

**FUNCTIONAL MONUMENTALITY: AN ARCHITECTURAL STUDY
"COMMUNICATIONS, COMPUTER AND DATA TECHNOLOGIES"**

STUDY SITE: - ABUJA

BY

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DATE: JUNE 1983:

DEDICATION

TO MY PARENTS

DECLARATION

I, NWAKUDU UGOCHUKWU, conscientiously declare that this thesis is original, authentic and a result of my keen effort and intense research and has not to my knowledge been accepted in any previous publication anywhere, but I make haste to add that all contributory references have been duly acknowledged.


Signed: JUNE 1983

FOOT PRINTS IN ANCIENT HISTORY

Five hundred years from today Abuja would be an ancient city:.....

.....What shall Nigerian architects of this decade leave for generations yet unborn.

Abuja is our chance.

.....Shall it end in the square boxes of central Abuja or shall a student of Architecture at Zaria-Lagos or Nsukka -- 3000 AD stand up and proudly point to a visiting colleague from Mongolia, Romania, or Brazil and Say - "This was done by an old student of my school in the year of our Lord (1983)". Shall we give that student a chance or shall we not.

.....Buildings that would puzzle or intrigue generations yet to come. Look at the Pyramids of Egypt and take a lesson.

Arc (Dr) Aku Omokhodion.

(Submission in Tropical architecture
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People who deal in words envy the ability of music to communicate universally. ? - Time Inc -

Phantasia:

A leader of the Bell Laboratories, when talking about a universal communicator back in the 1930's made the comment that "when a child is born he will be issued with a small device - the size of a wristwatch - engraved with a number which will be his world identity number for all purposes. Through this device, and using this number, you will be able to communicate with him at any time wherever he may be. When one day you try and there is no reply, you will know that he is dead 3/.

Communications are undoubtedly among the major influences on our way of life. Not just the systems that make sure we get the message, whether its information, education, entertainment, images or dreams. We are in an age where communications can create, as well as satisfy, our needs and desires. This applies as much to big business as it does to small everyday pleasures. This is only made possible by technological advances, yet it is a fear of technology itself that often clouds the public's full appreciation of the benefits and the scope of communications.

There is clearly a need to explain to people just how the systems aid business as well as provide information and entertainment. And how in the future they will lead to even further improvements in our life style.

NOTES ON MONUMENTALITY

1. Monuments are human landmarks which men have created as symbols for their ideals, for their aims, and for their actions. They are intended to outlive the period which originated them, and constitute a heritage for future generations. As such, they form a link between the past and the future.
2. Monuments are the expressions of man's highest cultural needs. They have to satisfy the eternal demand of the people for translation of their collective force into symbols. The most vital monuments are those which express the feeling and thinking of this collective force - the people.
3. Every bygone period which shaped a real cultural life and the power and the capacity to create these symbols. Monuments are, therefore, only possible in periods in which a unifying consciousness and unifying culture exists. Periods which exist for the moment have been unable to create lasting monuments.
4. The last hundred years have witnessed the devaluation of monumentality. This does not mean that there is any lack of formal monuments or architectural examples pretending to serve this purpose; but the so called monuments of recent date have, with rare exceptions become empty shells.

They in no way represent the spirit or the collective feeling of modern times.

5. This decline and misuse of monumentality is the principal reasons why modern architects have deliberately disregarded the monument and revolted against it. Monuments should constitute the most powerful accents in vast urban schemes. The people want the buildings that represent their social and community life to give more than functional fulfillment. They want their aspiration for monumentality, joy, pride and excitement to be satisfied.

--- J.L. Sert

--- F. Leger

--- S. Giedion

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Five exciting and imaginative years in School of Architecture:

— ENORMOUS DEBTS ~~2~~ ENORMOUS BILL

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UGO NWAKUDU
ZARIA, JUNE
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THESIS ABSTRACT

The starting point of this thesis is not the monument, rather the monumentality is the end product of the synthesis of an idea, an on-rushing phenomenon and an impulse to express human aspirations *on* a worthy scale - a functional monumental is that attempts to graft our technological knowledge on all branches of the human tree. The architectural foray lends itself to the idea that, to quote Philip Johnson, "the only real urge is immortality-not sex, Monuments last much longer than words. Civilizations are remembered by buildings. There is nothing more important than architecture." 1/

This investigation is architectural, its womb is a technological incubator, its eggs are communications, computers, Data, ..., its character a scientific graceland and its shell the monumental.

The thesis found its motivation in man's vertical mobility; out into space-launching the Sputnik 1 Satellite in 1957 to expand our horizon, landing man on the moon to explore other forces, spacecrafts "loafing" out into space beyond the solar system to contact the extraterrestrials, powerful radio telescopes pointing skywards in search of signals from extraterrestrial intelligence-all in a bid to enrich our life on earth and probably glimpse our own future.

These and other basic human rations are served by basic human needs - the need for adequate information are communication are the prerequisite for increasing the productive capacity of the organism in the environment. In a fast developing society like Nigeria this need becomes paramount in it; ort to feed, house and transform itself, to provide a sense of belonging, and identify for its members. The "information revolution" that futurists long predicted has arrived, bringing with it the promise of dramatic changes in the way people live and work. An international Computer network could bring important agricultural and medical information to even the most remote villages 2/. Thus was born the idea to architecturally translate our development goals into a physical monument that best serves our basic needs and aspirations.

In a larger sense, exotic technology is coming home to all people, for it is the heritage of all mankind. On this premise is the theme of this thesis;

Sharing tomorrow's technologies for the benefit of all mankind. Its aim is to achieve a functional and dynamic monumentality, not a relic of the past nor an edifice for the decaying present, but a symbol to the radiant future.

A monument in both spirit and function expressing and serving basic needs and aspirations of contemporary man in the anticipation of their future consequences. Eliel Saarinen 3/ considered "spiritual function" inseparable from "practical function" and described "civilized existence itself as a "search for form".

GOALS

1. To inspire in the people the thought, conscience and an acceptance of the future.
2. To further the people's ability to survive through communication with fellow humans. To serve as an educational park for the commUNity, business and Government.
3. To facilitate the organic growth of science and technology within our culture through the "information revolution".

OBJECTIVES;

1. A centre that will continually introduce, test and demonstrate ever changng ideas and tomorrow's technologies.
2. A computerized and electronic data base that can provide general information and specialized services.
3. Am environmental research bation for scientific observation and meterological services.
4. An exhibitions farr park that will promote the futuristic art of science and technology through, through the medium of communications.

5. An amusement arcade that employs the creative ideas of industry for education and recreation.

The housing of technological fascinations and mini-wonders reminds one of the intricate weaving of the wasps' nests. But it is all a world of machines and also a world of people, the different people who operate, use and aspire by them. It is also a world of the environment and that of the architect whose concern is architectural harmony. The monumental becomes a weave pattern of technologies, cultures, environment, ... Its architecture is sensuous, seeking the respect of the environment and the satisfaction of social concerns. Aesthetically appealing and satisfying, it enjoys a freer architectural expression that is imaginative, innovative and daring -- It tends towards a sculpturistic future, embracing and not denying its origin. Our work, to quote Hans Sharoun, "is the ecstatic dream of our hot blood, multiplied by the blood pressure in the millions of our fellow human beings. Our blood is the blood of our time, of the possibilities of expression in our time. We create, we must create just as the blood of our ancestors brought on the waves of creativity...." 4/

The study site is Abuja, the symbol of Nigeria's aspirations for unity and greatness. page 10
The site is a symbol of the new Nigeria, page 11

Its choice is neither accidental nor careless. It is the result of a synthesis of the aspirations of a people and an idea. The longing for a symbol and a place that can sustain instead of denying their specific identity. Abuja and its location satisfy most of our development objectives, but its infrastructures must go beyond mere satisfaction. Their physical expression of federal character regardless, they seek the total commitment to excellence.

This thesis is that of change, architecture in change and architecture of change and the impact of the new wave of technologies on a people the method of research is by both secondary and primary sources, books, journals, magazines, articles and features on the impact of the new technological revolution, historical forays into the history of man-made environment, architecture and monuments. It starts with a brief synopsis on architecture and the change phenomenon which attempts to establish that the future is an integral aspect of the human condition and the role of architecture as a physical translation of that change. The introductory chapter discusses the onrushing wave of new technologies that is about to affect and transform our society.

It is the duty of the architect~~to~~ to transform that fear of the future into total space and confidence in the new environment. Chapter two deals with the historical perspective of man and his successive achievements translated into architectural monuments. Chapter three looks at the problems, confusion and crises that attends architecture in revolutions. Chapter four undertakes some abstract studies to lend character to this study. The remaining two chapters are painstaking attempts to achieve the object of this thesis---a monumentality that is both functional and dynamic lending itself to the declaration of love and admiration to the higher purposes men hold in common.

In this regard, we must all bear in mind that, in the words of that idealist Le Corbusier; A great epoch has begun...

There is a new spirit: It is a spirit of construction and of synthesis guided by a clear conception....5/

For this, this work is also dedicated to all those to whom architecture is a monument, for architecture and monument are inseparable.

1/. Charles Jencks (1973) page 50: Modern movements in architecture.

As a novel civilization erupts into our lives we
are left to wonder whether we ourselves have become
obsolete.

----- Alvin Toffler.

SYNOPSIS

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ARCHITECTURE AND THE "CHANGE" PHENOMENON

Suddenly, the future was now. Its embryo we did not nurture. Its soul we found upon us. Its revolution cataclysmic. Its relativity in time and space dizzyfying. Its conscious transformation elude us..... and to quote Terra Nostra by Carlos Fuentes -- "Are we dying or being born?" It is the change phenomenon.

