VOL. 2

NO. 3

SPRING 1952

raleigh, n. c.

UDENT PUBLICATIONS OF THE SCHOOL OF DESIGN, NORTH CAROLINA STATE COLLEGE

master builder

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You will have noticed as you read the following pages that our sources have been almost exclusively from individuals actively engaged in the creative processes for which we are preparing ourselves. Our intention in so predicating this issue is singular: we have arrived at a time of self-analysis. In order to achieve some order in this analysis we felt the necessity for comparison of our thoughts with those of these individuals. The "fresh approach" mentioned by Mr. Nikolaus Pevsner in our last issue at times requires the scrutiny of more experienced minds.

The response to our inquiries has been gratifying. It is interesting to be reminded of the active interests of such responsible individuals in us as students and in our thoughts as people of the younger generation. Indeed, there are some pertinent questions we may ask ourselves. Does not the "fresh approach" seem to be possessed by some members of the older generation in more markedly a degree than in the youth? Does our education prepare us as thinking individuals or merely inanimate basins receiving only superficially the water from the so-called "fountainheads" of wisdom?

A last word as to the contents. Photography, physics, landscape architecture and creative writing are fields of activity properly our concern, and we will continue to believe in such thoughts until someone can propose a valid contradiction.

Understandably we could not publish all which is our concern since we would have had to represent activities as diversified as tool and die making and home economics. Our reason for such range is simple. We cannot find an adequate contradiction to the question: Is not everyone an artist in his own right? As Fr. Courtrier has said: "The artist is not a special kind of person, but every person a special kind of artist."

The Editor

spring 1952, raleigh, n. c.

this magazine was originated by the students of the school of design and is maintained as an independent student project.

PUBLISHED THREE TIMES A YEAR. PATRON SUBSCRIPTIONS $10.00 YEAR. REGULAR SUBSCRIPTIONS $6.00 YEAR. INDIVIDUAL COPIES $2.00

THE FUTURE OF THE YOUNG ARCHITECT

Architecture is on the way to becoming master building once again. Let's try to see where this puts the young architect.

Architecture was master building during the Middle Ages but with a difference. That was the *beginning* of the industrial revolution. As Coulton pointed out, even in cathedral building there was an organized building of labor, and the "mason's mark" was actually a device for inspection, to fasten responsibility along the assembly line.

Today architecture has the problem of absorbing a more advanced stage of the industrial revolution. The profession as a whole is very, very far from having caught up with the facts of the situation. The profession has been accustomed to serving gentlemen: the first princes of the church, then the princes of the State, then merchant princes. Today all at once somebody has to serve the common people. The other way of saying this is that someone has to serve the Market; and the techniques of industrialism have now advanced to the point where serving the Market means producing goods of all kinds in advance of orders.

It's a tough situation, and there are many, many reasons for bewailing it. Yet there stands the fact. Since architects have not been set up to serve the Market, others have served it. They have been called the "merchant builders," or the "speculative builders," depending on whether praise or scorn was aimed at in the semantics.

World War II gave an enormous boost to these merchant builders. One firm, the Levitts, built 5,000 houses last year, expect to build 7,000 this year, and each year these are

built in the form of one more or less complete community—a town a year. Gunnison Houses, prefabricators, sold 7,000 houses last year through local distributors. Since World War II, the "home builders" have produced a new home for one of every seven Americans. Architects have designed a distressingly small proportion.

Under this frightening acceleration, the older members of the architectural profession have tended to pull back into their shells. Some have roundly scolded such publications as *House & Home,* offshoot of their well loved *Architectural Forum,* for daring to do constant attention calling. Even to think about this situation is equivalent, in the opinion of these older architects, to being tinged with the dread disease of "commercialism."

Yet there we are. If architects were to persist in withdrawing, they would soon be in the position of Haitian exiles—generals without an army. To fight the battle of architecture, the first requisite is to know where the army is and what it wants. It will be small honor to architecture if *all* it can produce is Epicurean gardens in the mass-produced wilderness. I hope the young man in architecture is tough enough to take on this assignment. It will be a heartbreaking one, fit for unsung heroes. Not many of the traditional amateurs of architecture will have the slightest comprehension for either the aims or the nature of the effort.

There are three possibilities I can think of for the young architect who wants to think big and make himself genuinely useful. One is to attach himself to the efforts of the men who stand today in the forefront of home building—the big volume home builders. Let the young architect realize that even though, to him, some parts of the current product may look vicious—the miles and miles of today's new slums raping the virgin landscape—yet the men who are producing it are human beings, and when they fail they are more often ignorant than vicious. Moreover, these men are in command of skill sometimes startling: for example, this year when the Levitt's put the utility room for a three-bedroom house into a single kitchen cabinet no bigger than a dishwasher they rendered obsolete in advance the heating arrangement of thousands of homes yet to be designed this year by touted architects.

There is a second way to serve building, a more conventional way: and that is to design the best possible houses on order for individual clients, but with a keen eye to stating the

idea of the house so clearly and so well that in a way it becomes a prototype and serves a humanity broader than the initial client. And I hope ardently that this can be done with a minimum of apple-polishing to Wright or Mies or Wurster or Breuer or others who have already won their distinction.

Then there is the third way pioneered by Buckminster Fuller. With a devotion worthy of the medieval monk, Fuller and his followers have held to the ideal of learning by loving study how to do more with less, how to study and use the products of today's market without being sucked into the falsities of high-pressure salesmanship, how to remain canny and creative and not lose energy through mere pugilism. Fuller has set realistic goals well ahead of the day, and his kind of a man has made major contributions to large-scale building without ever yet having founded an actual large-scale building operation. By tomorrow his group will truly be in position for a direct large-scale effort.

My own generation did just one good thing in preparation. It opened the way to the *definition* of total architecture. Since no one has yet succinctly stated it, let me try. Architecture is the art of producing or qualifying human surroundings to create a human setting. *Any* human surroundings. This means that architecture neither begins or ends with building. Architecture is not something that happens to building—it's something that happens to man's environment regarded as human surroundings. Increasingly our surroundings are found to be indivisible in their effect. The house means little without the street, the street without the road, the road without the farm, the farm without the forest, the forest without the stream, and so on as far as eye can reach. Since industrial civilization ignorant and unguarded can despoil the entire scene, architecture can no longer content itself with isolated and selected building situations. It has to work at big scale on total environment or it will work not at all. Wherever and whenever the street, the road, or even the land is deliberately changed for the purpose of producing a more enjoyable setting the effort is architectural, no less than when a fine building is erected. That's what "master building" must come to.

Douglas Haskell, editorial chairman
THE MAGAZINE OF BUILDING

The sudden impact of contemporary art on the whole of our surroundings has faced the landscape architect with a problem which may not be quickly solved. A solution will be reached more rapidly when architecture is prepared to reassure a greater share of responsibility for the layout of grounds in the immediate vicinity of buildings. Like Adam and Eve the architectural profession was driven out of the garden two hundred years ago for having learned too much. Since then it has lost confidence in its ability to deal with a problem which now seems to it only very partially architectural.

In the meantime the aftermath of the romantic landscape gardening school of the late Eighteenth Century dominates the scene and its influence is still quite evident in the work of even the most contemporary of garden designers who find it impossible to disassociate themselves from their early "landscape" training.

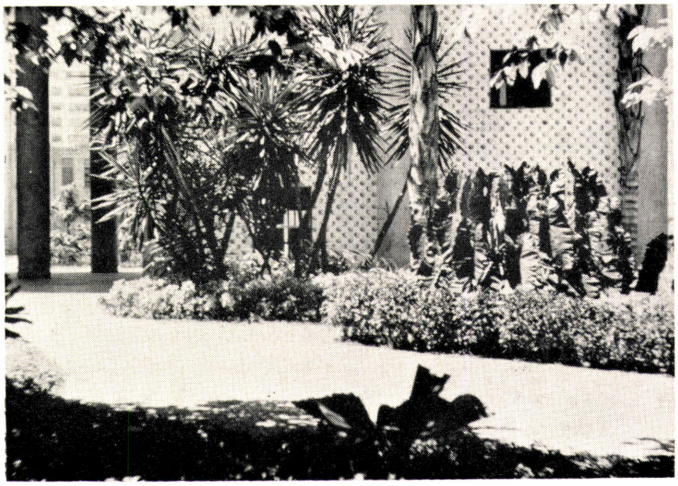
Kent's* famous aphorism "nature abhors a straight line" has been responsible for, not only the vermiform garden walks of the Nineteenth Century, but also for the modern interest in primitive protozoan forms resulting in amoebic swimming pools and planting beds. Has it ever been suggested that, in addition to straight lines, nature "abhors" walks, swimming pools, planting beds, and almost everything else that we commonly associate with garden craft?

The incongruity of the landscape garden as a setting for architecture was more keenly felt by our ancestors than it is by us today. Their answer was: first, the informality and romanticism of the Gothic Revival; second, an attempt to blackout architecture from the landscape scene by covering the building with a dense overcoat of ivy; third, a transitional semi-architectural area separating the buildings from the "naturalesque." In modern Brazil curved buildings, which suggest the influence of the landscape gardening school on architecture itself, are beginning to appear, but most architects in that country seem satisfied to accept the local interpretation of the landscape garden as a setting for the contemporary building.

For the last two centuries the tradition of Latin America has been to follow France in the arts. Bookshops display a high percentage of French titles. I arge numbers of people speak fluent French. French town planners and landscape architects, with Paris as their model, claim credit for the layout of most Latin American cities from Havana and Mexico City to Buenos Aires. Evidence of their work is obvious on every hand. In architecture no attempt is being made to catch hold of the disappearing tail of the Beaux Arts and Le Corbusier now provides the inspiration for the greater part of today's building, which in Rio and S. Paulo, is proceeding at a speed that makes North American cities appear stagnant.

Lengthy explanations failed to enable me to understand their reasons for mounting so many of their buildings up on stilts with open space below. This treatment is not confined to administrative and commercial skyscrapers but it also applied to apartment blocks and even individual houses. It seemed

* William Kent, 1684-1748, architect, painter, sculptor, landscape gardener.



to me that a lot of floor space, sometimes the most valuable, was being lost for want of enclosure at nominal cost. They must have better reasons than just copying Le Corbusier but I failed to notice any very effective use being made of the space under the buildings for parking or sitting in the shade. In some cases planting beds and even pools have been attempted underneath. In others the space has been utilized for decorative mozaic screens.

Various attempts at solving the problem of contemporary garden are being made in America. At Cranbrook, Michigan, the late Eliel Saarinen's idea was a contemporary architectural layout quite monumental in feeling. The design of Frank Lloyd Wright's interesting garden at Taliesin, Phoenix, Arizona, is also architectural, a scheme based on triangles. Neither of these two leaders shows any evidence of landscape influence.

The California school led by Thomas Church and Garret Ekbo is architectural to the extent that it makes much use of constructional features such as well-designed shelters, pergolas, fences, walls, steps, swimming pools, and levels instead of slopes but evidence of early landscape training is often quite strong.

Roberto Burle-Marx, the celebrated Brazilian painter turned landscape architect, says that garden design is "painting with plants." Lacking academic training in either architecture or landscape architecture Marx approaches his problem as a study in pure decoration in two dimensions. With the earth as his canvas, mozaic, bedding plants, and grass as his colours and his own garden contracting company as his brush, he paints pictures; abstract pictures, on the bare ground, on the roof of a skyscraper, or under a skyscraper.

The gardens of Burle-Marx are a horizontal adaptation, in different materials, of his world-renowned mozaic screens. Since he has been joined by his collaborators Mr. and Mrs. Robert and Susan Cordoza, trained landscape architects from California, topographical surveys have made it possible to study levels in a country where there is very little level land indeed. This is beginning to produce such constructional architectural features as walls and steps and will undoubtedly improve design. Up to the present the functional aspect of Marx projects has been largely confined to means of access, that is pavements in mozaic or decomposed granite for walking and sitting.

