, which they worship to a degree inconceivable to a scientist, I said earlier that it was in the power of all artifacts to become icons, no matter whether or not they were specifically created for this purpose. Perhaps I might mention certain objects of the nineteenth-century world of technology which had power of this kind — steamships and locomotives, to give only two examples. Even though these objects were made ostensibly with utilitarian purposes in mind, they quickly became gestalt entities, which were difficult to disassemble in the mind's eye into their component parts. The same is true of later technical devices such as cars and aeroplanes.

The fact that these objects have been imbued with aesthetic unity and have become carriers of so much meaning indicates that a process of selection and isolation has taken place which is quite redundant from the point of view of their particular functions. We must therefore look upon the aesthetic and iconic qualities of artifacts as being due, not so much to an inherent property, but to a sort of availability or redundancy in them in relation to human feeling.

The literature of modern architecture is full of statements which indicate that after all the new operational needs have been satisfied, there is still a wide area of choice in the final configuration. I would like to quote two designers who have used mathematical methods to arrive at architectural solutions. The first is Yona Friedman, who uses these methods to arrive at a hierarchy of organization in the programme. In a recent lecture, in which he was describing methods of computing the relative positions of functions with a three-dimensional oblique grid, Friedman acknowledged that the designer is always, after computation, faced with a choice of alternatives, all of which are equally good from an operational point of view.

My second example is Yannis Xenakis, who, in designing the Phillips Pavilion while he was in the office of Le Corbusier, used mathematical procedures to determine the form of the enclosing structure. Xenakis says...
as our classification techniques were unable to establish all the parameters of a problem, it might be anachronistic to provide a methodology of forms to fill the gap. From the examples of the statements made by modern designers it would seem that it is indeed never possible to state all the parameters of a problem. Truly quantifiable criteria always leave a choice for the designer to make. In modern architectural theory this choice has been generally conceived of as being in the intuition working in a cultural vacuum. In mentioning typology, Maldonado is suggesting something quite new, and something which has been rejected again and again in modern theory. He is suggesting that the area of pure intuition must be based on a knowledge of past solutions to related problems, and that creation is a process of adapting forms derived either from past needs or on past aesthetic ideologies to the need of the present. Although he regards this as a provisional solution - "a cancer in the body of the solution" - he none the less recognizes that this is the actual procedure which designers follow.

I suggest that this is true, and moreover that it is true in all fields of design and not only that of architecture. I have referred to the argument that the more rigorously the general physical or mathematical laws are applied to the general problems, the less it is necessary to have a mental picture of the final form. But, although we may postulate an ideal state in which these laws correspond exactly to the objective world, in fact the laws are not found in nature. They are constructs of the human mind; they are models which are valid so long as events do not prove them to be wrong. Not only are the methods of architecture frequently faced with different problems which are not logically consistent. All the problems of aircraft configuration, for example, could not be solved if there was give-and-take in the application of physical laws. The position of the power unit is a variable, so is the configuration of the wings and tailplane. The position of one may effect the shape of the other. The application of general laws is a necessary ingredient of the form, but it is not a sufficient one for determining the actual configuration. And in a world of pure technology the size of free choice is invariably dealt with by adapting previous solutions.

In the world of architecture this problem becomes more critical because here the general laws of physics and the empirical facts are even less capable of fixing a final configuration than is so in the case of an airliner or a bridge. Recourse to some kind of typological model is more likely to be necessary. It may be argued that, in spite of the fact that there is an area of free choice beyond that of operation, this freedom lies in the details (where, for instance, personal "taste" ought legitimately to operate). This could probably not be so true of such technically complex objects as airplanes, where the topological relationships are largely determined by the application of physical laws. But it does not necessarily apply to architecture. Here we are usually so far beyond the area of free choice in the sense of the "Philips Pavilion," for example, it was not only acoustic restrictions which established the basic configuration, but also the need for a building which could not have a certain impression of vertigo and fantasy. It is in the details of plan or equipment that natural laws become stringent, and not in the general arrangement. Where the designer decides to be governed by operational factors, he tends to work in terms of a highly traditionalizing rationale, for example in the case of the office buildings of Mies and SOM, where pragmatic planning and cost considerations by the decision-makers in the case of "archiprism" forms are borrowed from other disciplines, such as space engineering or pop art. Valid as these iconographic procedures may be - and before dismissing them one would have to investigate them in relation to the work of Le Corbusier and the Russian constructivists who borrowed the forms of ships and engineering structures - they can hardly be compatible with a doctrine of determinism, if we are to regard this as a modus operandi, rather than a remote and utopian ideal.

The exclusion by modern architectural theory of typologies, and its belief in the freedom of the intuition, can at any rate be partially explained by the general problems which was current at the turn of the century. This theory can be seen most clearly in the work and theories of certain painters - notably Kandinsky, both in his paintings and in his book Point and Line to Plane, which outlines the theory on which his paintings are based. Expressionist theory rejected all historical manifestations of art, just as modern architectural theory rejected historical forms of architecture. To it these manifestations were an ossification of technical and cultural attitudes whose raison d'etre was to exist. This theory was based on the belief that shapes have phasomorphic or expressive interest which communicates itself to us directly. This view has been subjected to a great deal of criticism, and one of its most convincing refutations occurs in E. H. Gombrich's book Meditation on a Hobby Horse. Gombrich demonstrates how an apparent inconsistency in the process of vision, such as is found in a painting by Kandinsky or by Paul Klee is in fact very low in content, unless we attribute to these forms some system of conventional meanings not inherent in the forms themselves. His thesis is that physiognomic forms are ambiguous, though certainly not without expressive value, and that they can only be interpreted within a particular cultural milieu.