The future is an integral aspect of the human condition. Man survives, uniquely, by his capacity to act in the present on the basis of past experience considered in terms of future consequences. By assuming a future, man makes his present endurable and his past meaningful. Pasts, presents and their alternative futures interwave in the anticipation and prediction of his future actions 1/

The technological and modernist revolutions of today are quite tremendous. It pulls society through a change vacuum. This change phenomenon and its reliance on architecture as a medium of physical translation has been hailed as an instrument of social salvation. Every period requires an instrument with which to tackle the human problems posed by the period, as well as those which, from period to period remain the same, that is, those posed by man. Architecture, writes A. Van Eyck^{2/}, implies a constant rediscovery of constant human qualities translated into space.

Man is always and everywhere essentially the same. He has the same mental equipment though he uses it differently according to his cultural and social background, according to the particular life pattern of which he happens to be a part. If, as I.M. Pie believes, that architecture is an important art form mirroring life, where then is our mirror?. Is architecture a factor or a product of the change phenomenon. A simple synthesis is attempted here. Pardon my indulgence.

Change phenomenon.....C
 Physical medium (Architecture)....A
 Deterministic variable.....D
 (call it culture sphere of change)
 Relativity constant.....R^{t/s}

The deterministic variable and relativity constant bear a direct influence on the physical medium of translation of which architecture, A, is also a variable. This implies:

$$\begin{aligned} A &\sim D \\ A &\quad R^{t/s} \text{----} A = KDR^{t/s} \\ &\quad \text{----} K = \frac{A}{DR^{t/s}} \end{aligned}$$

Where K is a constant, here it represents man who is a constant in the sphere of change . But: the change phenomenon C is a function of the future, F, thus:

$$\begin{array}{l} C \quad \dots \quad F \quad \text{====} \quad C = KF \\ \text{this implies} \quad C = \frac{A}{DR^t/s} \cdot f \end{array}$$

From this, we can simply submit that architecture is a factor of the change phenomenon. Thus our mirror is reflective of the future, for to do otherwise is to subject design to the obsolete, building to the decaying present and housing to a dead past. The function of architecture is to establish optimum conditions in which the present becomes the future. To do this, it must seek out, explore and explain the relationships between human activities. The important question! asks S. Woods³, is not 'how?' - or 'what for?'. We have no quarrel with the past except when it is used to compromise the future. The past can guide us but past techniques are of little avail. Present techniques and present means must be used to open as many doors to the future as possible. The world of architecture therefore given impetus to the billowing flame of change, harmonizing continuity and change, the natural and the esoteric.....It is the soul of the new environment.

First, man creates environment, then environment in its turn influences man. Our task writes J.B. Bakema in an article.....is to introduce the play of volumes in space as a function of social life.

The new society must enable the individual to express his personal opinion about total life. It is our task, to transform a fear of total space into respect and confidence. These, he concludes, are the oldest and at the same time the most recent functions of architecture and town-planning.^{4/} Any society goes through a change in its cultural experience. The phenomenon of change and its impact on architecture as a physical translation of society's cultural values and social organization is profound in the developing societies of Africa, Adeyemi E.A.^{5/}. If we divest ourselves from the concept of a global culture and believe in cultural and technological patches per se, then we must accept that a culture can absorb alien technology and experience societal changes and still retain those essential features of a culture that make it distinctive and provide a sense of self identity and belonging for its members. But the world, then, which the expanding network of electronic communication is fast reducing to a complex but single ecosystem, confronts the technological civilization with a profound and growing imbalance.....the first step towards a human future is the acceptance of responsibility for meeting the emergency in our total environment by creating those generalized human conditions which will at least prevent the system from further degeneration.

In the immediate term, the only way to do this is by devoting the necessary physical resources to feeding the hungry; in the immediate term, we must do it by inventing the necessary means to graft our technological knowledge on all aspect of the human tree.^{6/}

Living by society's rules means having an outlet for the expression of self and some way of relating to the forces outside of themselves. Thus there is a need to provide a base to sieve through society's anxieties, hopes and aspirations and further promote awareness in the cyclic process of change. Society's hopes and aspirations are the stabilizing factors of change and the physical embodiment of these aspirations, the monument becomes the architectural translation and spatial expression of society's values and human conduct. With the architectural impulse of every period to create symbols in the form of monuments, our architecture must be consciously conceived in form and appearance so as to provoke predictable reactions in those who see or use it. Thus by creating monuments with recognisable and conflicting symbols they act as the stabilization and filtration processes in change.

The phenomenon of change has many complex elements: Increased frequency--the new relationship and narrowing intervals between scientific discovery, technological

development and large scale usage have already introduced many unknown environmental effects. Expanded impact and awareness - through increase in the speed of transportation and communication, the agencies of change are diffused more rapidly and penetrate more swiftly into many areas of living. There is no less time for critical assessment and for individual or social adaptation. At one extreme, change becomes the preferred norm; at the other, as associated with disruption and uncertainty, resistance to change becomes the mode. Our understanding of the new dimensions of change and their immediate and long-range implications has not kept pace with the change themselves. Repeated emergency-presumed attention to the long-standing social consequences of various technologies is evidence of inadequacies in our conceptual mapping of change relations and in the indicators we use to monitor such changes.

The main difficulty stems from our historical perspective. Accostored to slow and sporadic change, and the visible linearity of linked cause and effect, we are still captive in much of our thinking to the concept of stability as the obverse of change, instead of assuming that since change and motion are constants, we may have stability in change. The conceptual understanding of the occurrence of changes, their potential consequences, and their relation to physical and social process have now become a prior survival imperative.

Our present concern with the future is an expression of that imperative. It is also concerned with the control and guidance of social and technological change in relation to human society. Writes John Mchale in his book "The future of the Future". To remind ourselves that the future of the present is in the past is an oblique way of emphasizing the need for a more comprehensive understanding of past change and past change agencies as a guidance to present and future change⁷. And, again the future was the past.

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- | | | |
|----|----------------|--|
| 1/ | John Mchale pp | Future of the Future |
| 2/ | A. Van Eych pp | Gwen Bell and Jaqkeline Tyrwitt
(1972) |
| 3/ | S. Woods pp | |
| 4/ | J.B. Bakema pp | Human identity in the modern
environment. |
| 5/ | Adeyemi E.A | |
| 6/ | John Mchale pp | Future of the Future |
| 7/ | John Mchale pp | |

Soon, myriad chips of intelligence will be embedded in one form or another in every home, hospital and hotel, every vehicle and appliance, virtually every building brick. The electronic environment will literally converse with us.

--- Alvin Toffler

<u>CHAPTER ONE</u>	<u>PAGE</u>
ARCHITECTURE AND THE TECHNOLOGY OF CONSCIENCESS	
1.1 COMMUNICATIONS REVOLUTION	
1.2 COMPUTERIZATION	
1.3 INFORMATION REVOLUTION	
1.4 REVOLUTIONARY IMPACT	

ARCHITECTURE AND THE TECHNOLOGY OF CONSCIOUSNESS:

The technology of consciousness has arrived. There is an over powering reason to expect volcanic changes in personality = "Communications Revolution =" the link between communications and character is complex but unbreakable. We cannot transform all our media of communications and expect to remain unchanged as a people. A revolution in the media must mean a revolution in the psyche. The communication revolution gives us each a more complex image of self. It accelerates our movement through successive images. It makes it possible to project our image electronically to the world. In no previous civilization have we ever had such powerful tools. We increasingly own the technology of consciousness.^{1/}

The info-sphere -- communication channels through which individual and mass messages could be distributed as efficiently as goods or raw materials, intertwined with and serviced the techno-sphere and the socio-sphere helping to integrate economic production with private behaviour. Each of these spheres performed a key function in the larger system, and could not have existed without the others. The techno-sphere produced and allocated wealth, the socio-sphere, with its thousands of interrelated organizations allocated roles to the individuals in the system. And the info-sphere allocated the information necessary to make the entire system work.

Together they formed the basic Architecture of society².

THE TECHNO-SPHERE:

Science and technology are both universal and particular. They are universal in the sense that the principles of Physics and the Engineering principles involved in technology transcend national boundaries. Scientists have a means of communication that are not limited by race, culture, religion or environment. They are also particularistic. Science is a body of ideas, some only distantly practical, if at all, while others are directly useful in human enterprise. Technology is fundamentally problem-solving.

The particularity of science and technology is derived from the fact that each country has its own complement of problems and therefore must, in its science and technology policy draw and create from this common fund of knowledge the most relevant and useful ideas and tools. Finding out what we want should become a major object of attention.....there is a vast difference between letting changes occur under the impact of technological advances and choosing the changes we want to bring about by our technological means. On a larger time-scale, one can imagine much of agriculture devoted to "energy forms" - the cultivation of crops for energy production. Ultimately we may see the convergence of weather modification, computers, satellite monitoring and genetics to revolutionize the worlds food supply.

Governments must consider these potentials in their long-range agricultural planning and must search for ways to combine as it were, the hoe and the computer.

Productivity is rising spectacularly in the computer chip industry "It is certainly an advantage to capital-poor developing countries to get greater output per unit of capital investment". The great product diversity in microelectronics means that developing countries can take a basic technology and adapt it more easily to suit their own social requirements or raw materials. Microelectronic technology lends itself to decentralization of production. The universality and particularity of science and technology can be the basis for finding unity in diversity and diversity in unity. Unity and diversity in all aspects of the human endeavour are necessary today if we are going to share this globe and its heritage.

People who deal in words envy the ability to music to communicate universally. - Time Inc. -

1.1 COMMUNICATIONS REVOLUTION

Communication is essentially an art which takes the fruits of scientific development and by manipulating them meets the practical needs of the everyday world. All human groups, from primitive times to today depend on face-to-face person-to-person communications.

But systems were needed for sending messages across time and space as well. As an instrument of progress it must match the job. What is the present form of this instrument and how is it shaping for the future? But first a brief look back.

From the earliest days the runner has been a communication agent. In Egypt, the message was inscribed on clay tablets, and the invention of papyrus may have been stimulated by a competitive agency who found that they could thereby make their runners go faster and further. The ancient Persians are said to have set up towers or "call-posts" placing men with shrill, loud voices atop them to relay messages by shouting from one tower to the next.