Roberto Burle-Marx is an extreme romanticist. Like many painters he has little use for the architectural approach to garden design. Although Rio abounds in some of the best hedges I have ever seen, (Ficus retusa nitida) providing a perfect architectural setting for buildings, no hedge has ever been allowed in any garden by Marx. As far as he is able to avoid it the pruning knife has no place in his scheme of things. Every plant must be allowed to take its natural form. If it grows away from the desired shape and size the blame must be placed on faulty choice of planting material. In order to produce a romantic wild effect he will never hesitate to plant bullrushes or Egyptian Papyrus almost under the walls of skyscraper. The maintenance staff risk the loss of their job if they remove the dead leaves clinging to the stem of a Yucca. When they start cutting grass Marx just turns his back. In a country where labor is the only cheap commodity the cost of maintenance is not such an important consideration as here but the very nature of Marxian design must involve much maintenance. "Paint-

ing with plants" means a very flat low ground cover treatment which, in the tropics, can only be accomplished by mass planting such temporary bedding plants as Coleus and Alternanthera. Such planting must be so constantly renewed that failing the possibility of finding permanent material for that purpose the maintenance of these gardens would be almost prohibitive in the North.

In addition to being painter, garden designer, and linguist Marx is a great horticulturist and plant collector. He loves to go and spend the day at his own nurseries some sixty miles south of Rio. Once there it needs force to drag him away from all his treasures. Each new colour in Anthuriums brings forth an outburst of enthusiasm. Before I left he sent Robert Cordoza on a voyage of discovery to the tropical jungles of the Upper Amazon to collect new species. The last I heard was news of a Philodendron with leaves six feet long.

Marxian gardens are important as they are having great influence all over the world. The fact that they appear to satisfy all the most celebrated architects in Brazil provides Marx style with sufficient impetus to make it fashionable while an additional attraction is its low cost when compared with any architectural type of garden. As his designs do not appear too difficult one might fear a repetition of the aftermath of the original landscape designs, in the form of a big rush of copyists producing a caricature of Marx work. Such an eventuality would call to mind the words of Sir Wm. Chambers* written in 1772: "A new manner is universally adopted in which no appearance of art is tolerated. There is generally so little art in the arrangement that these compositions rather appear the offspring of chance than design. It matters little who are the gardeners, a cabbage planter may rival a Claude and a clown outtwine a Poussin; the meanest may do the little there is to be done and the best could reach no further."

To architects I recommend Brazil as a stimulating holiday. Comparatively few tourists reach it and architects particularly will receive a warm welcome and be given an opportunity of inspecting some of the most daring and original designs to be seen anywhere. The studio of Roberto Burle-Marx seems to be headquarters for many branches of design. With so much hospitality and so many people interested in the arts drifting in and out until late in the evening it is difficult to understand how so much work of such a high standard gets done. To me the contacts made with architects, landscape architects and town planners were particularly exciting. Days spent visiting gardens with Robert and Susan Cordoza; long and delightful arguments about the principles of landscape design with people whose approach and attitude was so different from my own; struggles to make some sort of a start at learning planting material of a richness difficult for Northerners to grasp made an unforgettable holiday.

Rio is possibly the world's most romantic city, a mecca for all sailors whose song "rolling down to Rio," now centuries old, has made the place famous. All visitors have recollections of languorous tropical nights with the moon on the bay between the Corcovado and the Sugarloaf, and the heavy perfume of exotic vegetation.

H. B. Dunington Grubb
Landscape Architect
Toronto, Canada

* "A dissertation on Oriental Gardening," 1772, by Sir William Chambers, brilliant architect and oriental traveller.

The photos accompanying this article show some of the gardens of Roberto Burle-Marx in South America

Photos by H. B. Dunington Grubb

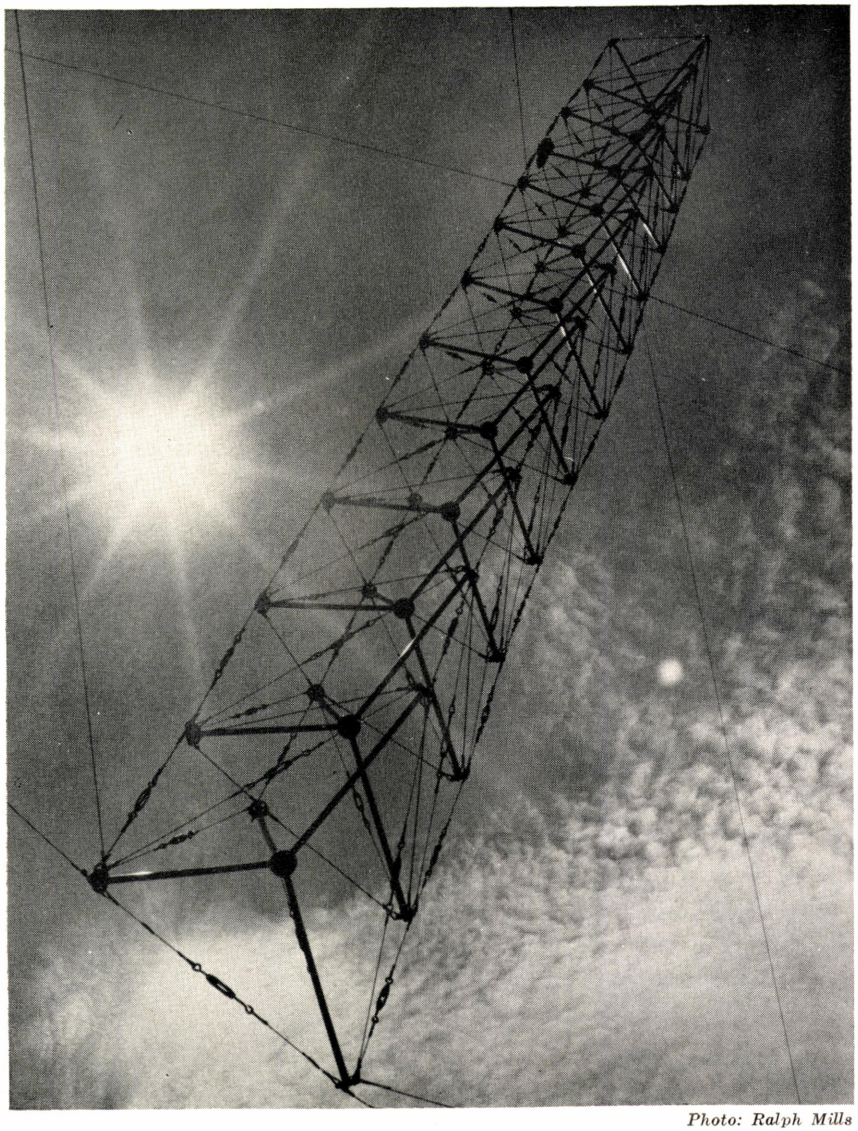
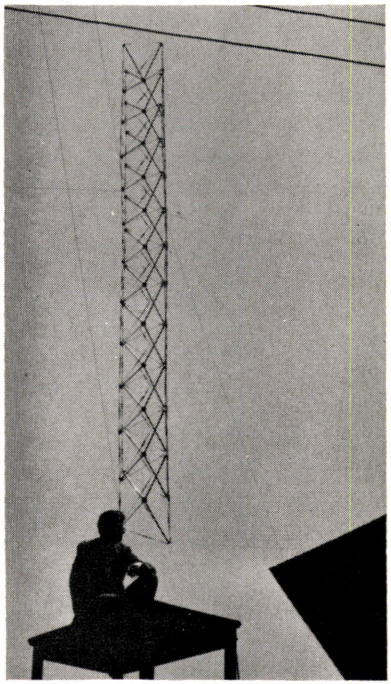


Photo: Ralph Mills



Twenty foot discontinuous compression tower erected by students of the School of Design in collaboration with the Fuller Research Foundation

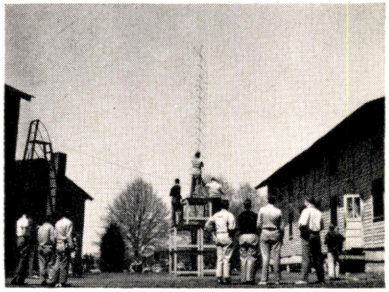


Photo: Jack Shriver

THE following article is taken from the personal writings of Richard Buckminster Fuller. These thoughts are from a private publication entitled 4-D TIMELOCK compiled in 1928

Richard Buckminster Fuller
Scientist, Inventor, Mathematician
Visiting Professor, School of Design.

CHAPTER TEN

The Revolution in Design
The Industrial ARTS vs Selfish Creation
The New Scale and the Time dimension.

Europe as usual as pertains to inspirational design is tremendously in the lead. Our clothing, automobile, furniture and other designs still emanate from Europe, even as did the designs of our early and lovely colonial doorways, popularly supposed to have been born here because peculiar to this country in actual execution. America is so rich in material things, that its mind is not attuned to abstract searching to the same degree as in the older civilization. American minds are still completely satisfied with stylism, as they have not as yet run the gamut of the styles to the extent of mental fatigue and nausea. Europe surfeited with stylism, is going through a revolution in surface design, seeking out every possible harmonious or rhythmical projection of plain geometry. In America we have of course our own designers with some popular reception of their new composition; possibly with a great longevity of popular reception as the surface designing from Europe. The revolution is interesting only as a fact and as an indicator of trend.

Artists, that is the good ones, are the thinkers who venture into the field of the abstract and with the ideas or truths obtained there *create* within the realm of conciousness some form of material projection of one, two, three, or four dimensional emphasis, with rythmic division, sometimes implied, sometimes realistic, of line color, texture, mass and the composition of the whole.

Here are important changes of our age. We are now advancing into PROGRESS BY CREATION, as opposed to progress by destruction. In either instance progress we must, but, inasmuch as everything must balance, the former bespeaks creation in return, and progress by destruction bespeaks only further destruction. When we have attained a state of sufficiently creative progress we will no longer have cause to fear of war. We are approaching a time when the greatest sin will be falsehood, which is identical with inefficiency, which is further identical with selfishness or evasion of truths for personal gain. We have arrived at a period when artistic projection must be made on a vastly increased scale and of far greater abstraction.

Nature has provided no unmixed materials for our use. We are forced to pick the good from the bad, the useful from the useless. By dint of progress, there is no material in our highly specialized design of the best airplane today which is not synthetic. Nature's mixed materials have been separated into their elements, and as we have seen before, the elements have been recomposed for their useful solution of a problem. If any of the large vested interests in raw materials had conceived the large volume of business that was coming in airplanes they would have badly opposed progress in an effort to maintain volume in their portion of the design. The war taught many industries the folly and short sightedness of such tactics. The building industry has not yet learned of it, or to those who have conceived the problem there has been no solution evident. There is in effect no real building "industry" as we have come to know the word. It is merely a disjointed tailoring practice as applies to housing.

The breaking down, resorting, and recomposition of synthetic materials, be they fabric or metals, or any other, has become the great functional use of industry. We cannot, in our present mode of life, afford the time or money, to fabricate synthetic materials at home, by the arts and crafts method. The very paints and canvas of the painter, the paper and pencil of the architect, or the clay and bronze of the sculptor must be fabricated by industry and placed at the disposition of the artist by industry. In the feudalistic past the artists composed their own materials. Their architecture, or the combined arts applied to the housing of life, embodied the use of home made materials, and was incidentally the artistry of one man. Our architecture, broken up into specialized groups on account of the vast amount of formula that now pervades it, cannot overlook, today, industry or the great new tool of industry—METAL. The very strength of metal in tension, which makes possible a scale of fabrication hitherto undreamed of, requires a proper conception of the scale of the picture to be created, by the artist, through industrial channels, before he can properly design in that element. What is more important is that there is required a new modulus of expression, comprehended by and satisfactory to both industrialist and artist.

In the days when cloth was spun at home, and we sawed and planed our wood, fabricating our dwellings with these simple tools and materials, the artistry in men was well portrayed in these single endeavors. Industrialism must of necessity imply quantity production. It is uneconomical without it. It is born of the very truth that: what is truthfully good for one is truthfully good for all.

The first artists to apply their art to the new industrial canvas were our word artists or authors, who have conceived their manuscripts as not for themselves alone, but for mass production. It is however actually true that the inspirational harmony of art comes to the artist by his individualistic conception and enjoyment.

It is when the rhythm of the abstract idea is so strong within him that he must create visual, tangible,

or other sensorial evidence thereof, that we have artistic projection. The next artistic movement to attain mass production, was our sheet music. For long have our pencil and brush artists despised the printed reproduction, but today such men as Rockwell Kent, Bernard Boutes DeMonvel, Arthur Rackham, etc., lend their art to the varied pages of the hitherto artistically despised advertising. Lalique and others give their art to mass production of the perfume bottle and other production glassware. The enlightened industrialists, (particularly in the fabrics such as Mallinson) have encouraged the artist to express himself in their industrialized effort. Architecture, particularly as applies to the individual home is the last of the arts to be provided with its industrial synthetic media of expression. It is the last of the arts to consider the industrial medium worthy of its projection. (There are of course, notable exceptions to this, but such of the architects who have conceived of the new scale have not been sufficiently versed in industrial affairs to permit of their provision of the media). Quite reasonably so in view of the ramifications of mechanical specialization, which must be compassed as a complete and broad subject between artist and industrialist, with a common language of modular expression, before creation from abstract, artistic thought can therein be expressed. The emancipation will be complete with a common knowledge of both the sense and the formulae of the fourth dimension.