One of the ways he illustrates this is by reference to the supposed effective qualities of colours. Gombrich points out, in the now famous example of traffic signals, that we are dealing with a conventional and not a physiognomic meaning; and maintains that it would be equally illogical to extend this reasoning to traffic signs, so that red indicated action and forward movement, and green inaction, quietness and caution.4

Expressionist theory probably had a very strong influence on the modern movement in architecture. Its application to architecture would be even more obvious than to painting, because of the absence in architecture, of

4These principles are similar to those formulated for sign systems in general by F. de Saussure; see Cours on General Linguistics, F. de Saussure. The Philosophical Library, Inc. New York 1959.

4It is interesting that, since this book came out, the Chinese have, for ideological reasons, reversed the meanings of their traffic signals.
any forms with overt iconic meanings. Architecture has always, with music, been considered an abstract art, so that the theory of physiognomic forms could be applied to it without having to overcome the hurdle of direct representation and anecdote as in painting.

But if the objections to expressionist theory are valid, then they apply to architecture as much as to painting. If, as Gombrich suggests, forms by themselves are relatively empty of meaning, it follows that the forms which we intuit will, in the unconscious mind, tend to attract to themselves certain associations of meaning. This could mean not only that we are not free from the forms of the past, and from the availability of these forms as typological models, but that, if we assume we are free, we have lost control over a very active sector of our imagination, and of our power to communicate with others. It would seem that we ought to accept a value system which takes account of the forms and solutions of the past, if we are to retain control over concepts which will obtrude themselves into the creative process, whether we are aware of it or not.

There does seem, in fact, to be a close relationship between the pure functionalist or teleological theory that I have described, and expressionism, as defined by Gombrich. By insisting on the use of certain methodological tools, functionalism leaves a vacuum in the form-making process. This fills with its own reductionist aesthetic — the aesthetic that claims that "intuition", with no historical dimension, can arise spontaneously at forms which are the equivalent of fundamental operations. This procedure postulates a kind of onomatopoeic relationship between forms and their content. In the case of a biotechnical/determinist theory the content is the set of relevant functions — functions which themselves represent a reduction of all the socially meaningful operations within a building and — it is assumed that the functional complex is translated into forms whose iconographical significance is nothing more than the rationalized structure of the functional complex itself. The existent facts of the objective situation in functionalism are the equivalent of the existent facts of the subjective (physiognomic) situation in expressionism. In both cases the resulting forms are assumed to obey natural laws, in the one case physical, and in the other psychological.

But traditionally, in the world of art, the existent natural facts, whether objective or subjective, are less significant than the values which we attribute to these facts, or the system of representation which embodies these values. As in language, the meanings attributed to elements which constitute the system cannot be derived solely from the elements themselves. In a given cross section of history it is never possible to reduce a sign system to one in which all the elements can be shown to be the result of natural forces.

It is true that the analogy between a system such as architecture and language is not exact, because in the case of architecture there are natural (technical and expressive) facts which are not present in language. But these facts are not sufficient to explain the entire meaning system, which depends less on the intrinsic nature of the signs than on convention, and the series of expectations that such a convention makes possible. It follows that a plastic system of representation such as architecture has to presuppose the existence of a given system. No more than in the case of language can the problem of form be reduced to some kind of essence outside the system itself, of which the form is merely a reflection. In both cases it is necessary to postulate a conventional, arbitrary system embodied in solution/problem complexes.

My purpose in stressing this last is not to advocate the return to an architecture which accepts tradition unthinkingly. This would imply that there was a fixed and immutable relation between these forms and meanings, which it has been one of the chief purposes in this paper to refute. The characteristic of our age is change, and it is precisely because this is so that it is necessary to investigate the part which the modifications of the stereotype play in relation to problems which are without precedent in any received tradition. The process of change must involve a dialectical relationship between those parts of the system that are resistant to change (because they are conventional) but changeable (because they are arbitrary); and those parts of the system which depend on natural laws which progressively come to light under the pressure of technological evolution. Underlying both there are undoubtedly certain psycho-physical constants; but these are always mediated both by the existent language on the one hand and by technological developments on the other.

I have tried to show that a reductionist theory according to which the problem/solution process can be reduced to some sort of essence is untenable. One might postulate that the process of change is carried out, not by a process of reduction, but rather by a process of exclusion, and it would seem that the history of the modern movement in all the arts lends support to this idea. If we consider painting and music we can see that, in the work of Kandinsky and Schönberg, traditional formal devices were not completely abandoned, but were transfigured and given a new emphasis by the exclusion of ideologically repulsive iconic elements. In the case of Kandinsky it is the representational element which is excluded; in the case of Schönberg it is the system of triads based on the harmonic series.

The value of what I have called the process of exclusion is to enable us to see the potentiality of forms as if for the first time, and with naivety. This is the justification for the radical change in the iconic system of representation, and it is a process which we have to adopt if we are to keep and renew our awareness of the value which can be carried by forms. The bare bones of our culture — a culture with its own characteristic technology — must become visible to us. For this to happen, a certain scientific detachment towards our problems is essential, and with it the application of the mathematical tools proper to our culture. But these tools are unable to give us a ready-made solution to our problems. They only provide the framework, the context within which we operate.

"When semiology becomes organised as a science, the question will arise whether or not it properly includes studies of expression based on completely natural signs... in fact, every means of expression used in society is based, in principle, on collective behavior..." Polite formulae, for instance, though imbued with a certain natural expressiveness (as in the case of a Chinese who greets his Emperor by bowing down to the ground nine times) are not the less fixed by rule, it is this rule and not the intrinsic value of the gesture that obliges one to use them." Y. De Saussure, op. cit.