Aeneas invented the floating message board - which is, perhaps, the first example of a coded system. On receiving the cryptic message, say six, the operator would draw off six pints of fluid in the top and the floating board which would then ascend to the appropriate line and the message could be read off at the rim.

Polybius introduced the first real telegraph code, the alphabet was written in five columns and each letter had a co-ordinate position, which was signalled by lighting multiple touches.

The Romans introduced the first vehicle-borne mail service - a method which was continued in principle until it reached its apotheosis in the mail coaches of the nineteenth century. In the twelfth century, Ghengis Khan launched the first air mail service by using pigeons, and tradition has it that Rothchilds made successful commercial use of the pigeon post after the battle of Waterloo.

With all these means of communications which depended on sight or sound, or on carried messages, civilized man had not really advanced very much beyond jungle methods until in 1831, the properties of electromagnetic fields were discovered and formulated by Michael Faraday. For the first time man had a reliable means of communications which could go further than voices and faster than horses. In 1876 Graham Bell invented the electromagnetic telephone and audio break-through, which allowed not just the long distance transfer of intelligence that the telegraph had given, but the transmission of recognisable personality in the voice.

The personal and immediate contact which the telephone offered led swiftly to the distribution of the service to the office and the home, and so the telephone exchange was born.

Quick as the telex service is, the speed of transmission is comparatively slow. The advent of the high speed computer, which has been made possible by the development of electronic storage and manipulative circuits able to work at a very high speed, has brought about the transmission of large amounts of data at very much higher speeds. This can be done over the ordinary switched telephoned connections by applying data transmission equipment. The combination of high speed data transmission at a central point fed from a multiplicity of outside collecting points is finding wider and wider application and will form an integral part of the communications of the future. The availability of a single central memory or inventory, that is being continuously and immediately updated as each transaction takes place, has obvious advantages.

Technology which is now available will lead to an increasing influence on communication so that more people will be brought closer and closer together. Direct contact between them will be faster and sight, will, in many cases, reinforce sound. Routine work will be handled more by electronic data processing and computer will talk directly to computer.

It is clear that telecommunications will be a vital tool in the hands of the overall planner.

The extent to which it is used, and the imagination with which is applied to changing conditions and to differing demands lies only partly

in the hands of professional men. Much will depend on the investment agreed upon by the government and on the changes in the social attitudes of business and individuals.

BREAK-THROUGHS:

Today, one of the most significant break-throughs in communications research is in fibre optics - especially the use of extremely thin glass fibres to transmit voice and data. In fibre-optics, hair-thin strands of glass carry digital bursts of laser light that transmit several times as many conversations in just a fraction of the space of conventional copper wires. After years of research, scientists at Bell Laboratories found that by making the glass fibres thinner, refining out impurities such as iron and sending signals with an infrared laser, the light impulses travel three times farther than on any other fibre-optics system.

A caller's voice is transmitted to a central telephone office via copper cable. It is then encoded by a computer and converted into laser impulses which travel through the glass fibres to another central office. A second computer decodes the laser pulses, reassembling them into sound audible as an ordinary voice. The great benefits of the technology are cost and capacity: glass fibres cost just \$29,000 per mile, while copper coaxial cables

cost \$61,000 -- and 25 glass fibres can fit into the same underground conduct that holds just one copper cable.

It is unworthy of excellent men to lose hours like slaves in the labour of calculations....

-- Gottfried Wilhelm Leibniz.

1.2 COMPUTERS

.....A single chip could be programmed to do any number of tasks, from running a watch to steering a spacecraft. It is the soul of a new machine: the personal computer. "Our ideal", says Kazuhiro Fuchi^{1/} "is to create a computer that programmes itself". - a real electronic brain....

In the beginning, there was only the concrete distinction between one stone and many stones. Even in these distinctions there was no abstract concept of "one" or of "many". In fact, many dialects contain like remnants of a time when 10 coconuts and 10 bananas were two different concepts requiring altogether different words; that is 10 was seen as a different attribute when applied to coconuts than when applied to bananas. In early Egyptian and Chinese ideograms "many" is represented as in three waves = water, or three trees = forest, or eye with three tears = weep. See illustrations. In a sense, humans have been computing - manipulating and comparing numbers of anything they may represent -

In looking back, it is probably not too much to say that throughout history the complexity of a society could be measured by the complexity of its calculation.

1.2.1 EARLY CALCULATING INSTRUMENTS

The precursors of the abacus were called counting boards. A counting board is made by dividing a board or flat surface into columns each of which represents successively the positions corresponding to units, tens, hundreds, thousands, etc. - each column with sufficient space to place up to nine counters representing the digit value. The use of movable beads on rods or wires instead of stones used in the counting boards originated with the chinese. See illustration fig. From the abacus we can skip over the many special-purpose calculating devices that indispensable roles in the development of computing.

The computer, as we know it today, is the result of the invention in 1947, of a tiny, deceptively simple device called the transistor (short for transfer resistance). The transistor was a sandwich of semiconducting materials, mostly crystals of germanium; silicon was used later. The crystals were arranged so that a tiny current entering one part of the sandwich could control a larger current in another.

Hence, they could be used as switeches, controlling the ebb and flow of electrons. The first computers, were put together like early radios, with tangles of wires connecting each component. Soon the wiring were "printed" directly on a board eliminating much of the hand-wiring. Then came the quantum leap into the miniworld. - any number of transistors could be etched directly on a single piece of silicon along with the connections between them. Such integrated circuits (ics) contained entire sections of a computer, for example, a logic circuit or a memory register. The microchip was born.

Today, hundreds of thousands can be etched on a tiny silicon chip. The microprocessor designed by Ted Hoff of Intel Corp in 1971 contained the entire central processing unit (C.P.U.) of a simple computer on one chip. With the mircroprocessor, a single chip could be programmes to do any number of tasks,.....

1.2.2 THE COMPUTER SYSTEM

In the simplest terms, computers may be described as electronic devices which are capable of storing data in an internal memory, and following stored sets of instructions (known as programme) to operate upon data in order to produce desired results. The fundamental elements of any computer system are items of computing machinery and associated devices

generally referred to as the hardware, the data to be operated upon, and the programmes which are collectively known as the software. See fig....

Data entry to the system is via an input device, which, might for example, be a punch-card reader or an electric typewriter keyboard. The input device encodes data as electrical pulses, encoded information can then be stored in memory. Information to be output is transmitted to the output device in the form of electrical pulses. The output device decodes this information, and expresses it as output data in a useful format such as typed symbols or a picture displayed on a cathode ray tube.

The whole system is controlled by the central process unit (C.P.U.) which contains the system's capability to perform arithmetic and logical operations on the numbers contained in the primary memory. The control section retrieves, interpretes and executes (by sending signals to the appropriate devices) instructions from the programmes store in memory. These instructions may require the input or output of data, storage or retrieval of data in memory, or performance of arithmetic and logical operations on data.

1.2,3 THE COMPUTER LANGUAGE

Computers deal only with finite sets of finite numbers.

The binary system of numbers are the standard internal language of digital computers. In the binary system. Only two digits are used, 0 and 1. Thus if zero is represented by 0 and one by 1, then two is 10, three 11, four 100, five 101, six 110, seven 111, eight 1000, and fo forth. At their most fundamental level, the computers are little more than a complex maze of on-off switches that reduce all information within the machine to one of two states: yes (1) or no (0), represen ed either by the presence of an electrical charge at a particular site or the absence of one. Thus if a row of three switches, two of them are in an on position (11) and the other off (0), they would represent the number six (110).

Each of these pieces of information is called a bit (for binary digit). In most personal computers, bits are shuttled about within the machine eight at a time. Clusters of eight bits, forming the equivalent of a single letter in ordinary language, are called bytes. A typical personal computer offers users from about 16,000 bytes of memory (16k) to 64,000 (64k), and it is climbing fast. The first 1 million-bit RAM is in the offing.

1.2,4. COMPUTER PROGRAMS

A program is nothing more than a sequence of instructions, and these instructions must be defined.

An instruction must specify two things: an operation and the address of the location in the memory of the operated (number) on which the operation is to be performed. Computer programs are written by programmers, once the task is clearly defined, the programmer lays out step by step procedure for executing the task. He translated each step into commands that the machine can understand. The machine translates them, character by character, into sequences of numbers. These numbers, in turn, are translated into a corresponding sequence of electrical signals. These signals are sent to an electron "gun" housed in the vacuum tube behind the computer's video screen. This gun following the sequence of signals, fires bursts of electrons at the back side of the screen. The electron strikes bits of phosphor that coat the screen and energize them, lighting up a pattern of dots. These dots form the shape of alphabetic characters, spelling out the message. When the program has been thoroughly tested and corrected, it is stored on a magnetic tape or disc.

1.2.5. THE PERSONAL COMPUTER

The personal computer is a machine with formidable capabilities for tabulating, modeling or recording. These capabilities can be multiplied almost indefinitely by plugging it into a network of other computers. By hooking a desk-top model to a telephone line or by using a two-way cable and earth satellite,

one can then dial an electronic data base, which not only provides all manner of information but also collects and transmits messages: electronic mail. See illustration fig. for parts of the personal computer and what they do.

.....A personal computer can send letters at the speed of light. It can suggest dialnoses, it can help you meditate, you could supervise your staffs activities....., with the push of a button on a remote-control panel, you could call up hourly news and weather reports, airline schedules, do your shopping, access yourself array of games.....they aid in the discovery process. Futurist Alvin Toffler¹ imagones the arrival of "the electronic cottage" a utopian abode where all members of the family work, learn and enjoy their leisure around the electronic hearth, the computer.

The prophets of high technology believe the computer is so cheap and so powerful that it could enable underdeveloped nations to bypass the whole of industrial revolution. It's teaching capabilities can conquer the developing countries. Illiteracy and even its traditional high birth rates. "It is the source of new life that has been delivered to us" says French editor Jean-Jacques sevan-Schreiber.