With the advent of this new architecture is there the great possibility of this country, which already excels in industrial prosaicness, becoming the artistic creational center of the new age. American architecture is where American literature was, back in the early nineteenth century, when its poetry was filled with skylarks and nightingales, there being no character that convinced the perception that there might be beauty in the birds of the new world, the bob-o-link or thrush.

This new industrial art does not imply a resurrection of the cast iron deer, or promotion of the quantity production bronze "Doughboy" for the sculptor. The new art is not picayune. It calls forth the skill and harmonious design of the sculptor applied to the whole of the building in consideration of its complete mass and composition, with play of refinement and technique wherever the materials functionally involved provide a suitable medium of expression. Production methods applied to the bronze grills such as are executed by Samuel Yellin, must be the new field of the sculptor. The individual pastorals or other paintings either of past or embrionic master must be considered, in the light of the new industrial scale, as entirely of academic consideration, no matter how lovely. They can serve only as exercises in projection, harmony, scale, and composition.

James Munroe Hewlett with his wide architectural experience, and his lifetime study of mural painting, composition and technique, together with his scenery designing and practical creation methods, underlying all of which is his strong character and innate harmony, is nearer to the new artistry as it applies to the concordant embellishment of the twentieth century home, than any other of the real artists in the

architectural field. His studies and execution in composition, ably considerate of their setting and functionalism, and quantity projection methods to panels, is the nearest approach to the proper harmonization of the non-structural isolation panels of the coming home.

There is that sameness that makes twins, or even brothers and sisters of different ages, oft times indistinguishable to strangers; that makes whole races indistinguishable to the member of another race, yet which, with familiarity, becomes suddenly inconceivable of existence. That kind of sameness embodying character and harmony through repetition is not unhappy. There is the even greater sameness of a flotilla of destroyers, far more accurate in duplication than the human, with inspiring rhythm of appeal when seen in formation under way or moored. Without visible distinguishing mark to the stranger, the destroyers have almost living individualism to their crews. Beyond doubt there is, and always will be, by virtue of characteristic touch and fourth dimensional properties, the greatest difference in the world between original and industrial duplicate in art; none the less, the new art must presage its reproduction and its original must be, if good enough, relegated to private collection, museum, or academy. Like the retired Sire of race horses, "Man-O-War," the original is too valuable economically to be exploited individually.

In recent conversation with one of our leading residential architects on the subject of the great geometrical evolution in design, and its results in interior decoration in Europe and in England, now infiltrating this country, he remarked on the lack of composition, because he could see it only in relation to his composition of the whole of the building. In reality the decorative designers have created many decidedly attractive units of wall panel, floor panel, hanging or piece of furniture (amongst a raft of atrocities), *but* they are only designing in surfaces for industry has provided, as we have seen, no media as yet. These artists are only, not of their own fault, designing for single consumption, which must be condemned as selfish, inefficient, expensive, etc.

They go so far as to tackle in architecture the exterior wall of the house, laying the brick of the feudal era in crazy geometrical lines, only complicating and making more expensive the all ready top heavy problem. We repeat that, one cannot design from the outside in, in the new era. There can be no character unless we design from the inside out.

The hovering "art" of Ferro-concrete carving is time or creatively selfish of the employer of the artist. It may attain character as indulged in by the owner or occupant himself for self development. Inasmuch as concrete is too heavy, and involves the ridiculous special composition of job molds, it is hardly worth discussion, though a current topic.

The surface must express the interior functionalism and spirit both. Louis Sullivan, American architect, is now being acclaimed by many of the architectural profession, for this truth which he tried

valiantly to bring forth in his architectural expression in the early days of the skyscraper. In Louis Sullivan's day, as even up to the present, industry had not provided the architect with the full media of expression, wherefor, in the light of future conceptions, the renditions seem dull, despite his finer perception and the courage of his convictions. WE WILL HAVE ARRIVED AT OUR NEW ARTISTIC ERA OF ARCHITECTURAL EXPRESSION, WHEN OUR BUILDINGS HAVE LOST THEIR LAST TRACE OF FEUDALISTIC OPPRESSIVENESS: WHEN OUR BUILDINGS ARISE IN CONCENTRATED CENTRAL HIDDEN AREA OF COMPRESSION, IN OPPOSITION TO GRAVITY, BY MEANS OF MAST OR CAISON, REACH OUT IN SPACE FROM THE VERTICLE BY TENSION AND COMPRESSION, COMPRESSION DIMINISHING DIRECTLY AS WE RECEDED FROM THE VERTICAL? UNTIL THE BUILDINGS FINALLY FLOWS DOWNWARD IN PURE TENSION. Then may the exterior enveloping shell, completely freed of spiny skeleton present a lithesome fullness and harmonic grace, not dissimilar to the sheer and lovely, though sufficiently austeer lacy veils flowing from the hennins of the fifteenth century French court ladies, so marvelously portrayed in Maurice Boutet de Monvel's Joan of Arc at the court of Chinon.

As a closing admonition to this chapter on the proposed industrial projection of the combined arts in architecture for the birth of a new world culture; there is most applicable the philosophy of Margaret Fuller, Marchessa d'Oosoli, critic and inspirational mentor of American literature, quoting from her Woman in the Ninteenth Century, "What I mean by the Muse is that unimpeded clearness of the intuitive powers, which a perfectly truthful adherence to every admonition of the higher instincts would bring to a finely organized human being—Should these faculties have free play, I believe they will open new, deeper and purer sources of joyous inspiration than have yet refreshed the earth. Let us be wise and not impede the soul."

CHAPTER ELEVEN

Building "From the Inside Out" as Opposed to building "From the Outside In."

What we mean by "Building from the Inside Out" (Nature's way) as opposed to "Building from the Outside In" (our present method of building) will be found in the following paragraphs, together with a description of the proper modulus for such design.

Building from the outside in, we start by "laying off" the perimeter of the plan in some modular division. We then are forced to consider this perimeter as the basis of adjustment. As we proceed to build inwards, we run into adjustments indivisible evenly by our exterior modulus. This method necessitates pearing down or progress by destruction and waste. Inasmuch as the outside shell of a building is not

even necessary to its support, since the development of the metal industry; and since, even when containing enough material to support the house, it comprises but 10 to 15 per cent of the total cost of the building. It will be seen that we still persist in the palpable error of; adjusting the majority to the standards of an inconsequential minority. This is feudalistic. Even in our city building, though omitting the outside shell, we still in plan design from the outside in.

Building from the inside out must of necessity involve circular progression as the core or center of things can not be cubistic in shape. Building from the inside out involves a modular division of the central angles of the circle with relative modular division of the radial distances from the center, which is synonomous to the fourth or time dimension and solvable by trigonometry and very satisfactory for graphic portrayal, and solutions in a manner similar to the "Mooring board" as used in the United States Navy.

Instead of the theoretical straight line modulus of plane geometry, we have angular and distance, or time moduli, in designing from the inside out. Everything fits without cutting or pearing, until we come to the inconsequential outside surface (inconsequential from a structural standpoint), which may be divided also in modular units, if the space of the problem permits. If eccentric termination is desirable in the final shell, as many whole modular units are used as the limits permit and the adjustment space or spaces are filled in by pneumatic or other expanding units, particularly designed for this function. This permits of progress through creation rather than destruction and waste. It only involves stepping up the common mathematical language of the building arts and trades from fallacial plane or cubical geometry to trigonometry and spherical geometry.

There is no use in continuing the frightful economic waste for sheer mental laziness. It is a strange paradox that the world turns up its nose at the artist's projection of natural or fourth dimensional matter in three dimension or cubistic form, and yet goes on designing its houses about itself in this same limited cubism.

CHAPTER TWELVE

Abstract Design, Harmony and Fourth Dimensional Control.

Repeating somewhat, let us review what has just been said. Europe as usual, is leading the world tremendously in design, but it is merely designing surfaces. Inspired with much of the new truth, the inspirational, artistic world is doing this fine new design, revolting for a new era of characteristic expression but all they can do, unfortunately, as artists, is to make new three dimensional geometric combinations. There is no limit to this any more than there is to musical composition. Industry is today

centralized. It produces en mass for individualism and, therefore, all that is practical and useful is produced on a gigantic scale, world encompassing, hitherto little thought of and still apparently unperceived by the world in general.

Your greatest artists today are designing for mass production in print, fabric and even radio, etc. Industry makes possible one more dimension in design, fourth dimension. In all design today we use synthetic materials, or recomposition of elements, to perform best a given function. A material before it reaches its final lodging, passes through many hands, and over much space, and therefore to be efficient and pleasing, must have no unnecessary weight. When it reaches its destiny, how long will it stay there? For the time limit of its existence. The fourth dimension is time. In the composition of synthetic materials, the fourth dimension is the most important. There are no materials which nature has not mixed with others. To use them today the elements which fulfill the function, debunking them, as it were; removing weight, and combining them again with materials whose longevity or fourth dimension is equivalent to their own. Don't mix bronze and wood in design. Wood and paper, yes, brass and glass, yes.

In consideration of the fact that no matter can exist without *time*, else it would not exist; and that the *time* dimension is the most important dimension of all matter; and that all our industry is but a *time* saving institution; that all sport is but a time controlling demonstration; and that all art is but an harmonic division, composition, and projection of *time;* and that we are fast approaching a *time* standard (men dollar hours) instead of a gold standard; and that inasmuch as everything is balanced, all these time creations are balanced by credit or faith, as opposed to material coin exchange, which is becoming more and more an antiquated practice and confined only to inconsequentials and the lower classes of trade. In full consideration of this new economic law must the new era home be designed and its plans of industrialization evolved.

When it is clearly understood, by a proper study of the fourth dimension, that all time or temporal matter has but one scale applicable to all the various scales which we now know as color, sound, etc., for in reality sounds, colors, etc., are merely registrations through different nervous systems of the same temporal characteristics, be they hard, rough, sharp, round, smooth, high or low, etc., then will it be realized that with proper fourth dimensional consideration of all the discords, that may disturb the sense, these may be reduced to a minimum. On the other hand by the same fourth dimensional consideration is it possible to provide harmony of presentation in all the material design to which the nerves are subjugated; to the end that the abstract spirit, freed from too constant contemplation of material prosaicness, may at last attain harmonization of individualism by virtue of industry or completely segregated and controlled materialism.

Time and faith are both abstract. As people become more individualistic their lives and contacts become more abstract, though ever greater in volume and distance. They more constantly deal by wire, letter, wireless, or multiple letter. Almost any well known speaker today rarely orates to his company without the presence of a microphone, for clarification of his speech to those visably present or to those invisibly present. It would seem that we are possibly approaching a time when the distinguished guest might be spared the actual useless meal and address his audience by telephone instead of attending the banquet in Brownville or Greenville. Relative time, distance or space is constantly reduced.

In due consideration, then, of this time dimension, it is evident that progressive design must be time saving. Time saving is accomplished by segregation of functions. As functions are segregated and individually solved, involves exceedingly light weight materials. This saves in every handling from original source to ultimate disposition. (Incidentally this deweighting process of material things goes hand in hand with the "Debunking" process of the mind).

As time is saved by progress, and time is in everything, all material products of industry must necessarily become lighter and lighter. It is worthy of note that this will be definitely reflected in the mirror of economic progress, the stock market, provided the time saving progress is balanced by the increase in good faith, and may be taken advantage of by those who intelligently acquaint themselves of this fact. Judge life and industrial progress by their measure of these tokens:—GOOD FAITH and TIME OR WEIGHT SAVING. When these two are well balanced, progress may be further measured by the harmony of design as opposed to prosaicness (harmony is service, artistic appeal, etc.).