1.3 DATA BANK:

By plugging the personal computer into a network of other computers and hooking it onto a telephone line, one can then dial an electronic data base, which not only provides all manner of information but also collects and transmits messages: electronic mail.....

1.3.1 DEFINITIONS

Data:- A general term loosely used to denote any or all facts, numbers, symbols etc which can be processed by a computer.

Data Bank:

Computer files created to store and furnish on-line or off-line information for man on man or for some aspect of accumulated knowledge. The information may be retrieved selectively or enmasse.

- A comprehensive collection of libraries of data: example, one line of an invoice may form an item. A complete invoice may form a record. A complete set of records may form a file. The collection of inventory files may form a library and the libraries used by an organisation are known as a data bank.

Data Storage:

The utilization of any medium for storage data and suggesting a capability to store large volumes immediately on-line to a central processor as in a magnetic drum or magnetic disk store.

1.3.2 STORAGE SYSTEMS:

Data storage facilities devices such as terminal memory, magnetic disc, drum and tape.

(a) Magnetic disc - This is a random access storage device consisting of magnetically coated discs accessible to a reading and writing arm in much the same manner of an automatic record player. Data are stored on the surface of each disc as small, magnetized spots arranged in circular tracks around the disc. The arm is moved mechanically to the desired disc and then to the desired track on the disk. See illustration fig.

(b) Magnetic drum - This consists of a rotating cylindrical drum surfaced with a magnetic coating. Data are stored as small magnetized spots arranged in closed tracks around the drum. A magnetic reading and writing head is associated with each track so that desired track can be selected by electrical switching. Data from a given track are read or written sequentially as the drum rotates. See illustration fig.

(c) Magnetic tape.- This consists of metal or plastic tape coated with magnetic material. Binary data are stored as small, magnetized spots arranged in column from across the width of the tape. A read-write head is usually associated with each row or magnetized spots so that one column can be read or written at a time as the tape move relative to the head.

(d) Magnetic-static core storage - This is the fundamental and most important storage of the central processing unit and usually of magnetic cores, each core of which is capable of storing one binary digit and which cores are uniquely arranged in matrices arrays or stacks and on digit planes or worked strings. Almost all store storage is high speed, random access, and expandable with high speed auxiliary units or extra cores.

1.3.3 DATA PROCESSING:

Raw data by itself has little value. It has value only after it has been categorized, combined and synthesized or in some way put into a form that is both more meaningful and more manageable. When data achieves this condition, it is usually referred to as information. See illustration for steps in data processing.

1.3.4 RETRIEVAL SYSTEM:

A computing system is designed to recover information from a mass of data. Information retrieval techniques include recovering, collecting and segmenting particular items of information which are required at a specific time and for a specific purpose. Information enters the system, is analyzed, clarified and stored. The user then translates his requirement and as a search of storage is developed.

1.3.5 MEMORY ACCESS:

Random access describes the process of obtaining information from or placing information into a storage system where the time required for such access is independent of the location of the information most recently obtained or placed in storage.

The RAM (for random access memory) consists of a number of devices that are used to store the macrocode (user program) under execution. It is a temporary memory and can easily be changed.

The ROM (for read only memory) is a special memory that can be read from but not written into. It is a permanent memory and can not be modified.

1.4 THE REVOLUTIONARY IMPACT

The world we are fast entering is so remote from our past experience that all psychological speculations are admittedly shaky. What is absolutely clear, however, is that powerful forces are streaming together to alter social character -- to elicit certain traits, to suppress others and, in the process, to transform us all.

(Toffler 1980 pp)

If we are right in concluding that the acceleration in rates of communication and metabolism is crucial to urbanised life, Le Corbusier's dictum, made in the early 1920's that 'the city that achieves speed will achieve success' takes on a new significance.

Our cultural values lead us to use communication facilities in certain ways, but in using them new value emphasis develop. So, in turn, the facilities themselves come to influence the values. Thus the city is made to the pattern of our values, but in turn, its accelerating rate of communication and metabolism of energy modifies and remakes the pattern of our culture. Communications are not therefore to be seen as serving our environment; they are an integral part of it.

The most revolutionary feature of the new means of communications is that many of them are interactive--

permitting each individual user to make or send images as well as merely receive them from the outside. Two way cable, video - cassettes, cheap copiers and tape recorders all place the means of communication into the hands of the individual.

The well-known theorist of the cultural meaning of communications Marshall McLuhan is famous for his aphorism: 'The medium is the message'. By this he means that the important thing about communications is not the material communicated, but the fact that the mode of communications has certain characteristics, for example, it is instantaneous, all pervasive and demands a spectator's involvement.

Thus the world, then, which the expanding network of electronic communications is fast reducing to a complex but single ecosystem, confronts the technological civilization with a profound and growing imbalance.....the first step towards a human future is the acceptance of responsibility for emergency in our total environment by creating those generalized human conditions which will at least prevent the system from further degeneration. In the immediate term, the only way to do this is by devoting the necessary physical resources to feeding

the hungry; in the immediate term, we must do it by inventing the necessary means to graft our technological knowledge on all aspect of the human tree. One of the author's suggestions is--Create monuments. Society has always created monuments, be it an abstract symbol to an idea, a cause or an era, monuments have always been the physical landmarks of man's revolutionary achievement. The new wave of technologies is more than a revolutionary trend, it marks a whole **epoch**, so let us translate it into a physical monument but first a brief look at how past societies tried and what the present holds for the future.

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1. Toffler, Alvin (1980) Third Wave
 2. " " " "
 3. Ireland J.C. (1969) Communication between people:
The available technology.
 4. Slonnick Esq (1979) Computers, their structure,
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In architecture, one aspect of individualism stands out: The idea of building monuments. Based on a general notion that "the form of an object should last".

----- ADOLF LOOS -----

CHAPTER TWO

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ARCHITECTURE AND MONUMENTS

Architectural theory and history have traditionally emphasized the study of monuments. Buildings that survive from the past are fossils of civilization. For early cultures that left no written records, monumental remains are the principal sources of information. Even of 'high' periods - Periclean Greece or Rome - such edifices as the parthenon and the Pantheon are, for many people, the most impressive manifestations. Thus the history of architecture is the history of mankind. Each culture produces new versions of the house of God, the house of man and the house of the dead. In their outward form, these structures express and project the deepest feelings and highest aspirations of mankind. Architecture is often able to tell us far more about how people worshipped, lived, loved and died - what they glorified and what they feared. To quote Sigfried Giedion, "every period has the impulse to create symbols in the form of monuments.....this demand for monumentality cannot, in the long run be suppressed. It will find an outlet at all costs. Then the architect's impulse to express human aspirations on a worthy scale is the monument that Lewis Mumford describes as a declaration of love and admiration to the higher purposes men hold in common.

The history of earliest monuments are filled with architectural forms that commend themselves to abstract dedications. A sculpture, a spire or a bust in memory of a 'legend' in history or a symbolic abstraction dedicated to an action or event. These soon lose their reverence and become out of character with the living aspirations of the people they are meant to inspire. But with new technologies and increased awareness, architectural and monumental dedications began to commend themselves to the modern mind seeking 'functional expression'. In this era society's hopes and aspirations are embodied in living monuments that would continuously and consciously inspire and relate to them. No single individual in this period of diversity in role models could command history's sole attention, such roles are now the preserve of innovations and gigantic strides in the evolutionary process of man. Hence monuments today are the functional expressions of man's aspirations for the future.

Monumentality springs from the eternal need of people to create symbols for their activities and for their fate or destiny. For their religious beliefs and for their social convictions.

Periods of real cultural life had always the capacity to project creatively their own image of society.

They were able to build up their community centres. (agora, Forum, medieval square) to fulfill this purpose. Our period, up to now, has proved itself incapable of creating anything to be compared with these institutions. There are monuments, many monuments, but where are the community centres? Neither radio nor television can replace the personal contact which alone can develop community life.

Everybody is susceptible to symbols. Our period is no exception. But those who govern must know that spectacles, which will lead the people back to a neglected community life, must be reincorporated within urban centres - those very centres which our mechanized civilization has always regarded as inessential. Newly created urban centres should be the site for collective emotional events, where people play as important a role as the spectacle itself, and where a unity of the architectural background, the people, and the symbols conveyed by the spectacles, will be achieved. Monumental architecture will be something more than strickly functional. It will have regained its lyrical value when they are integrated into new urban centres which can form a true expression of our epoch.

2.1 MONUMENT: HISTORICAL PERSPECTIVE:

In its first evolutionary stages, the pattern of man's existence was tribal and nomadic. Caves and natural shelters provided him with a home. These satisfied his primitive needs in his wandering search for food and hunting animals. The discovery of the possibilities of agriculture introduced new factors into his life, which restricted his movements and resulted ultimately in the permanent settlements of a farming community. Under these circumstances individual homes acquired a new significance. The craft of building was devised for the purpose of housing certain domestic functions that needed to be enclosed and protected. The availability of stone lent itself to a pile making a wall, a rectangular hut with an opening in one side might suggest itself. The form and appearance of earliest buildings were dictated, literally, by material consideration, they lacked conscious planning and therefore were composed of architectural innocence.

The most elementary requirements of architecture is that a designer or builder should have consciously contrived the form and appearance of a building in such a way as to provoke predictable reactions in those who see or use it-reactions, that is, either of personal satisfaction or aesthetic pleasure.

In doing this, certain principles need deliberate considerations. Structural and functional principles must be evident and impressive. Its specific purpose must adequately be expressed inside and out. Its spatial relationship considered and its external envelope must lend itself to the limitations imposed by all other considerations. Thus, with the possible exception of the structural principle, earliest buildings lacked the observation or architectures cardinal principles. The building effects obtained were unpremeditated and as a result, their architectural innocence was short-lived.

Archeologists detected the first germ of an impulse towards architectural design among village communities in the Near East. During the neolithic period, contrasts in the conventional shapes of buildings were perhaps already dictated by tradition. In Turkey, for instance, on the fringes of the Anatolian Plateau, there were houses substantially built of mud-brick on stone foundations, still consisting of a single rectangular compartment. But they had a doorway in the centre of one side and the position of the domestic hearth directly opposite is emphasized by a formal niche in the wall behind it. At Jericho in Jordan, a circular stone tower, twenty-seven feet in diameter, seem to point to the

fortification of a contemporary settlement. Here another significant find was a building evidently devoted to some cult; square, with a portico screened by wooden posts and two doorways leading one through a tiny vestibule, all consciously arranged on a single axis. Here, at least, the functional principle was being considered.

Then, in the proto- and pre-sumerian settlements of Southern Mesopotamia, amid a crescendo of creative invention, real architecture suddenly materialized as a setting for the complex functions of newly developed civilization. The earliest dwellings here were of reeds of mud. By -umerian times these had long been abandoned in favour of more substantial brick buildings; but memory of their external appearance conditioned Sumerian design for many centuries to come, and the complicated pattern of their entrance farcades survived both as a form of ornament and as the pictographic symbol of a temple. For already, in the middle of the third millennium B.C., temples and shrines were the buildings upon which the new-found faculty of architectural expression was mainly concentrated. These prehistoric temples and shrines were build on elevated platforms, which was clearly intended to emphasize the exalted purpose to which they were dedicated. They provided a setting for the sacramental ritual around

which the Sumerian fertility cult centred. The platform on which they stood were heightened and elaborated beyond all recognition. There "staged-towers", with their monumental stairways and superimposed porticoes, now became the most conspicuous features of Sumerian temple cities. The Sumerian architect, in the great period of universal discovery which followed was able to make his own striking contribution.

In discussing early architecture, it is religious buildings which monopolise one's attention. Far less care was lavished on secular construction. Stone was the conventional material for monumental buildings, and all these stone buildings, then, were dedicated to religious or monumental purposes; and with few exceptions it is they whose ruins have survived above ground or been considered worthy of excavation.

ARCHITECTURE IN MONUMENTS:

Structures conceived, designed and built as monumental dedications are first monuments and then architectural. Terms are interchangeable depending on whether it is a functional or an abstract dedication. It is a matter of semantics but here are two examples of monumental architecture.

(A) STEP PYRAMID OF ZOSER, SAKKARA, EGYPT:

The complex of buildings laid out around Zoser's tomb at Sakkara is the first major example of monumental design and planning. The architect's, Imhotep, elegant designs, their freedom and individuality are now a thing of the past. The most famous group of Pyramids is that at Gizeh, containing the tombs of Cheops, Chefren and Mycerinos. The cheops pyramid is 755 feet square by 481 feet high, and geometrically it makes an angle of forty-five degrees at the intersection of the sides. The dual aims behind pyramid design were practical ones - permanence and concealment; and the severity with which these functions were expressed precluded the use of ornament even in the internal chambers. Structural perfection must also have been a central objective, yet the weight-relieving devices over these chambers suggest a lack of confidence in its attainment. All else was subjected to the sheer scale of the central conception; and this must have been given extra emphasis by the low horizontality of the subsidiary buildings which completed each of the three complexes. In the case of the Chefren group (which is best preserved and includes the colossal sculpture now known as the sphinx), one sees how the funerary temple on the pyramid terrace is connected by

a long causeway to a smaller 'valley temple' on the river bank below. In both temples, there was a formal arrangement of colossal statues, mostly of green diorite, which must have provided a contrasting colour in the dim light diffused by vertical shafts in the walls. This was the first use of free-standing figures and it initiated the close association between architect and sculptor which has persisted.

The efficacy of a pyramid as protection for a tomb proved an illusion to the people and the king was buried elsewhere. The monument that was conceived as a "reverence dedicated" to the dead was out of character with the aspirations of the people. They were abandoned and left to serve only as pointers to the impressive architectural achievement of the period.

But their memorable beauty and structural capabilities are still recognisable landmarks in modern architectural reflections.

The needs of the Roman people were far more sophisticated than the Egyptians. They had their old Forum Romanum - around which their principal monuments were built, and which served also as a meeting place, market, social and political rendezvous. The triumphal arch is a more famous example in the old Forum Romanum. These monuments illustrate how the conventional pattern of a classical order can be used as a superficial

framework of ornament around an essentially Roman form: the deeply soffited archway. The monumental archway at palmyra (1st century AD) was an impressive focal point of the splendid colonnaded streets and its erection at the intersection of four main streets introduced a functional relationship to axial planning. Speaking of technological accomplishments, we are reminded that Roman competence in practical engineering produced spontaneous architectural forms which commend themselves to the modern mind seeking "functional expression".

2.2. FUNCTIONAL EXPRESSION:

A train of developments leading to the familiar radicalism of today's architecture emerged with the growth of a new technology in the wake of the industrial revolution. The impact of this phenomenon upon the evolution of architecture is subtle, complex and devious in the line of its development. The main revolution in architecture began with the new master problems that emerged as long ago as the 1780s when a vast amount of monumental symbolistic building began and when new problems of a specifically public architectural character were met by the architects of the period. Example, the museum buildings of that period were considered as temples built to emphasize the holiness of art, but the desire for monumentality which spread through new building types such as prisons, hospitals, and educational establishments soon evolved into a pheralism of styles. This became an obsession of the revivalists of the 19th century. The inaugural monument of this period was the work of the shrosphire ironmaster, Abraham Darby III: his elegantly arched cast-iron bridge at coalbrookdale with its span of 100 feet was soon outclassed, both in distance and elegance of design by the masterpieces of early suspension bridge art.

This expressive quality - which some have designed to interpret as an early instance of the functional tradition - is to be found in bridges, market halls, railroad sheds and similar structures whose development follows an evolutionary path consonant with the more familiar architectural idioms of the day. It culminates in Sir Joseph Paxton's unique stroke of inspiration, the original crystal palace london for the Great exhibition of 1851. This superb, if overfamiliar, monument reflects not so much the period in which it was built, but rather an aesthetic and point of view that shares elements in common with its immediate past and of the future. Both its interior views show the result of industrial methods of standardization and pre-assembly. While we rightly admire this work for its technological precocity as well as its striking anticipation of the glass architecture of mid-twentieth century, we ought equally to recognise that in the purity of its forms and the regularity of its detail, it is as much a belated manifestation of earlier Romantic classic taste as it is an explicit foreshadowing of the machine age.

This attestation is evident today in the breath-taking, spidery monumentality of Gustave Eiffel. The Eiffel tower designed as the temporary centerpiece of

of the Paris 1889 Exhibition is one of the most remarkable engineering structures of the world. It is a product of technology aimed at bridging the often unbridgeable gap between scientific research and cultural development. It reveals the force and originality of a century as expressed in technical inventions. The statue of liberty in New York harbour which Eiffel designed is one of the most recognisable monuments to man's aspirations of total freedom. It is to inspire in man the thought, conscience and an acceptance of the future.

In architecture, one aspect of individuals stands out: the idea of building monument, it is still with us today, being based on a general notion that (to quote the Czechoslovakian, architect Adolf Loos from 1908) "the form of an object should last" and that implicitly there are some forms which have eternal validity. Monumentalism really took hold among the German pioneers of modern architecture. Examples abound and such architects like Mies van der Rohe (1886-1969) never gave up his interest in monumental buildings; Le Corbusier (1887-1966) rooted part of his own theory of new architecture upon monumentalism.

Architecture simply follows the general trends of its age

CHAPTER THREE

ARCHITECTURE AND REVOLUTION:

- 3.1. THE CRISES
- 3.2. THE MEANING
- 3.3. THE TREND

ARCHITECTURE AND REVOLUTION

ARCHITECTURE IN TRANSITION:

The main reason for our confusion is that we find ourselves in an epoch of transition, the general nature of which is also reflected in our architecture. In trying to find our way in the darkness by which we are surrounded, we have to understand first where we are in space and time. The earth is the space we are talking about, and it is on this earth that we find ourselves living today in an age of great transition, an age where the rate of change is accelerating from one day to the next. This rate of change is the most characteristic phenomenon of our age, whether we talk of technological progress, or economic development, of population growth or of social or cultural phenomenon. Our transition is a transition from old to new, from traditional to modern, from the concepts of the past to the concepts of the future, and so from the problems of the past to the problems of the future.

Architecture simply follows the general trends of its age. It is now in a process of evolution more intense and more rapid. Public opinion very often demands the traditional, but in demanding the creation of some thing reminiscent of the old houses, it forgets that old houses, as Casona said are created not by architects, but by time.

We are thus obliged to create the new while living in the midst of the old which is still in existence and the old which is again being imitated. "We shape our buildings", said Sir Winston Churchill, "Thereafter they shape us. The average man is a slave of the past in terms of architecture more than in anything else depending on him. He tends to consider as right what is prevalent. This was all very well when there was no distinct change in technology and ways of living, but it is no longer satisfactory now that the main characteristic of life around us is rapid change. Yet the architect himself is also a slave of his own environment. An architect who misleads society will create such an investment that large numbers of people will have to suffer for many years because of the community's inability to demolish any architectural creation. In this sense, it is wise to respect the architectural creation of the past and to draw from it as many useful lessons as possible. On the other hand, however, the habitat which is there acts as a real break since, consciously or not, people tend to consider what exists as the best guide to what should exist.

In any case, humanity is trapped between old and new. If the rate of change is small then there is always time for readjustment, since the rate of change

of needs is also very small. But when the rate of change of the whole society is as great as it is today, then the slow rate of change in our habitat definitely acts as a break on normal evolution and progress. The rate of change requires the contemporary architect to create something which in many respects should be new, but at the same time he bears the great weight of his own habitat. Thus he is really caught between the old which cannot be demolished overnight and the new which is indispensable for the new type of life that the people have to lead.