There are the very definite abstract conceptions: First, that all matter is of globular, radiating form, and that all dimension is fourth dimensional or radiating spheres, which radiate for a certain period of time. The time dimension being the distance from the center of the sphere to the greatest surface attained by radial measurement. There are the radiating spheres whose wave lengths are attuned to our wave length receptivity of consciousness or nervous system of antenae, which is our conscious zone of human vision, hearing, taste, touch, smell, etc. It is through a definite perception of the scientifically recognizable characteristics of these wave lengths within the conscious spheres that scientists have shaped the rules of the truths thereby revealed. This in turn has made possible scientific exploration into the abstract or unconscious spheres, which have made possible abstract discoveries, such as the radio. For example, a human shouts aloud, creating radiating spheres of sound. There is a definite distance away from that human at which the spheres die out, or the temporal matter, which is sound in this case, has ceased. A cross sectional projection of the fourth dimension is provided by the radiating waves in a pool of water caused by the impact of a stone. The fourth dimension can be measured as the time and space between the contact of the stone with the water and the extreme longevity attained by radial

measurement. It will be readily conceived that the intensity of original impact creating the splash as well as the medium in which the splash is made, together with temperatures and other outside conditions, will affect the longevity of the waves.

Without much further discussion of these fourth dimensional truths, be it explained we have exquisite or rapidly moving spheres, and slow or long wave length spheres, depending on the element and on the zone in which it is active (earth, water, air, electricity, ether, fire). It is the variation in the fourth dimension, or time life in individual elements that finally causes the break down of nature's synthetic materials, such as stone by erosion, which is but a "slow movie" form of the effervescence in champagne. In the modern internal combustion engine, we have arranged a group of similar fourth dimensional metallic material in precision relation, and in proper consideration of dynamic truths. We introduce into what we call the cylinder head two groups of fourth dimensional spheres of greatly varying speed and wave length. Due to their discordant wave characteristics, they create explosion or repulsion of exquisite effervescence. These rapidly repulsed and swollen spheres, greatly magnified by the electrical "step up" to the next higher plane of activity, (the mathematical increase being figured by spheroidal content increase, as attained by radial or time distance in the next higher zone of each element, there being always geometrical reduction of friction with each higher plane attained) cannot be opposed by the counter dynamic position of the slow material or metal, and the consequence is the translation into motion, as we can perceive of it, within the material or conscious sphere. It is by proper scientific handling of these subjects, that, with synthetic materials, we have devised mechanics and translated fourth dimension into useful motion. Though as is so often true in the first appearance of a truth, completely unconscious of the material law of time dimension, covering the problem, have certain of its solutions been made. That is, those devising the gasoline motor have not conceived of it as a fourth dimension design and control, though, that it was in effect. Malodor, noise, rupture, disease, fracture, are one and the same, being characteristic perceptions of the different senses of the wasteful protest of inharmonies of time composition. Of such is radio "static"; of such is thunder; of such is rust; of such is earthquake; and of such is stockyard smell.

The basis of denial of the fourth dimension, which has been supported by the theoretical and fallacious plane and cubical geometry, has been the inability to produce an additional or fourth perpendicular to a cube, as the basis of an additional power multiplication, whereas poor little plain arithmetic and algebra, without geometrical reference, being abstract, indicate the perfect ability to do so. Very rightly do they do so, for if the geometrist will go back to his first perpendicular, he will find it perpendicular to a sphere, for did he not assume a dot as the first basis of his geometrical theorem, which if conceded at all must be spheroidal. Matter if existent at all, (and we cannot fallaciously assume

Q: I know that some students feel that architectural schools in general are really teaching a craft rather than a profession. They are not teaching architecture any longer in the sense of the Master Builders of the past. I think we both agree that this is very important.

Mies: Certainly. You know, it is very difficult to train and educate somebody for a master builder. I think that in the Medieval times they had to start as an apprentice and then they learned something and then they worked more and more and became a master and so on; there was a great tradition. The trouble now-a-days is that there is no tradition whatsoever.

Q: We haven't accepted a tradition but actually this is our heritage. Don't you feel we should continue from that basis rather than cast it aside and start a new one? I don't believe we can start a new one.

Mies: No, certainly not. But to understand it is another thing. Some people, when they see a cathedral, think it is a grand idea. A caprice, but that is not so. It is the logical consequence of what the Romanesque master builder formed when he tried to build a solid roof on the cathedrals. That is what I tried to show when I showed the diagram by Violet le Duc and when I talked about Berlage.

Q: Do you feel the single greatest characteristic of our society is our technology?

Mies: Yes. Some people think our problem is the human situation today, but that is a general problem. That is not an architectural problem. That is a sociological problem.

Q: In what way specifically, should the architect be acquainted with technology and do you feel he should be actively engaged in determining its future nature.

Mies: You know, technology is neutral. It can go for good or evil. It can be used for good or evil and architecture should use it for the good; not let it go.

Q: Nor resort to older handicraft methods?

Mies: Yes.

Q: We are more or less aware that we are depleting our natural resources and in particular steel, lead and copper, those resources used in the building industry. Do you feel consideration of this fact is of very pertinent importance to the architect in his conception of building? Not only of being aware of the fact that this is true but also being actively engaged in his structural conceptions to minimize

their use in such a way that he will get a much greater advantage per amount of materials used.

Mies: Yes, but that would not be the primary consideration the architect should have. I think since technology, in my opinion, is a great historical movement, we should work in the framework of technology. It is, in fact, the essence of our time; the inner-structure of the epoch. There are other things on the side but its essence is the main field of architecture.

Q: Due to the great concentrations of power in destructive weapons which can reach any part of the globe, do you feel it is a vital necessity for architecture to concern itself with the idea of mobile houses? That is, houses which are capable of being demounted and re-erected at different geographical locations.

Mies: I feel it is avoiding the real solution.

Q: The real problem is to solve the problem of war, is that what you mean?

Mies: Certainly.

Q: Suppose you were called upon to design structures for the Army. Then, don't you feel that there is a great opportunity to bring in the technology of mobility?

Mies: Certainly. But that would not be normal and could be changed tomorrow.

Q: In other words, the idea of mobility is not entirely incongruous with the idea of design?

Mies: Certainly, it is not, but I see no reason to move houses.

Q: Third year design students are working on housing for married students and one of the solutions proposed is a building complete with packaged utilities which could be bought at a net cost by the student upon graduation and thereby have a home to live in during the rather uncertain transition period between graduation and enterprise stability.

Mies: Should not the college provide living quarters? It seems again an avoidance of the real problem.

Q: Of course, but as students we are not always in control of such considerations.

Mies: Certainly, that is true.

Q: The college would have difficulty in providing such housing. Of course, one might suggest a subsidy. In other words, the college must accept this burden or it must come up with a building system which adapts technological techniques to

300 books with me to America and I can now send 270 books back and I would lose nothing. But I would not have these 30 left if I would not have read the 3,000.

Q: In the real analysis those book rejections were as valuable as the ones you kept because they provided you with a very valuable negative knowledge.

Mies: Most certainly. It is exactly what research means. Research does not mean to get only positive results but rather to get at the facts. I don't know if someone told me or I heard it on the radio concerning this story of Edison. His assistant was deploring the failure of 800 experiments on filaments for electric lamps and the resulting waste of time. Edison said, "What! Waste of time? We have proved that 800 things do not work."

Q: That is saying in essence that any success is a compilation of failures.

Mies: Yes. That may be said.

Q: I'm glad you brought up this question of people having the right to their opinion because that is one of the misconceptions of a democracy.

Mies: Yes, but we must organize our considerations in a more concrete manner. In a democracy we have the right to express our opinion but as a human being we have the duty to formulate a clear opinion. Not just some assumption out of the clear blue sky.

Q: Yes, but the general masses conclude that since everyone has the right to his own opinion, every man's opinion is as good as the next man's.

Q: It really is an encouraging thing to find two people who have a great deal of faith in technology and in man's ability to control his thoughts, his actions, and his environment for instance, as Mr. Fuller and yourself, and arrive at completely different solutions to their problems while completely within the framework of technology.

Mies: Why certainly. The whole world is similar. There are fir trees and pine trees growing in the same environment.

Q: For example, there are millions of solutions to the same problem.

Mies: I would say there are a variety. Somewhat they are limited. Let us take the closed plan and open plan. In designing a house you could use the open plan and develop one, two, three, maybe ten solutions. With a closed plan you would find that you can produce one, two, three, maybe ten solutions. You know, people think with the open plan we can do everything—but that is not the fact. It is merely another

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Q: Of course, but as students we are not always in control of such considerations.

Mies: Certainly, that is true.

Q: The college would have difficulty in providing such housing. Of course, one might suggest a subsidy. In other words, the college must accept this burden or it must come up with a building system which adapts technological techniques to

such an extent that it can lower the rent to very low levels. In conventional construction solutions, of which we have had bids, it turns out that it would require $3,000-$4,000 per unit of 500 square feet and anything we can devise in multi-story units comes out much more than $7.00 per square foot.

Mies: I think that is again avoiding the real solution. In a time when you spend 85 billions a year you could build many fine things at 1 per cent of that figure.

Q: In a sense that is a subsidy idea and an avoidance of what we are trying to do in getting a rent which would pay for this building and yet be sensible.

Mies: Yes, but in my lecture I talked about how we tried to reduce the sizes of apartments in Berlin and the bankers got twice as much, leaving it still too expensive for the people. It is an economical problem, not an architectural problem. I think we must distinguish these things clearly, before we can answer questions of this sort.

Q: Do you feel, as we are often forced to feel, as young architects, that architecture is part of a parasite on society, and the way bankers, financiers and real estate men move around, we are just called in as bystanders who are going to take whatever they give us and do something with it. I know you are not in that position, but you no doubt can understand how we feel.

Mies: You know, there are, in the whole structure of civilization, some facts which are given which cannot be changed. Facts which come from the past. Some have done something and it has influence. We can lead and guide these factors of reality but we cannot change them.

Q: You mean we cannot change the character of reality but we can change its direction?

Mies: Yes, but our effect is quite limited because these facts take their ultimate way.

Q: What you mean is that you may for a time force a deviation but eventually they will fall back into their former line of force.

Mies: Yes. That is a mistake many people make. They believe they can change reality but that is not the case.

Q: To get back to the question of technology. As an example, let us consider the Gothic period which had a very logical development and solution of a functional

problem. Do you think the attempts of the Gothic architects to achieve verticality and use stone in pure compression was entirely due to the idea of solving a vaulting problem or do you feel that the religious fervor of the period was also instrumental.

Mies: It may have had an influence to find a way of doing things. All these factors of reality and ideology are interplaying but in fact the reality is all important. For instance, the Romanesque architects could have said that the wooden roof was good enough, but technology, for instance, in our time, depends on the masses and the masses depend on technology. We could not live otherwise. And technology is what we see. Our whole way of seeing and thinking is determined by it. For instance, we like a very simple glass. We take preference to the simple form, the technological form.

Q: Yes, but as you were talking of Saint Thomas Aquinas and logic in your seminar a thought kept running through my mind about the distinction between logic and emotion. Logic is not only an analytic state of mind.

Mies: Yes, but you can prove something logical by reason. You cannot prove feelings. Everyone has emotions and this is the hell of our time. Everyone says they have a right to their opinion but they really only have the right to express their opinion.

Q: However, in attempting to prove something by reason don't you feel that you are guided along a certain path by intuition? Logically one might not be able to determine an ultimate result by any of its effects. However, intuitively you feel one or another direction is proper. Once you have determined your course, you may begin application of reason.

Mies: Why certainly, I often experience that my thoughts have to be controlled by the work I have done. Sometimes, out of the work I have done I have a certain direction. I am convinced of the importance of technology but that was a long process. I could not read it in a book and it wasn't dessert served on a lunch plate. Little by little one thought is put to another. One is doubtful of a thousand things in this process but by experience and logic you may build upon these thoughts, until you achieve a real conviction and in the end you have such a strong conviction that no one or anything in the world could change it. That is the way it has to be. I don't know if I told you about the time I had 3,000 books in Germany. I spent a fortune to buy these books and I spent a fortune to read them, to study them. I brought

300 books with me to America and I can now send 270 books back and I would lose nothing. But I would not have these 30 left if I would not have read the 3,000.

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conception of space. The problem of space will limit your solutions. Chaos is not space. Often I have observed my students who act as though you can take the free standing wall out of your pocket and throw it anywhere. That is not the solution to space. That would not be space.

Q: The problem of accuracy always presents itself when you think of Mies van der Rohe. One gets the idea that there is an exact place for each element in a building and it must be exact. However, there is a certain magnitude of accuracy. How close does it have to be? In talking to a number of your students, they have discussed how they work for days upon the preciseness of a composition. I wonder if that preoccupation with accuracy is the fundamental thing or whether it is superfluous to the real conception.

Mies: If you have the conception why should it not be executed with the greatest accuracy.