One most important change in architecture was the shift of architectural creation from handicraft to industry. Thus there is a whole range of solutions which prove that the modern architect is being forced to move from an architecture which was a product of handicraft to one which has become an industrial product. At the same time the number of people who participate directly or indirectly in the creation of a building becomes larger and larger and moves towards the infinite. (fig).

The gradual trend from handicraft production to industrial production also implies shift of architectural solutions from the local towards the

international level (fig.) thus regardless of region or town, there are functions - particularly in the field of communications - which are based on standards of a more or less universal nature. Therefore in this epoch of transition our goal can not be to create architecture in the abstract, but to dedicate our architectural creation to the service of the people.

3.1. THE CRISES:

During the past few generations - architects have in general been suffering from megalomania. Each thinks that his job is to create another Taj Mahal or a Parthenon, an approach that is both wrong and wasteful.

There is the fact that in the growing urban areas those buildings of the past which gave their cities a monumental character, buildings such as churches, city halls, palaces or monuments, are now passing to secondary importance within the city. The church is no longer the tallest building in the city, and the same applies to all our monumental buildings. Thus the direct influence exerted by the buildings on the people is declining; while at the same time, their very function as symbols is itself diminishing in importance because they have lost their significance in the scale of the city.

The large buildings of the past which were of monumental nature constituted at the same time the major elements of the city, controlling its rythm and imposing their character on it. These monumental buildings were formerly the real city, for, as Sir Christopher Wren said, "architecture has its political use, public buildings being the ornament of the country; it establishes a nation, draws people and commerce and makes the people love their native country, which passion is the original of all great actions in a commonwealth".

These buildings were concieved as monumental, and as such were planned on introvert, closed schemes, schemes which cannot stand expansion. The functions they serve, however must and do undergo a continuous expansion. When their needs become greater they are unable to serve their purpose any longer. It is the conception of monumentality in buildings that has led to introvert forms, and it is these forms which in their turn have arrested the possibiloty of normal growth and normal expansion in the functions of many of our buildings thus creating bad architecture. The resultant rigid and unexpandable forms are left in our hands, like fossils.

If we try to pinpoint the main characteristic in a situation which has so radically altered the

framework in which our architecture is created, we shall see that what has really changed is our notion of time. What is really different in our age, is the tempo of change, which has already been expressed in pop and in social and economic phenomena but not in architecture. That is how the gap has been created.

Summing up all this in another way, we might say that the basic problem of architecture today is the addition of the dimension of time to the three - dimensional synthesis we have had to handle up to now. In place of static situations involving slow change, we are now caught up in a dynamic situation bringing the most rapid changes in their train and this is what makes the radical difference in the present situation and outlook for architecture.

Architecture in our era has had to conquer this fourth dimension of time. In doing so, it has been forced to change technologically and to make major adjustments. Moving from the period in which it was the two-and to a very small degree, the three - dimensional domain of the craftsman, architecture has now to adapt itself to the new conditions which the growth of the third dimension and the growing factor of the fourth dimension, the dimension of time has brought to the scene.

3.2. THE MEANING:

Architecture (from the Greek architekton, meaning "master mason" or 'master builder') was essentially the art of building. As such it was the expression of the best technique available in a certain age, as well as the expression those powerful minds which, through natural selection, find themselves at the top of the cone of architectural creation. The peak of this cone in every culture represented the monumental expression of the craft of building as exercised by every mason, and builder throughout the country.

Today in the era of rapid socialization and developing interest in the whole of humanity, architecture is not justified in concentrating on one or a few exceptional buildings or groups of buildings, but should be able to cover a community, a region, a country; in short the total building activity all over the world. This interpretation is due not only to the broader social concepts of our era, but also to the fact that it is no longer possible to differentiate between important and unimportant parts of a city or between its monumental and non-monumental sections; for cities today are characterized by an all-inclusive conception of

architectural space.

Thus, if we accept architecture as the technique and art of covering the total building activity, we will necessarily conclude that architecture is also enormously influenced by science, since in our time everything tends to become more and more scientific.

The conception of architecture as covering the total field of building activity reminds us that architecture was created at the bottom level of the cone of total building activity, then gradually refined as it went to a higher level unit at length it found its monumental expression at the top of the cone. But if the architect goes to live in an ivory tower, selfishly designing monuments and disregarding the trends and the needs around him.

The architect must seek a way into the future. He must recognise the new needs and new trends, and find new ways of coping with his problems.

With fresh forces, economic, social, political, administrative, technological and aesthetic entering the arena, architecture is no longer a matter to be decided solely by the architect, but must be thought out in conjunction with many other people and co-ordinated with many other views. Nor is it any longer sufficient to say that we can indeed create the best architecture, but that society does not understand it or that

government cannot finance it, so that it all remains stillborn, a vague cipher on paper. This is not architecture, but merely designing. Architecture exists only when it is implemented by actual building.

We live in a developing world, and the only justification for architecture is its connection with the overall evolution of society. For our purposes we may define this as the expression of all the forces which influence the creation of buildings, bearing in mind that the architect is conditioned by economic as well as by aesthetic, by social as well as by technical, by political as well as by cultural considerations.

If we view architecture as part of the overall development taking place around us we shall understand how much it is conditioned by environmental factors, factors that must seriously be taken into account. We shall also understand how much it is conditioned by non-environmental factors, and shall seek to satisfy their demands too.

3.3. TREND:

The new role of architecture requires the understanding of the new dimensions of problems and the complexity of forces creating the present situations. The problems which architecture faces today can be divided into two categories. The first comprises the problems which require an understanding of local environmental situations and the role of architecture as the consolidating and co-ordinating discipline. The second consists of problems which are not connected with the environment and require action at a much higher level. The problems here are those which architecture faces in relation to industry, art, government and the other forces of the modern expanding society. The role of architecture must be defined in both fields.

Architecture must be co-ordinated geographically, that is, with its environment at the local level. Great achievements of the past such as those cities, neighbourhoods, communities and squares that we still admire as masterpiece of architecture, were certainly the results of the co-ordination of architecture at the local level first and then at higher levels.

It is easy to understand the necessity of co-ordination at the local level. What is more difficult, however, is to understand the necessity for co-ordinating architecture

at higher levels, whether regional, national or even international, and the techniques by which this will be achieved. We have already seen that our present confusion is due, among other things, to the fact that architectural creation is influenced by forces derived from many unco-ordinated centres of radiation; such as industry, government, arts, engineering and architecture. We cannot continue our activities successfully unless we realize that schools of architecture, centres of architectural research and education, etc, must have the great task of co-ordinating all forces influencing architecture, so that a total co-ordination radiating towards every area of architectural creation is finally achieved.

Architecture may now be seen in its proper context, as expanding in order to cover areas which still have buildings and ways of life of one, of ten or even more centuries; so that by expanding in space it acquires the real perspective of time, and is taught the rules of evolution.

In this light the architect's role was and is that of a co-ordinator of several efforts. Within a house he is the co-ordinator of all needs and elements of solutions, whether economic, technical or social.

He is to cover human needs with a physical shell which will probably have to be constructed of elements coming from many parts of the world and produced by other people. For many houses taken together, he is also the co-ordinator working for the creation of the neighbourhood, which is to serve the needs not only of the family but also of the community.

It is in the urban environment that we must look for the broader frame of our architectural creation of the present, and more especially of the future.

CHAPTER FOUR

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STUDIES OF THE MONUMENTAL:	
4.1 GATEWAY ARCH ST. LOUIS MISSOURI:	
4.2 (A) CN TOWER, TORONTO, CANADA:.....	
(B) PACIFIC SCIENCE CENTRE, SEATTLE, U.S.A:.....	
4.3 TOURIST AND TELECOMMUNICATIONS TOWER FOR SYDNEY:.....	

GATEWAY ARCH, ST LOUIS, MISSOURI, U.S.A.
JEFFERSON NATIONAL EXPANSION MEMORIAL - EERO SAARINEN
(1948)

Eero saarinen was helping to create not merely a new order of architecture, but a new order of man: the man of the future for who the great arch of steel is at least being built beside the Mississipp^{1/}.

The history of the Jefferson memorial reveals Saarinen's perfectionism at its searching best. As the work went ahead in 1958, he drew upon his experience with curving forms at M.I.T., the Yale rink and T.W.A., seeking a faultless arch form, contemplating the monumental arches of the past and the vaults and buttresses of Gothic Cathedrals, reflecting on the energy that a curved line develops in space, and on the paradox of its downward direction. He wished the arch to rise in a single aspiring movement. He built models and rebuilt them, studying them with mirrors, photographing them and rebuilding them again,, heightening the arch from the original 590-630 feet, then drawing its profile inward in a further refinement, until he arrived at the final magnificent form. At the same time he worked with the Engineers - Severud&s firm and the inner triangular frame of structural steel and its radiant sheathing of stainless steel were also refined.

He talked to inventors about the little vehicles which will carry visitors upward inside the soaring hoop, through a dark triangular tunnel, to the tremendous vision of the heartland of America that open from the observation bubble at the top.

It was all coming together, becoming one thing, talking its place between earth and sky. The rather dry original site was enriched with a surging baroque vigour. The curve of the arch was repeated, and repeated again, in paths and walls, and suggested in water. In a single lordly gesture, saarinen cast one of the great staircases of the world across the width of the river front descending in broad steps to the bank. The arch itself was moved to a rise of ground, farther from the river, closer to the city; and the terrain again was sculpted, molded, shaped, reshaped, and when saarinen had the land as he wished, he knew that it should be planted with a small forest of trees. In the trees there was a memory of the woods at "Hvittrask" but they were also a symbol of the American wilderness into which explorers had forged. The clearing from which the arch would rise, in single magnificence, was the image of the primitive clearings in which they had camped, while the great Virginian-America's only architect.

President (Jefferson) wished them westward, ever westward, carrying forward the destiny of the nation and the world, and this selfless spirit of discovery, by men of other men, is what the monument should commemorate forever.