Q: I am only trying to get it straight whether you may not have the conception without the extreme accuracy.

Mies: You could but it would not be an accurate expression of your conception. Accuracy is not the conception but you must have the clearest expression to get at the essences. Take a sentence. When I have a thought and try to express it I work on it and I work on it and I work on it. May I repeat a few sentences from what I read at the close of my seminars?

"Architecture depends upon its time, it is the crystallization of its inner structure" I worked on these sentences for weeks. It is not just saying things. It is thinking them. Let me give you another example.

"Form must be the form of the mind, the manner not of saying things, but of thinking them." John Cocteau said that. I have something else. "Construction, the framework, so to speak, is the surest guarantee of the mysterious life of the works of the mind." "Everything that is beautiful and noble is the result of reason and calculation." Now tell me who said that? Baudelaire, the French poet.

Even he thinks construction is important. Only the architect does not think so.

Q: Whenever one thinks of exhibition buildings one thinks of the Barcelona Pavilion. What social implications do you feel exhibitions have?

Mies: Philip Johnson's book on me contains my thoughts concerning the nature of exhibitions and I still believe in them, so if you would read his book it would

answer this question. I will tell you a story of the Barcelona Pavilion, however, which might interest you. One evening as I was working late on that building I made a sketch of a free standing wall, and I got a shock. I knew that it was a new principle.

Q: I'm glad you mentioned that because I'm sure you are aware that the general conception exists that your architecture comes from the intellect and therefore is very cold and calculating. However, we are aware, and this statement is a confirmation, that this idea is incorrect.

Mies: I am not a sentimentalist. The so-called humanists say that. They should define what is human. Let me ask a question. Do they have a patent on humanity? I'm living too. I have talked to people like that and asked them why they think they are the only ones who are human. But one thing is sure. I am not a sentimentalist.

Q: When you say you got a shock it is obvious that such an experience is extremely emotional and this immediately puts the lie to these rather uninformed statements.

Mies: Certainly. The shock is emotional but the projection into reality is handled by the intellect.

Q: I was very interested in your statement that you were not doing furniture anymore because you could not find anyone to make models. Real craftsmen.

Mies: Yes. In Europe you find many small shops to do this type of work. In this country the large factories are interested in terms of 100,000 chairs. They are not interested getting chairs, but in making them. I have used many modern chairs and I become tired after 10 or 15 minutes. When I made a chair I sat in it for hours. I did not answer the phone or anything because I wanted to discover when I would get tired. A simple ordinary old fashioned chair such as the one you are sitting upon (high back maple chair with straw seat) are more comfortable than most of the modern chairs. You do not become tired because you can move a little. In the modern chairs you cannot move. The angle prevents movement.

Q: You must leave now, but before you go, let me express our deepest gratitude for your consent to this interview and be assured that you leave us with a great amount of respect. We sincerely hope you will return soon.


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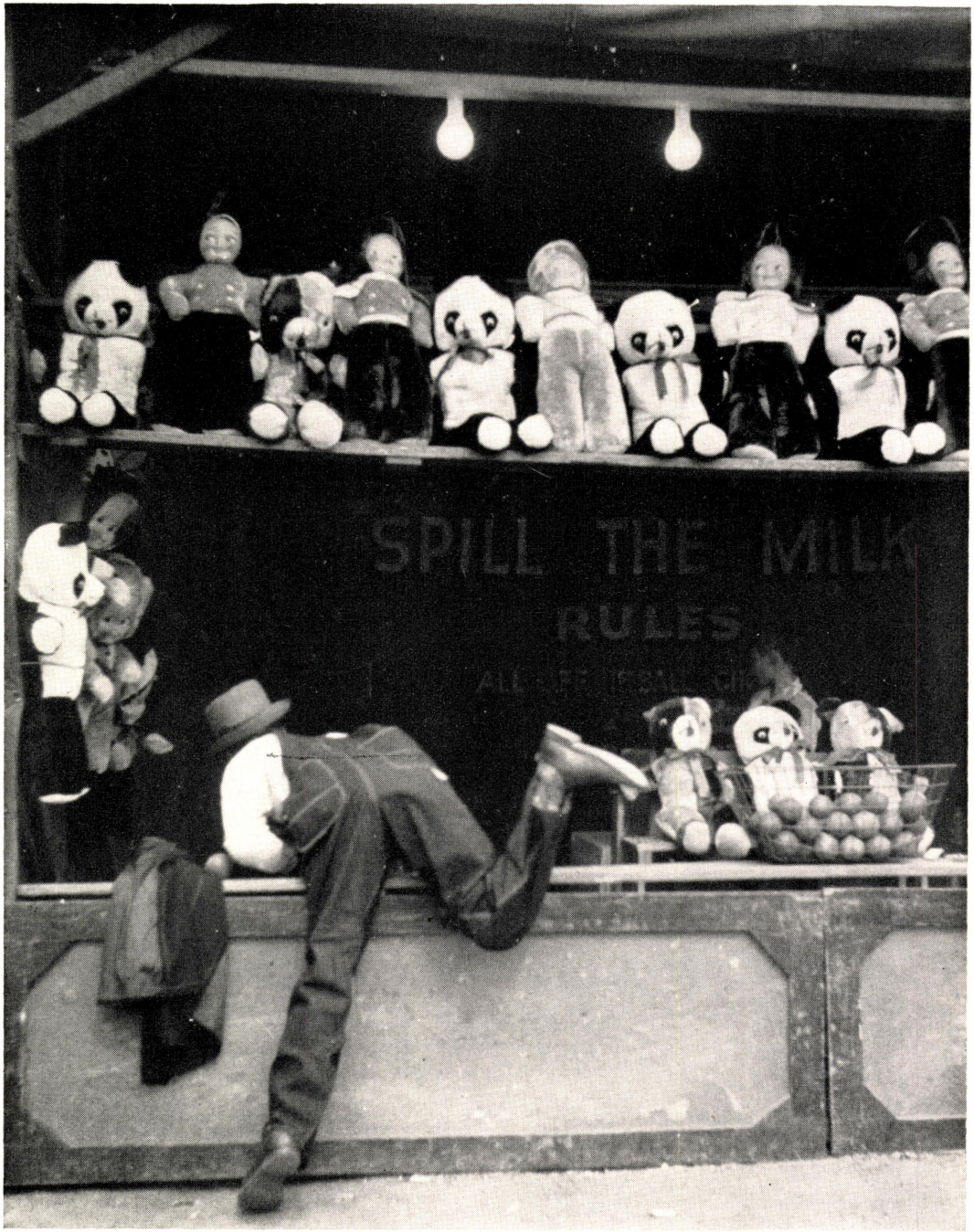
SPILL THE MILK
RULES

ralph mills is attached to the Visual Aids Department of North Carolina State College as a Visual Aids Specialist. He has worked continuously with this publication since it was begun. His work has appeared in Progressive Farmer, Farm Journal, The Magazine of Building, Modern Photography, Photography Annual, Newsweek, and other national publications. Awards he has received include 2nd place Graphex Contest, 1951 and 2nd place Freedoms Foundation, 1952. In our second folio are ten photographs from the work of **ralph mills.**


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TRADE MARK
SYNCHROMATIC
Rapax

Impressions
on
JAZZ

A slowly-moving picture is in progress—for how long does not matter and whereto has been forgotten. But there was movement, then suddenly none at all, and now the movement is different. Where there was moving light alone there had come the movement of sounds. Time had stopped on an instant, hung suspended, floundered for a moment, falling away, and then resumed its old momentum once again. What Condition was this? High sounds pouring out the recess of a waterfront dime-a-dance on a foggy night in New Orleans? The moving picture had shown us the swinging doors, but the music—that was JAZZ.

Over the sidewalks, over the foot-work of the pavement, grey light describes the hundred-story-high perimeter of the alleyways; a citizen beneath the gas lamp, the honk of humanity—through all this mute clamor ring shots of sound. Other shots follow, more sounds, a bombardment of sounds, from particle to particle, stone to stone, wall to wall, man to man—and strike the inner ear. An infinity of particles playing the punchboards, and this moment finding the key to but one.

The swinging doors swing shut; and the sound-particle, strident, loosed from the clatter without, mines the works of the back-reaches, flutters, feints, sings, and, spending itself, forces the last glazed vault of the soul. And in that instant—did the shutter tremble against the atom's feeble inertia?—the Man glimpsed the Brotherhood, the eon of Time and Humanity that had gone before.

While iron is being forged tonight for living business, what brass will escape to make the trumpet? What tree grows in Eureka-land to form the reed? The listener listens again, hears nothing, and forgets listening. It's a long way from tomorrow, and there is Time between days.

Over the roof-tops, along the hundred-story-high perimeter, the sounds ran rampant.

Photo: Courtesy of Joe Glasser

The Man sleeps.

The large, brown body-mass rocks in the cradle of space, the mind rocks in the cradle of the soul; the Empress speaks of old green fields.

Here is the Queen of Pulses, queen of hearts which surge, and powerfully resurge, at the insistence of this rich plasma of sound. The queen is at court, and forever will the clarion sounds of brass sing the call to the royal blue.

I Thought I Heard Queen Bessie Say—

I Can Roll the Best Jelly Roll in Town.

There is a brain-box behind the music box, a soul-box behind the sounding-board, with a common ground of white ivory between. By what contrivance do thought-atoms become sound-atoms at the overpowering insistence of a two-handed, finger-pistoned machine? What boundless volutes of energy in two hundred pounds of flesh can breach the wall of thought, action, ivory, and iron, to escape free? Perhaps bone is stronger than steel—or perhaps the wall does not exist at all. But the sounds are there, and the performer, looking down, listens, with the wonder of surprise.

The particles have sprung the common ivory-ground, have run the gauntlet of sounding-board steel, have invaded the soil of the earth, run the dark depths of the sea, have at some grey, remote point breached the cable between continents, and have traversed the iron Transatlantic to come up in the light of the Rue Pigalle in the sun—where a three-fingered Basque gypsy strokes the strings of his *guitarre*, and wonders whence these sounds come.

The little man in the corner, behind the back-bar, is shrunken; and shrinks bodily from the hold of ten tendons, distended from cut-off shirt sleeves, struck to the ivory board of the music box before him. He cringes as sound-thoughts forge the stronger bond. The spirit rejects, and is caught up in the ever-spinning web of thought engendering sound, and increasing sounds engendering thought. Thought embodies the soul in sound, flying backward in Time, ever backward, receding; back, further back, ever back, to Man before Man, to Man before Womb as Womb before man, to shifting sands, to dust—where over the desert, suspended remote in space, comes from the distant a faint rustle of movement, a faint breath slowly eddying, ever revolving, here gathering a first particle, another, others; and, in Silence passing, forms the Image of Man.

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PHYSICS as a SCIENCE and an ART

The charge of speaking after five such orators as have preceded me is not a light one, and yet is an assignment which should be treated lightly. The hands of the clock are joyously advancing toward the cocktail hour, and they advise me to pervert the famous words beneath a clock in San Francisco and say to myself, "Son, observe the time and fly from wisdom." The organizers of this meeting actually proposed that I should speak under the title "The Whole of Physics." Apart of course from my predecessors on this platform, the last man who could probably have done this was Hermann von Helmholtz. It interests me to realize that there are people still living who studied under Helmholtz; they are the last of our contacts with the era of omniscience. The wishes of the organizers will be formually fulfilled if I succeed in saying nothing that is more irrelevant to any one field of physics than to any other. This condition I will attempt to meet.

I ought to begin with a definition of physics. The American Institute of Physics has provided one, and it would be unseemly to use another in its place. Actually it is a definition of a physicist, but we can easily translate it into a definition of physics. Hearken to it. "A physicist is one whose training and experience lie in the study and applications of the interactions between matter and energy in the fields of mechanics, acoustics, optics, heat, electricity, magnetism, radiation, atomic structure, and nuclear phenomena."

Clearly this is addressed to people who have a clear-cut notion of energy, and therefore not to the general public. But even with respect to its intended audience it has a certain rashness. People who have a clear-cut notion of energy are likely to remember the equation $E = mc^2$. This equation operates like a nuclear bomb on the definition, for the definition implies that matter is cleanly and neatly distinguishable from energy, and the equation says it is not so at all. The equation in fact invites us to alter the wording, and say that the physicist is one who concerns himself with the interactions between energy and energy. This has a silly sound, but it is not a silly thought, and I can clothe it in appropriately formal garb by saying that the physicist concerns himself with the interactions between various types of energy. But I will not tamper further with the head of the definition, for it is just the sauce, and the meat is in the tail. Oddly enough, the meat is disguised as a limitation.