THE GATEWAY ARCH is the world's tallest monument - a gigantic hoop of stainless steel - probably the most ambitious symbolic monument yet undertaken in the 20th century.

It is a catenary in shape equal in extreme width to its height (192m x 192m). It is a stressed skin structure consisting in cross-section of a double-walled equilateral triangle, with concrete between the two skins in the lower half and cellular stiffening in the upper. The outer wall is of stainless steel six millimetre thick and the inner of mild steel ten millimetre thick. Lifts pass through the hollow centre to and from an observation gallery at the crown.

Although the grand clarity of the original concept ostensibly left little room for change, the design had nevertheless been meticulously reconsidered and fundamentally improved - during the intervening years - Such perfection Eero Saarinen called "responsible architecture"; architecture which takes full cognizance

of the complex needs of site, structure and program and resolves them logically but passionately - in a single unified 'expression'. This kind of responsibility transcends personal style when it is fully realized in terms of industrial technology: It belongs, as the finest architecture of the past inevitably did, to a whole epoch. Yet the search for such an architecture was in the profoundest sense an individual's quest for truth.

He created a monument not only to Jefferson and the nation of America, but also to the modern age. Although he usually considered the "spirit" of a project independently from its purely mechanical "function", the two were here inseparable. The spirit was the function.

4.3. STRUCTURAL CONTEXT

A 700 FEET HIGH TOURIST AND TELECOMMUNICATIONS TOWER
FOR SYDNEY

The tower consists of a central steel core of 21 feet diameter with external prestressing cables forming a hyperboloid of revolution connected to the core at four points to provide interaction between the cables and the core.

As part of an ambitious downtown project in Sydney, Australia, it is proposed to develop half of a city block as one unit; The plan suggested a 15 - storey high shopping and office complex connected to other buildings by underground and above ground walkways. Sitting atop the building of this complex is a 700 foot high tower to be used for a circular building approximately 50 feet diameter and five stories high to be situated at the top of the tower to house the necessary facilities, thus the supporting tower is 650 feet in height from the top of the structure below to the underside of the facilities building. Because of the sitting of the tower, one of the major design considerations was weight, further more because of its location the structure of the tower should not present too much of a visual obstruction. With these and other factors in mind, the design engineers, wargon, chapman and

associates of Sydney, produced a solution in the form of a steel tower with a 21 foot diameter central core surrounded by a straight external prestressing cables skewed to produce a one sheet hyperboloid of revolution with a base diameter of 122 feet, a top diameter of 50 feet skewed in such a way as to produce 21 feet as the diameter at approximately 462 feet above tower base. To increase the stability of the tower against twisting there were cables skewed both clockwise and anti-clockwise producing a net in appearance.

The tower consists of a central circular steel shaft containing the lifts, ducts and stairs, stayed by 72 steel-tensioned cables inclined at an angle of $82^{\circ} 50'$ to the horizontal and skewed so as to make a tangent to the shaft at a height of 462 feet above the base forming a hyperboloid of one sheet. The 72 cables are arranged symmetrically with 36 skewed in one direction and 36 in the opposite direction.

The preliminary dimensions for the prototype were as follows:

Core: Outside diameter 21 feet consisting of 54 Universal column sections (10m x 10m x 6016) grouped in pairs and connected to built rings.

Cables: Two sizes of cables were proposed: 3.57 in^2 and 10.7 in^2 cross-sectional area for each cable.

The aim of the prototype was to use physical models to examine the feasibility of the overall structural concept and so provide confirmatory evidence for the designing engineers.

Wind Tunnel Testing: Since the value of the distribution of the lateral load is paramount, it was decided to check the overall drag coefficient for the tower experimentally because of the uniqueness of the structure.

Static Structural Testing: Aim of tests were to examine variations in deflection and internal load distributions under various structural configurations (a) Cables attached at bottom and top only (b) Cables clamped at 462 feet (neck) and (c) cables clamped at 462 feet and 292 feet.

OSTANKINO TV TOWER, MOSCOW, U.S.S.R

This is a free standing concrete tower, 537 meters high. The main structure of which is 385 meters high. The tower was heightened by four meters in 1973. There is a meteorological observatory high in the tower.

N.V. Nikitin, the designer reported to a congress in 1968 that the design figure for static deflection of the tower was 5.8m. Corresponding to a wind experienced for 1.2 hours in one year and the maximum amplitude of vibration 1.4m. He expected that the maximum deflections of the tower would be less. No one had felt any unpleasant vibrations.

C.N.. TOWER TORONTO CANADA

This is the world's tallest free standing tower. The main concrete structure is 446 meters high. The overall height is 555.33m and the structure weighs 130,000 tons. It is a post-tensioned reinforced concrete structure that serves for communications and observations. The 416 seat restaurant revolves in the sky pod at 347.5m from which the visibility extends to hills 120km distant.

CHAPTER FIVE

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MONUMENTALIS: PROGRAMMING

5.1	PROBLEM DEFINITION:.....
5.2	THE SITE CONTEXT:
5.3	BRIEF AND ORGANIZATIONAL CONTEXT:

5. MONUMENTALIS: PROGRAMMING

The context of sequence programming defines the problem, the criteria of site and the organizational structure. It sketches concisely the requirements that will lend character to a dynamic and fully functional monumentalism. The spirit of the project is the function, and the site is of crucial importance, so only from an integrated solution of the requirements of site and spirit could come the necessary symbolic program, which will all be locked together by an appropriate structural system.

5.1. PROBLEM DEFINITION:

Keeping pace with a faster changing mode of communications and ever increasing frequency of available information and new processes becomes doubly imperative for a developing society that has to match the new awareness in a changing environment. The wave of new technologies and its impact on the social, cultural, economic and political structure of society is increasingly penetrating. There is less time for critical assessment and for individual or social adaptation. At one extreme, as associated with disruption and uncertainty, resistance and rejection is the mode, at the other acceptance and change becomes the preferred norm.

Thus the problem confronting us here is finding out what we want and how to absorb the culture and social-shock (imminent) under the impact of technological advances. What necessary infrastructures and relevant education can structure the people for the inevitable clash of waves of change. In their desperate search for identity, what hopes and aspirations, and so the architect has to transform the fear of the future into total space and confidence.

The proposal here is for a scientific graceland; with emphasis on communications, computers and information processing. With these as the identified crests of the unrushing wave of technologies, other supporting facilities will be provided to make for a fully functional complex that will meet with the needs of the people. These needs are always changing and in order to provide a place of identity that will mirror their hopes and aspirations for the future, the proposal metamorphise into a dynamic and functional monument. This monument is to be open-ended and dynamic so that it could take in the increasing and expanding structures of technological innovations and discoveries.

It will serve as a research arm of the communications industry, because moving faster than borrowing technology allows for more basic research. Copying and improving will not be enough. Thus research will foster a new "creativity" movements of sorts. Real strength will lie in forecasting the future needs of the people, and convincing industry that it works. It will also provide cultural interaction so that irregardless of social background it will foster cultural affinity and unity and a sense of belonging to all members of society.

OBJECTIVES REDEFINED:

Centre to test, evaluate and dessiminate innovations on a broad scale, and to provide direction and to encourage innovation in other quarters.

It can design and produce materials that are not commercially available but which are need for specific instructional purposes.

It can provide technical assistance in using instructional technology effectively. Helps overcome a fear of mechanical devices about which people have little knowledge and great anxiety.

5.2. THE SITE:

Criteria for site location lies in the context of equal and easy accessibility to source control

emphasized by centrality. Place of identity symbolized in a monument to national unity. Location to be neutral and mirror national aspirations. In the national context, Abuja, the new Federal capital provides and meets the ideal requirements for this pioneer project.

The site is located in the central business district. This is the hub of both the city as well as the nation itself. This is true not only in a symbolic sense but in a physical actuality as well. All affairs in the city and the nation will focus on it. It will also be the centre to which representatives of other nations will come. Therefore it will symbolize Nigeria to the world, thus reaching beyond national concerns alone.

The space defining requirements in the central area is the commercial and business core with its tall buildings serve the function of visual identification of important places from a distance.

PHYSIOGRAPHY:

The bulk of the city is concentrated in land with elevations from 1,200ft to 1,700ft to capitalise on climatic advantages of higher altitudes. Topographically the area is typified by gently undulating terrain interlaced by riverine depressions;

with height variations of around 50 metres. This produces short views which are made even shorter by the typical park Savanna vegetation of the site. The central area consists of uplands and plains, with numerous inselbergs, wharebacks, and other rock outcrops of various sizes.

GEOLOGY:- Migmatite, granite gneiss, and boitite granite underlying the majority of the site are rocks of medium to high strength and are expected to present a minimum of engineering problems.

SURFACE WATER:- The site can more or less neatly be divided into small contiguous watersides, all converging on one point. Construction will cause increase in stream-channel changes and will increase stream flows that could lead to local flooding and erosion problems if adequate design solutions are not provided.

SOILS:- The soils underlying the site are derived from migmatite, granitic gneiss and are generally suitable for most developed land uses. They are typically deep and well drained; having only local constraints where they are high in clay or stones, shallow or poorly drained. Where soils have a high runoff potential, special design or construction techniques may be required to eliminate potential

flooding and sedimentation problems. Successful landscaping of public places and tree planting is reasonably assumed.

VEGETATION:- Site vegetation is generally characterized by park savanna park. Park savanna is typically a stratified community with a discontinuous canopy, shrub and grass layer structurally they may include a thick, tall grass layer consisting of Hyparrhenia and Andropogon species and canopy species dominated by Albizia and Parkia. Efforts should be taken to preserve woodland areas for their value as an aesthetic and recreation resource, and for their ameliorating effects on climate.

CLIMATE:

Planning with climate should take place at all scales.