There are two limitations here, and one of them is not in Nature and I think that it was not in the minds of the definers. It is implied that in respect of magnetism, for instance, there is one part of magnetism that involves interactions between matter and energy and another that does not. The first part is physics and the second part is not. But there is no second part, and the whole affair reduces itself to a plain and simple definition by enumeration. Physics is a grouping of nine fields like the nine Muses, and the names of the Muses are

mechanics, acoustics, optics, heat, electricity, magnetism, radiation, atomic structure and nuclear phenomena. This is what the definers really say and this is the meat of the definition, and all the rest is a valiant attempt to express in a few words something that slowly dawns on the physicist as he progresses in his science. When in this manner we get down to brass tacks, the only people who can rightly complain are those who would like to have their tacks removed from the list and transferred to some other science than physics, and those others who do not find their tacks in the list and yet would like to be considered physicists. I will not be their spokesman; let them enter their own objections.

The definition also speaks of "study and applications." This sounds like the classic antithesis between pure and applied physics. Let us examine into this distinction, which as will soon appear I deem a necessary evil.

As our science expands, its journals become so huge that they are insupportable in all senses of the word, and the meetings of its cultivators so congested that they defeat their purpose. These are only symptoms: the malady is of the finiteness of the human brain, which can absorb only a finite amount of knowledge before old age sets in. But although the malady is incurable the symptoms can be controlled, and this is done by the same technique as prevailed in the cities of ancient Greece and prevails to this day in the beehive. Some of the bees get tired of the congestion and swarm off to another hive. This is the reason and the only reason why the American Physical Society cannot deprecate the newer hives of the Optical Society of America and the Acoustical Society of America, each of which has taken a large piece of physics unto itself. The engineering societies swarmed away a long time ago and they have even larger segments of our domain, but we could not force them back into our hive if we would and we would not if we could. The distinctions are evil in principle, but we cannot get along without them.

Let us try to contrive a definition. One begins by saying that a pure physicist is interested in a device because it illustrates the laws of physics, an applied physicist is interested in the laws of physics because they explain a device. The teacher of physics teaches the dynamo because it exemplifies Faraday's laws, the teacher of engineering teaches Faraday's laws because they show how the dynamo works. This definition implies a static science and a static technology. We try to put evolution into it. A pure physicist is one who discovers new laws of Nature, an applied physicist is one who improves an old device or invents a new one. But many experimental physicists of uncontested purity spend a large part of their time in improving their devices. We must introduce more motive into the definition. A pure physicist is one who improves his devices for no other purpose than to extend his understanding of Nature. On this basis Rutherford was an applied physicist at the start of his career when he was trying to make a radio, purified himself when he abandoned the attempt; Lawrence was a pure physicist until his cyclotrons started to make isotopes which are useful to medical men, then he lost his caste. It is evident that our definition is one of extremes, and it takes a rather single-minded person to hold a position at either extreme. Let us see whether we can discover any analogies in the practice of the arts.

A composer who produces a symphony is presumably a pure musician, one who writes for a dance-orchestra is presumably applied. Yet any conductor knows that the subscribers will not object and will in fact be very pleased if he plays some of the works of Johann Strauss and Manuel de Falla. We are meeting in an opera house. Richard Wagner himself said that the only purpose of his music was to enhance his libretto; he is accordingly an applied musician. Even more singular is the case of Tschaikowsky, who remained a pure musician until he had been in his grave for fifty-odd years, whereupon the sonorous opening theme of his piano concerto in B flat minor was converted into a dance entitled "This Night We Love." I shall leave to people more expert than myself the question whether in the Gilbert-Sullivan team Sullivan was an applied musician or Gilbert an applied poet.

Take painting and sculpture. The pure painter, let us say, is the one whose paintings hang in a museum; the applied painter is the one whose paintings are fitted into the deco-

rative scheme of a house. On this basis Monet and Renoir are are applied painters for those who can afford to pay twenty thousand dollars for a picture, pure painters for the rest of us. I do not know quite where to put the portrait painter, except that he is probably pure when his work is hung in a museum with a label "Portrait of a man." I am reasonably sure that there are many modern painters who, in the inconceivable event that they were present, would wish me to say that the pure painter is the one whose pictures look like nothing on earth, and all the others are applied. There is an analogy to physics in this; we will take another glance at it later.

Architecture ought to be the perfect example of an applied art. Yet I note that there is a doctrine called "functionalism," the exponents of which profess that every part of a building ought to be requisite for its purpose and essential to its structure. The existence of such a doctrine implies that there are buildings with details that are not required by their purpose or their structure, and indeed this is obvious to anybody who has seen a cornice. A drawback of this doctrine is that it forbids you to enjoy a cornice, and indeed in principle it forbids you to enjoy a Gothic cathedral until a civil engineer has proved to you by calculation that if any flying buttress, any pinnacle or any crocket were removed the building would fall down. Then there arises the question of the stained-glass windows: these are functional if they stir a mystical emotion, decorative if they please the tourist, anti-functional if they just impair the light. The first of these views was that of the artists who created the windows of Chartres, the second is that of the guides, the third was that of the eighteenth-century people who improved the lighting by smashing some of the windows and throwing the precious fragments onto the rubbish-heap. It is not easy after all to distinguish what is functional and what is decorative in the totality of a cathedral. A cathedral is a texture of purposeful construction, purposeful decoration, decoration for the sake of decoration, and symbolic instruction. So also is a science. And if some of the sublimest features of a Gothic church derive from the fact that the builders did not have steel beams available, and if the modern builders with steel beams produce a structure that in spite of all its competence is mysteriously lacking in something that we like, these are perhaps analogies with the classical physics and the theories of today.

I might suggest at this point that the names of pure and applied physics be changed into decorative and functional physics; but this also would be bad. I suggest instead that the distinction be recognized an an irrational one which is required by imperious practical necessity. A piece of applied physics is either physics or it is not; in the former case the adjective should be dropped, and in the latter case the noun should be dropped. Architecture is architecture whether it is exemplifid in the United Nations Building or in the Sainte-Chapelle. Music is music whether it is a Viennese waltz or the B minor mass. Painting is painting whether it results in a landscape, a portrait, or an abstraction. Physics is physics whether it explains the television set or the helium spectrum. If some of physics is now called acoustics and another part is called radio engineering, that has no more and no less significance than the breakup of the Roman Empire. The empire broke up because the administrators at the capital could no longer hold the sprawling thing together; but France and Spain and Italy went along on the basis of the Roman culture.

However, there really ought to be more of a distinction than I have admitted, since people are always talking about fundamental research and therefore implying the existence of a nameless opposite. A good definition of fundamental research would certainly be welcomed: let us see whether we can contrive one. We have to begin, of course, by defining research. Unfortunately the concept of research contains a negative element. Research is searching without knowing what you are going to find: If you know what you are going to find you have already found it, and your activity is not research. Now since the outcome of your research is unknown, how can you know whether it will be fundamental or not?

At this point we switch the adjective "fundamental" from the outcome of the enterprise to the enterprise itself, and say for instance that fundamental research is that which you

undertake without caring whether the results will be of practical value or not. It would be imprudent to go further, and say that fundamental research is that which you will abandon as soon as it shows a sign of leading to results of practical value. By saying this you may limit your own achievement and even antagonize your sponsors. The way to please even the most difficult of sponsors is to say that fundamental research is that which may have no immediate practical value, but can be counted upon to lead to practical value sooner or later. There is no truer statement and there is no safer gamble. The extension of knowledge will always be profitable in the long run if not in the short. The only question is one which I will phrase in the language of Wall Street. Will the profits be paid out in immediate cash dividends, or will they be plowed back into plant?

This is a very powerful argument for fundamental research and it is a completely unassailable one; and yet there are people who will not like it. This in fact leads to one of the best definitions I can contrive for a pure physicist. A pure physicist is one who does not quite like to have his activities condoned on the ground that they may be useful some day—not even if the expected use is something as noble as the cure of a disease or the more nearly perfect reproduction of a symphony. Let us seek a definition which will give to fundamental research a value of its own, not contingent upon other uses appearing soon or late. We say that fundamental research is that which extends the theory of physics. Now we have to theorize about theory.

There have been several viewpoints about theory. One is, that theory discerns the underlying simplicity of the universe. The nontheorist sees a crazy welter of phenomena; when he becomes a theorist they fuse into a simple and dignified structure. But now that quantum mechanics has become so intricate, there is an increasing number of people who would rather take the welter of the phenomena than the welter of the theory. A different idea is the one lately proposed by Condon, who says that the office of theory is to enable one to calculate the result of an experiment in shorter time than it takes to perform the experiment. It is dangerous to disagree with Condon, who is generally right; but I cannot think that this definition is very pleasing to the theorists, who are thus entered in a race which they are foredoomed to lose when the problem is that of ascertaining the resistance of a silver wire or the wave length of a line in the spectrum of germanium. Another viewpoint is that theory serves to suggest new experiments. This is sound; but it makes the theorist the handmaid of the experimenter, and he may not like this ancillary role. Still another viewpoint is that theory serves to discourage the waste of time on useless experiments. I presume it is true that some attempts to design impossible heat engines have been prevented by a study of the laws of thermodynamics. On the other hand it is a matter of record that some good experiments have been delayed, and quite possibly others have not been performed even yet, because the experimenters who might have done them were scared away by too much faith in a fallacious theory which pronounced them vain. I do not know how the balance can be struck.

Let us try to flatter theory by giving it a definition that shall not describe it as a mere handmaid of experiment or a mere device for saving time. I suggest that theory is an intellectual cathedral, erected if you will to the glory of God, granting a deep and indescribable contentment to the architect and to the onlooker—and incidentally able to help quite a number of people who have no concern whatever with the faith in which it was raised. I shall not describe it as an image of reality. The word "reality" frightens me, because I have a notion that philosophers know exactly what it means and I do not, and anything that I might say about it would offend them. I do not mind describing it as a beautiful thing, for beauty is a matter of taste, and I am not afraid of what the philosophers may say about it. Let me develop further this simile of the cathedral.

Mediaeval cathedrals were never quite finished, and no more is theory. Sometimes the money ran out, and sometimes there was a change of architectural fashion. When a change of fashion arrived, the early part of the cathedral was sometimes pulled down, in other cases coupled with the newer

part. You may find a severe and solid Romanesque choir built with an enormous factor of safety, and an airily soaring Gothic nave built very near to the verge of the dangerously unstable. The Romanesque choir is classical physics and the Gothic nave is quantum mechanics. I remind you in this connection that the nave of Beauvais cathedral fell down twice, or perhaps it was three times, before the architects reconciled themselves to building something that would stand. A cathedral is also a congeries of chapels. The chapel of solid-state physics has only a remote relation with the chapel of relativity, and the chapel of acoustics has no connection whatever with the chapel of elementary particles. Those who habitually worship in one of the chapels can get along without the rest of the cathedral, and the chapel itself can survive if the rest of the building falls down. The cathedral may be very magnificent to those who do not share the faith in which it was reared, and even to those who spurn the faith in which it was reared, and even to those who would build an entirely different building if they could make a fresh start.

You are all worshippers in this cathedral, you have already heard five speeches about the chapel of acoustics and the chapel of optics and the chapel of solid-state physics and the chapels of the atom and the nucleus. Unless some one of the previous speakers has wandered away from his title, you have not heard about the choir in which the quantum-mechanicists are presumably singing Alleluia but are more likely trying to figure out how they can fix the cracks in the pillars and get the nave roofed in. I am not going to try to fill this gap; the rest of my talk will be devoted to a different question, which is: how are we going to communicate to the layman some of our passion for the cathedral? This is a more important question than it is sometimes made to seem, for everyone is a layman, or at any rate a lay child, until he becomes a student of physics. If we can solve the problem of interesting the mature, we might be able to do better at the job of seducing the potential Condons, Fermis, Slaters, Lands, and Fletchers of the future into the field of physics. Nothing could be more desirable.

A frequent technique is that of surprise. The trouble with this is, that one cannot be surprised if one is not accustomed to the situation which is nullified by the surprise. Not long ago I read that someone had swum 100 yards in 49 seconds. This did not surprise me, for I had no idea whether the previous record was 39 or 59 or 99 seconds. But I did read further, and discovered that the previous record had been 51 seconds and had stood for several years. The original statement now evoked a very mild interest, hardly distinguishable from zero—but still, no surprise. Surprise, is not retroactive. Now imagine a physicist, myself for instance, trying to amaze an audience of the laity by telling them that there are a dozen elementary particles instead of two or three, or that lead has no resistance at all below a certain temperature, or that the newest cyclotron imparts an energy of 500 Mev to protons. It simply will not work; and if I load my discourse with extravagant statements and similes, I shall produce the same effect as a lecturer who is shouting and waving his hands in order to impress a man who is stone deaf. A certain degree of amazement can be produced by telling the audience that there are temperatures four-hundred-odd-degrees below Fahrenheit zero, pressures of the order of thousands of atmospheres, velocities of almost two hundred thousand miles per second, particles weighing less than a billionth of a billionth of a billionth of a gram. We are entitled to derive all the benefit we can in this way, but it will not be much. The astronomers can really produce an awe-inspired amazement, but we cannot rival them.

Fallacious also is the notion that we can excite an audience by solving a mystery for them. The trouble here is that practically no one is interested in the answer to a question which he never thought of asking. Relativity had a wonderful build-up in the decade before 1905, for the physicists of that era were acquainted with the sequence of experiments which were designed to show that the earth moves relatively to the aether and which obstinately showed the opposite. Each stage in the unfolding of quantum mechanics was exciting to the physicists who knew the earlier stages, because they knew the problems which the earlier stages left unsolved. The writer of a detective story creates the mystery before

he solves it; but the mystery usually begins with the discovery of a murdered man, and this is considerably more gripping than a murdered theory. The corresponding technique in physics consists in trying to create a particular brand of out-of-dateness in the mind of the public, in the expectation of bringing them up-to-date at the end of the lecture or article. There is too much danger of leaving the audience in the out-of-date condition, and I cannot recommend the technique.

Another mistake, in my opinion at least, is that of stressing a paradox. Try telling an audience that if you know the exact position of a particle you cannot know its momentum, and vice versa—the effect is unpredictable, but is not likely to be what you wanted. Perplexities like this are reserved for the student. Another mistake is that of springing an isolated fact upon the audience. An isolated fact is not physics and it is not interesting. The statement that tritium is radioactive, the statement that the magnetic moment of the neutron is so-and-so-many nuclear magnetons, the statement that germanium is a semi-conductor—these are of no interest by themselves, and anyone who thinks that they are is ignoring the vast amount of background that he himself possesses. They are of interest only as parts of a texture, or, to return to my first metaphor, as parts of a chapel. It is in the texture or the chapel that we must strive to interest the layman.

One device for this purpose is to tell the layman that if he enters the cathedral he will be on the highroad to omniscience. Omniscience is a grand concept and it has a certain inspiring power. In this respect our situation differs from that of our forerunners. Laplace said something to the effect that if there were a being who knew the positions and the velocities of all the particles in the universe at a given instant, and who had in addition the needful mathematical powers, he would be able to calculate the whole of the past and the whole of the future of the universe. Strictly this is a meaningless statement, since it can never be verified; but it does give one a curious feeling of omniscience. You somehow feel that once you realize that force is a mass times acceleration and that particles act on each other with forces varying as functions of the distance, you know it all, and you can either work out the details or contentedly leave them for others to work out as you may choose. Now it appears from the principle of uncertainty that even the hypothetical being of Laplace doesn't know as much as Laplace thought that he did, and the highroad to omniscience seems to end in a haze. On the other hand we are undoubtedly farther along the highroad of knowledge than our ancestors were, and the fact that it may terminate short of omniscience ought not to discourage the travelers.

Another device is to promise that he who enters the cathedral will gratify his deep desire to find the changeless, the abiding, the eternal and the immortal. This must really be a fundamental desire, for it recurs again and again in the writings of mystics, poets, philosophers, and scientists. Lucretius thought that he had satisfied it by saying that atoms are eternal. This was a nice idea, but unfortunately Lucretius did not know anything about atoms. What corresponds most nearly to the atoms of the ancients are not our atoms, but our elementary particles. By a singular piece of bad luck, not one member of this wierd and distracting flock is immortal, with the possible exception of the proton. Either they are radioactive, which is the case of the neutrons and the mesons; or they are liable to perish in the suicide-pacts with one another, which is the case of the electrons; or they vanish into another form of energy, which is the case of the photons. The proton itself is hanging onto immortality only by a hair, for as soon as somebody discovers a negative proton it will entice some positive proton into a suicide-pace with itself. Our ancestors delved for centuries to find the eternal atom, and now that we think that we have got to bedrock we learn that it is quicksand. With the invaluable assistance of the hypothetical neutrino, we can still manage to hold onto the conservation of electric charge. The totality of mass, the totality of energy, the totality of momentum and the totality of electric charge—these are quite possibly the immortals, even though we do have to take our stand on such an unsubstantial footing as the neutrino in order to

defend them. But they are not associated with individual particles, and therefore they are less agreeable than the vanished atom of Lucretius. This highroad also may be ending in the haze.

Shall we then fall back upon the grandeur and simplicity of our picture of the world? The grandeur is there indeed; but the simplicity that was apparent to Newton and Laplace has gone to join the atom of Lucretius. Simplicity has been drowned in the waves of quantum mechanics; the dream of omniscience and the dream of the eternal atom have been blotted out by an uneasy wakefulness; the stimuli of paradox and mystery and surprise are transient where they are not misleading—so where do we go from here?

The cathedral is far too grand to be apprehended as a whole by others than the mathematically-trained elite, and these are precisely the people who are most conscious of its unfinished state. But the chapels of the nine Muses of the definition of the Institute are not so overpowering, and there are subordinate chapels opening out of them which are harmonious and relatively simple. We can guide the listener into them, and point out the design and the vaulting and the pinnacles and the traceries and the stained-glass windows. It is possible to tell a good story of the conduction of electricity in metals and the escape of electrons from metals; we are not forced to talk about bands or the paradoxes of the Fermi-Dirac statistics. Quite an excellent story can be made of optics and its innumerable proofs of the wave theory of light; we do not have to confuse the listener by talking about photons. Acoustics affords a wonderful opportunity, for here there need be no confusion at all. It is possible to expound the periodic table of the elements and the arrangement of the electrons in the atoms without rehashing out ancient tribulations arising from the fact that classical theory says that an accelerated electron ought to radiate. It is feasible to give quite a good account of the taxonomy of nuclei by representing them as clusters of little globules hanging together by virtue of a strong cohesive force, contending against the repulsion between the charges of the protons; we do not have to lead the audience into the bogs of exchange-interactions and meson-theory. I suspect that of every field of physics it is possible to give a good and an instructive and enticing story, provided only that one does not try to go too deep. But there remains a question, and this is the very last with which I will torment your weary minds.

Suppose that I am lecturing on the hydrogen atom, not to a sophisticated audience like yourselves, but to the student body of a college or the members of a club. I will say that the hydrogen atom consists of a proton and an electron, and that these are particles of matter possessing definite masses and definite charges. I will say that they attract one another with a force e^2/r^2, and to this point I shall continue in agreement with the theorists, though they would doubtless prefer to hear me speak of a Coulomb interaction. I will say something about the normal state and the excited states of the atom, and I shall doubtless be able to convey some notion of the reason for believing in these states. Now the problem is near at hand. Shall I talk for a while about the elliptical orbits of the planets around the sun, and then assert that each of the states corresponds to one particular elliptical orbit of the electron? Or shall I say that each state corresponds to a certain eigenvalue of a differential equation of the second order, and that the product of the eigenfunction by a conjugate gives a measure of the probability that the electron shall be at the place for which this product is evaluated?

Well, these are purely rhetorical questions, for I know the answers and so do you. If I follow the first policy, I have at least a slender chance of holding my audiencne. If I follow the second policy the audience is lost immediately and permanently, and the chairman is muttering to himself, "I ought to have known better than to invite a physicist." I shall therefore follow the first policy. But shall I then be lying to my audience, and if I am, is it a white lie or a black lie?

The question is whether it is mendacious to use a comprehensible theory which goes only a smaller part of the way, instead of an incomprehensible theory which goes a larger part of the way. It is not a rhetorical question at all, for I am sure of the answer. I know, however, that it is a question which recurs again and again on all of the levels of physics,

and we are obliged to postulate an answer. The fact that it does remur on all of the levels of physics suggests to me that if my policy amounts to telling a lie, the lie is no more than a white one. Moreover I am told that even on the highest levels of theory the people do not yet know all the answers, and this implies to me that if lying is going on, even the pioneers are telling white lies to one another. However, I much prefer to believe that there is no lying at all, but instead there are various forms of truth, each of which is good as far as it goes. Bohr's original theory of the atom does not go as far as some of the others; but it is true as far as it goes, and it is better t climb to its summit than to stand helplessly staring at the side of a mountain which only a mountaineer can ascend.

Now if this is at all a proper way of looking at things, it suggests that physics partakes of the nature of an art. The purpose of an art is to produce a peculiar form of satisfaction, indescribable to those who cannot feel it but very real to those who can. I have chosen the word "satisfaction" because it is a neutral sort of a word. A physicist of the nineteenth century might have used words of greater glamour, might have spoken of the glory and passion of understanding; a physicist of the twentieth century would be more likely to indulge in the ostentation of understatement, and say that it is great fun. The adjective to be applied to a successful work of art is "beautiful." Bohr's original theory of the atom was a beautiful thing, and so is Newton's mechanics and so were some at least of the forgotten theories of the aether. These have an abiding beauty, even though in part or in the whole they may be superseded by another and a more competent fashion.

There are indeed people who feel that Bohr's original theory is no longer beautiful because it is outdated, and there are also people who think that the contents of the National Gallery are outdated and who prefer to wander in the Museum of Abstract Art, where almost nothing looks like anything that you have ever seen. Moreover these people tend to sneer at those who wander in the National Gallery, and try to cover them with shame by saying that all they like are pictures that tell a story. However, there are also disadvantages of abstract art, and these I will illustrate by telling an ancient joke. There was a Scot who decided to economize by training his horse to eat less. Week by week he reduced the diet of the horse, and eventually he got the poor beast down to a ration of one straw per day. At this point the experiment unfortunately had to be suspended, because the horse died. I cannot but feel that some thing important will die out of physics if it continues too far on the road to abstraction. If the time ever comes when all theoretical problems are solved by feeding a prescription into a calculating machine, whom shall we find who will care enough to learn to run the machine?

I have been presenting a sort of an argument for the study and cultivation of physics; and there are certainly people to whom it will not appeal. It is, however, a remarkable and indeed a wonderful quality of physics, that no matter whom you may want to convince of its importance there is some argument that will convince him. Music is of no interest to the deaf, and painting cannot appeal to the blind; but there is nobody who is blind or deaf to every attribute of physics, unless it be some hermit who has forsworn the world. Do you want to speak more clearly or travel more swiftly and safely to the ends of the earth? physics will achieve it for you if it can be achieved at all. Do you want to stay at home and enjoy the amenities of life? you have physics to thank for many of these. Do you wish to preserve your amenities by strengthening the defenses of your country? it is on physics that you must rely. Do you wish to give full play to the deftness of your hands? go into the laboratory and make an experiment. Do you wish to extend your mind to the utmost of its powers? try to extend the range of theoretical physics, or even to catch up with those who are now on the frontiers. Do you wish to travel along the highroad toward omniscience? physics is the portal, though no one can tell you how far the road extends. Do you wish to roam around the cathedral, enjoying the elegance and harmony and aptness of its structure, the beauty of its vaultings and traceries and decorations? it is there for your enjoyment. All these and more are offered to you by the science which now for twenty years have been ministered to by the American Institute of Physics.

Arkhi-tekton

By James Walter Fitzgibbon
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"The revolution is over"—The President, The American Institute of Architects, Magazine of Building, May 1951, page 28

One assertion the architect can hold against all disclaimers: His ancestors left the clearest, most evident records of the sort of men they were. And pretty fine records they are. Monuments and achievements descriptive of great men busy with great ideas. The architect, in fact, comes off very well in review. His building has been in the nature of contribution to the highest aspirations of his fellow humans and his efforts have been almost always positive in the search for truth and beauty and dignity.

Notable in this ancestral procession is the consistent position maintained by the architect as Arkhi-tekton, or Master Builder. Always the Master Builder, the best builder of his culture or of his age. No one built anything better than these old gentlemen built buildings. They produced the finest art-facts of their time. No one designed or made anything better than they designed and made buildings. They employed the best available techniques and know-how, they made the advances in experimental and applied technology, they marshalled the material resources of the culture, and they commanded the finest craftsmen of their day in building buildings. Old Arkhi-tekton building was always a stirring and historical event.

By aspiration and definition the architect today is claimant as his rightful heir and legatee. However can this claim be pressed today? Can anyone presently hope to insist and prove that architect, twentieth century, is undisputed Master Builder, Twentieth Century; that Arkhi-tekton is presently alive and active in the role of architect?—AIA, CIAM, RIBA, DPGF, Swiss, American Traditional, Modern, or Neutral?

It is of course possible that architect and Master Builder are one and the same today, but there is at hand an outsize mass of evidence to dispute any such contention. On all sides there are indications and examples of a growing number of men, neither architects nor trained as architects, who are building rings around him; who are building things more complex and demanding than a building; who are building with such undeniable skill, integrity, acumen and effectiveness that the architect's ability to assert his ancient rights, positions and exemption is in serious doubt. These not-architectural achievements have been for the most part in direct relationship to steady advances in applied and experimental technologies. Contra-wise, there is the strong evidence that in this century the architect's relationship to such technological development has been almost entirely peripheral and haphazard, if not directly antagonistic. His building methods are still dominated by handcraft techniques and attitudes. His design ideas are keyed to standards of attainment not even approaching the minimum standards of the enlarging group of not-architectural designers and makers. His buildings show these different characteristics. And worst of all, the craftsmen have deserted him. What architects today build buildings that are better designed, more skillfully contrived, better integrated, more efficiently disposed, and more accurately and carefully constructed than a ship? Or a good bridge? Or an aircraft? Or a fine motor vehicle? In no sense is it intended to convey the notion that the subjective qualities of a building are not of the highest importance. A building is not an immobile ship, or a stationary aircraft, or a bridge. But ship, aircraft and bridge each represent a design-constructional achievement by men using intellect, imagination, and the materials available to them. As such, each in its own right is worthy of comparison to that other design-constructional achievement, the building; and effective judgment may be made regarding the degree of excellence obtaining in each instance. The saga of the craftsmen is another sobering telltale. Craftsmanship follows a

kind of Gresham's Law. Poor technology drives out good craftsmen. The record, in spite of persistent obituary notices, shows neither the death or even the dearth of good craftsmen. They have just shifted away from building buildings into better technological areas. Shipbuilding, auto building, aircraft, machine tools, dies, patterns, and electronic equipment making. This is probably the age of the finest craftsmen the world has ever known, but they no longer have anything to do with building buildings. This has been going on for decades, and is only a further indication that the other evidence is reliable and that the decline of the architect as Master Builder is clinically detectable at an advanced stage.

Today's buildings are not our best construction, and in some fashion Arkhi-tekton has been slipped out of the picture and architect is presently in the position of being something less than Best Builder, Twentieth Century.

Brick

If architect is to regain his right to the title Arkhi-tekton and is to re-establish his claim to Master Builder ancestry, the energy and direction for such revivification must come from the architectural profession as a whole body. This presents a difficulty. The architectural body-professional has been momentarily, the past thirty to fifty years, split into two factions. One the Traditionalists, generally though not exclusively the older men in the profession; the other the Modernists, generally the younger men in point of years. Their dispute has been vigorously agitated for several decades with feelings strong on both sides, and it is hard to imagine that agreement, sufficient to successfully manage the difficult work of regaining the architects' position as Master Builder, is possible between them. However, hope for the future does lie in the curious and little-noted fact that the differences between the two embattled groups show on inspection to be more apparent than real. The distinctions fuzz out under scrutiny, and certain unmistakable signs point toward the probability that in the final analysis the two groups are really only one group.

In examining the two factions for marks and signs of their group affiliations, differences and similarities appear, and it becomes evident that accurate individual distinctions are, on many standards, quite impossible. Members of both groups are indistinguishable in terms of, sincerity, high purpose, education, enthusiasm,

or cultural attainments. Nor are there appreciable differences to be noted in kind or extent of practice, fees charged, client preferences, or general office procedures employed. Neither Modernists or Traditionalists hold important monopolies on any particular kind of building, and both groups share common concerns for ethical practice, high building costs, and ways and means of making their service potential known to the community.

Differences are most strictly maintained in two areas. Each side insists on certain esoteric criteria. Shibboleths apply to philosophical ideas, materials selection and application, structural expression, biological correspondence and correlation, and sources of design influence. Those accepted by one group are in turn wholly condemned by the other. Secondly, certain superficial manifestations appear; these differ with each group and can be noted in buildings designed and built today. These manifestations are well known and need not be fully catalogued. In particular, certain relationships of glass area to solid wall, patterns of roof pitches and overhangs (except in nonresidential work), and distinguishable modes of structure expression are recognizable as from the hand of Modernist or Traditionalist. Along with these a multitude of minor detail usages are favored or shunned by practitioners of both persuasions for varied reasons, such as being pure, not pure, correct, in taste, in keeping, moral, and even sometimes as evidence of the architect's freedom to practice his profession. When all these similarities and differences are observed, one outstanding and little-noted fact remains to be accounted for. Both groups are engaged in building the same sort of building. The members on each side, however radical or traditional, are actually contriving an architectural result by piling up masonry, with or without a supporting steel cage, arranging openings for sash or sheet glass, and ordering the installation of varying quantities of mechanical equipment. This remarkable sameness is easily seen upon an inspection of buildings extant by architects prominent on both sides, viz. Messrs. H. Bacon, Corbusier, Goodhue, Mies van der Rohe, Walker, et al. Such evidence is amplified by noting that masonry piling has been essentially the history of architecture. In fact, recalling the addition of steel bracing cages and mechanical items (plumbing, elevators, etc.), as they were invented, and taking into account period preferences in trim, glass areas, and detail, the History of Architecture from time out of memory to 1951 is mainly the story of brick or stone construction. Some, indeed much of it,

old and new, very beautiful and stirring and grand. The more recent building, however, has been done under circumstances unknown and unavailable to the old. It must be seen in context with a different technological history, a history that is forwarding the suggestion that the venerable masonry tradition in architecture is just about *hors de combat.*

The architect though, is still in the grip of anachronism. He has been faithful beyond question to the masonry tradition, and it will leave its mark on the newest architect graduating. This young man will be sorted out, whether he wants to be or not, as a member of one side or the other in the professional debate. He will modulate many brick piles during his life and career as an architect. If he piles his brick differently from some of his fellows, or uses a large rectangular module, or a cookie-cutter shape for his plans, or leaves oversize holes for glass, he will be known as a Modernist and a radical, and certain of his fellow professionals will warn against him. If he piles his brick in some time-hallowed manner and looks to an older precedent for his module, and leaves only small holes for glass, he will be known as a Traditionalist and reactionary, and certain of his fellow professionals will warn against him.

A curious brick ballet:

Pile one, throw one, duck. Pile one, throw one, duck.

Isn't it possible that all this brick piling is only getting the architect mixed up? Fellow professionals are out of sorts with one another. Superficialities are being mistaken for fundamentals; and worse, somewhere under the brick piles he has buried his status as Arkhi-tekton.

Masonry by nature is a heavy agglomerate, and being heavy is earthbound, static forever. Downpressing, massive, weighty, crushing, ponderous—however much steel caging is added to push it vertically. Masonry is solid, and durable and readily available. All these are marks of its value and use as the traditional building material. But it is completely a handcraft material and it has a negative polarity deriving precisely from this characteristic. It lies immobile across the body of the practice of architecture. This without dishonoring the brick or stone—the millstone is not reprehensible for drowning the man. Masonry will always be used in architecture, but it is presently a dragging anchor, and the architect relying on masonry as a do-all for his art and craft is treating non-masonry technology as

superficial addenda—a mistake that is not being made in other design-constructional fields today.

Architecture is not subservient to technique or technology. Neither can it be said to be free to ignore them. Technology, in a crude estimate, represents a record of methods men have developed to do and make through ever-improving understanding and manipulation. Architecture starts as a making and an understanding, and proceeds further to use and influence. It has represented at its best a mastery of available know-how, and an inspiring integration of imagination and technology, and sensitivity, and intelligence. These would all seem necessary ingredients.

But the architect, Modern or Traditional, and the technology of today are obvious strangers. He has, with few exceptions, been exclusively concerned with his ponderous, historically tethered structures, to the neglect and utter contradiction of the existing and developing technical know-how now being applied to all other constructions. He has paid little heed to the structural-assembly efficiency achievements now commonplace in all building except the building of buildings. The distinct trend in other fields towards ever lighter structures, ever more efficient uses of materials, and the ever-enlarging understanding of new forms based on increased strengths and adjustments of shape and material to the job to be done—all this has disturbed the architect not one bit.

The architect has apparently established himself as a front-line fighter against envelopment by the abstract enemy, Machine. His concern lest mankind be dehumanized is admirable and important; but his methods seem less than effective. One could safely bet on the proposition that the machine is here to stay. It looks like a case of having to join them to beat them. How else can such a problem be solved; how can human beings learn to control the machine for their own proper ends if the sentient, humanizing influence of the body-architectural is withheld from the effort?

Of all the creative groups of men organized and trained and talented to build for the varying purposes of mankind, the architect stands alone in this twentieth century in his undeviating loyalty and his almost unquestioning use of masonry as his prime building material; and also alone in his bewildering ability and willingness to defend his method of masonry piling as philosophically, ethically, and even

morally right to the exclusion and damnation of all other masonry piling employed by his fellows.

Is it strange then that this over-earnest devotion to the dying Cult of Compression is serving to separate the architect from the technological faculties that are properly his? That it is keeping him from realizing that he is intellectually and practically in arrears? That he is being prevented from taking stock of his real position and his real potential as sentient Master Builder to modern man in his awful struggle to perfect himself? Can he continue seriously to believe that he can Master Build in this time with a brick, however artfully he piles it? Can he really believe that the revolution is over? The shooting so far seems to have all been in the rain barrel.

Arkhi-tekton Revisited

Much of this argument can be resisted on the grounds that it is impractical; impractical in the sense that the architect is not entirely free to build as he might wish, or could teach himself, to build. He cannot build better than his client will let him build. He cannot, overnight, void existing building codes, and antiquated and restrictive techniques. He cannot experiment with his client's money. His financial sources lay restrictive burdens on his design freedom. His experience points out that logic, reason, and even first-rate techniques are not conclusive over prejudice, sentiment and well worn ruts.

Again in terms of technology, is it reasonable to expect to raise up the architect as a superman? Who can hope to command totally the technical skills necessary to produce a building today? It is possible, with ramifications extending into almost every field of activity, from planning, politics, finance, and applied psychology to structural design, lighting, climate control and esthetic philosophy? Is it possible for a single man to master these innumerable abilities when it is difficult enough just to keep informed on new developments?

These are, none of them, new questions or problems. Architects have been debating them in one context or another for years.

However, the decline of the architect's status as Master Builder, and the evidence of common plight, prompt the conclusion that the architects could well decide to close ranks and earnestly assess the situation with a view to solution of the ob-

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stacle problems on whatever practical basis may be necessary—practical, in the sense that the solutions are unlikely to be found in terms of cataclysmic change, but rather in the evolutionary processes that begin when a problem and a goal can be well defined.

Both Traditionalist and Modernist present momentarily a contradictory position to such a solution. They are, many of them, facing wrong way to the scene of the developing struggle. The Traditionalist is busy grappling for the throats of some pals he thinks inimical to his own devotion to architecture, past, present, and future. His pals, the Modernists, confident of youth and zeal and not much worried by the Traditionalists, are gathered in a happy huddle admiring and explaining the good work they are each getting out of the old brick pile. Even so, certain worthwhile developments have been fostered by the debate. Both sides have gone through a soul crisis, and many restrictive notions and fetishes that burdened architecture in the recent past have been cleared away. Again, public awareness of architecture and the architect has been stimulated. All these, however, are only short-term gains so long as the wrong-way look persists. The result of hesitancy to face squarely the problem of the architects' reunion with technological realities can only be a fruitless continuance of present efforts to bandage up the old, tired, masonry heap with all the new industrial products: more plastics, more light metal detail, more gleepsite, more of everything except the hard thinking necessary to rescue building-making from its present low estate.

And why not a truce, even at this late date? Could the profession close ranks and see about getting off the brick pile? Could architects, in unison, set out to discover the real potential of their genius and their ability in the twentieth century? Is it even possible that Arkhi-tekton could be revived? Or would this sort of thing spoil all the fun?

Reprinted from the
Journal of
The American Institute of Architects
October, 1951

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