TEMPERATURE-HUMIDITY:- The response to net-radiation is greatly influenced by the humidity conditions in the air. The FCT records its highest temperatures during the dry season when there are few if any clouds. Changes in temperature of as much as 17°C have been recorded between the highest and lowest temperature in a single day. Maximum temperature is lower during the rainy season due to a dense cloud cover.

Human sensibility to temperature is greatly affected by Relative humidity. During the dry season, relative humidity falls in the afternoon to as low as 20 percent and this low relative humidity coupled with high afternoon temperatures account for the drying effects of the dry season.

See fig. for temperature and humidity variations for the FCT.

RAINFALL:- The rainy seasons starts at about the 10th of April and tapers off very rapidly after the 20th of October. Thus, the duration of the rainy season is between 180 days to 190 days. In the Abuja area 60 percent of the annual rainfall is in the months of July, August and September. This concentration shows the needs for drainage systems that can handle large volumes of water very quickly.

See fig: for the mean monthly rainfall for the Abuja area.

WIND-DUST:- Two major air masses dominate the climate of the FCT. These are the maritime air mass and the tropical continental air mass. The tropical maritime is formed over the Atlantic Ocean to the south of the country and is therefore warm and moist. It moves inland generally in a southwest to northeast direction.

The tropical continental air mass is developed over the Sahara Desert and therefore is warm and dry and blows in the opposite direction, Northeast to Southwest. The oscillation between these two air masses produces the highly seasonal characteristics of weather conditions in the country. The tropical continental mass is associated with the dry season, and the tropical maritime mass creates the wet season.

-- See fig: for characteristics of prevailing winds.

In June the northerly flow of air component weakens and only the Southerly flow predominates. Being moisture-laden, it brings a lot of rain. In September, the tropical continental begins to intensify over the territory and the North-east trades becomes the dominant wind from October to March bringing with it dry, cloudless but dust-laden conditions associated with the harmathan.

The days are very hot but the cloudlessness means that at night there is a considerable loss of heat by radiation from the earth. The temperature drops sharply often to dew point, giving rise to early morning temperature inversions and to early mist or fog.

This is further complicated by settling dust particles which have the effect of reducing visibility to a few hundred meters.

SUN AND CLOUD COVER The NFCC city site is exposed to 2,500 sunshine hours annually (mabogunje 1977).

During the dry months, the monthly variation in the amount of sunshine follows the general trend of an increase from over 275 hours on the city site. With the approach of rainy season, there is a trend towards increased cloudiness. The decline in sunshine hours with the progress of the rainy season reaches its lowest values in the month of August.

--- See fig. for monthly sunshine variation.

POPULATION ESTIMATION:- The New capital is to have a permanent population of 150,000 persons in residence upon inauguration in 1986. This will be permitted to grow to a maximum population of approximately 3 million, after which population growth will be accommodated in Satellite towns. Population estimates were based on labour force participation relationships for both the formal and informal sectors, headship rates and workers per household typical in Nigeria.

Three key characteristics of the year 2000 population: age/sex distribution; the number of households and the anticipated income distribution

were developed to determine such planning factors as number of housing units required and service facility requirements.

-- See fig.

SUPPORT INFRASTRUCTURE SYSTEM:- Basic support infrastructure systems have been developed to support the functioning of the New capital City. These utility systems - water supply, waste water disposal, drainage, solide waste management, telecommunications, and power -- have been planned in response to the demands of the future population.

5.3. BRIEF AND ORGANIZATION:

The design brief is divided into three distinct but complementary parts that take cognizance of the facilities in the communication, computer and information industries to lend a functional character to the monument.

(a) The interact-core is a five-storey informal space meant to serve as the cultural magnet of the centre, its central objective being to encourage cross - cultural contact as a basis of enhancing national unity and the development of new social relationship and loyalties. It is also an exhibitions fair park capable of hosting the communications computer industries fair in an informal intense park surrounding with stands interlaced with patterned

walkways, refreshment and relaxation areas, sculpture, fountains and exciting landscaping. The play of levels to mirror a staged arena for electronically aided performances.

(b) The facilities core contain the main ingredients of the communications computer and information revolution.

- Electrical communications Laboratories.
(Basic research and practical adaptations)
- Production Facilities
(Test production to be manufactured under Licence by industries)
- Instructional Spaces
Lecture theatres and audio visual Laboratories with special Lighting acoustics and Climatic conditioning for presenting information from remote Locations.
- Computerland
 - Computation
 - Data Bank

Main computation Room will provide any interested group the facility for problem analysis and computer education.

A computerized and electronic data bank will be maintained by the centre and leased out to business,

organizations etc for the purpose of storing and retrieval of information.

Centre will be capable of acquiring information from both local and international data sources and making them available to relevant enquiries.

Computer programming to fill educational and entertainment needs.

(c) The landmark tower houses a meteorological and astronomical research observatory, a Planetarium where the stars glittering in an exact copy of the heavens is projected on a hemispheric screen. A revolving restaurant, terraces for physical observation and Television and Radio transmitting stations.

An egg is always an adventure: It may be different.

--- Oscar Wilde.

Great works of the distant past bear witness to
the efficiency of and power of intuition.

--- Pier Luigi Nervi

The stability of a building is inversely
proportional to the science of the builder.

-- Tredgold

CHAPTER SIX

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MONUMENTALS

6.1	STRUCTURE AND CIRCUMSTANCE.....
6.2	THE DESIGN CONCEPT:.....
6.3	ARCHI - STRUCTURES:

6:1. MONUMENTALIS

STRUCTURE AND CIRCUMSTANCE:

A very tall building serves not only as a focus or background of an immediate street or neighbourhood, but also serves at great distance to punctuate the form of an entire city. It can be an orientation tool and an element in the lasting total perceptual image that each city dweller takes home each night. These psychological picture postcards eventually become the more tangible kind which, when sent, result in a total image of the country conveyed abroad.

CONSIDERATIONS:

(A) GENERAL DESIGN CONSTRAINTS:

- (1) Building regulations and planning Laws
- (2) Intended occupancy. This governs the floor loading and influences the arrangement adopted. In office buildings the division of space between core and perimeter is made with moveable partitions to give maximum flexibility.
- (3) The transport of people is primarily vertical and the provision of a core containing stairs and lifts has a great influence on design. The design of tall buildings only became possible following the development of the electric hoist.

(4) Fire protection of the structural frame is mandatory as is provision of separate fireproof compartments for the lifts and stairs. The building must be able to be evacuated as rapidly as possible. The design must comply with the relevant regulations.

(5) Heating is a necessity and air conditioning is often provided. This requires space between floor slabs and suspended ceilings and in the curtain walls to accomodate ducts and pipes.

(6) The provision of services is an important part of the design that must be considered from the planning stage. Services can be included in prefab wall and floor units during manufacture.

STRUCTURAL DESIGN CONSIDERATIONS

In structural engineering language, a building is defined as tall when the horizontal loading due to wind or seismic loading becomes an important consideration in the design. This is particularly so with modern buildings clad with light curtain walling and using lightweight fire protection and internal partitioning. In these structures there is no great mass of dead loads to provide stability.

The frame must be stiff enough to restrict the deflection to an acceptable value. This is usually limited to $1/500$ of height to prevent sway

causing anxiety to the occupants. This limitation is of prime importance with very tall buildings and has led to the development of special structural forms as the tube type of building.

For tall buildings, erection must be carried out using the building itself. Here core type structures are very suitable as the concrete core can be constructed to full height by slipforming and this can be used to erect the steel work.

All the relevant factors affecting capital costs and operating costs should be considered. These include, the frame, foundation, flooring, cladding, types of partitioning, fire protection, air conditioning, other services, operating cost and maintainance.

6.2. THE DESIGN CONCEPT:

The design concept is the globe representing the earth in rotation on its axis and revolving in an elliptical orbit around the sun as seen from a satellite in universal communication. The structural concept is the suspension of this Geodesic ball at a height that will give it visual characteristic in relation to its surrounding.

The design has three distinct characteristic features.

(1) The monument seats in its own elliptic bowl which serves as the cultural space and magnet per se the faceted levels running laterally across the site created with economy the multi-level sculptured base of the main building. The bowl is a fifteen metre deep excavation created to give some variety and achieve a deep concourse - oriented attraction.

The space is designed as an informal setting for various types of activities such as exhibitions, cultural displays and cross-cultural interaction as a large scale with eating houses and souvenir and memento shopping along the side emporium.

(2) The suspended geosphere is the high point of the design. It is raised some forty-five meters from the concourse level on a cylindrical core which also is a structural frame for lifts and services. To provide stability and give the geosphere structural confidence a ring of six columns rise from the ground arching towards the sphere and making contact at the equator level and giving its structural assistance, then containing its upward movement to support the tower facilities.

The geosphere is a forty-five meter diameter space frame built up of elongated tetrahedra and given the overall shape of sphere.

The basic unit is a rhombus or diamond shaped in plan and triangular in elevation.

The geosphere encloses the maximum of space with a minimum of surface and is the strongest form against internal or radial pressures.

The complexity of interiors reflect special needs of occupants and special privileges of visitors. The centre should be a great fun for the visitors, but not so much fun for the scientists who are trying to concentrate. Therefore the plan is a kind of Labyrinth in which the scientists play hide and seek with the public - and win.

The space seems to be set in ^{motion} as one ascends a spiral stairs that winds up on a five degree diagonal grid leading to exhibition (participatory) areas, theatres and terraces. The interior is simultaneously experienced in many different ways. Each view yields to a more intricate pattern of staggered and overlapping floor levels and indoor areas in a way that expands not only one's vision but the understood relationship of space and time.

(3) The tower facilities is situated two hundred metres above ground level and contains the observatory and meteorological research station a revolving restaurant and a planetarium, a radio and

television receiving station. The height of the tower to the top of the television mast is about 275 meters above ground.

In planning the centre much thought was given to ensuring that it does not become dated. It has to have a futuristic appeal and protected from the ageing process by its special wrap of fantasy.

Modern materials and new techniques are used. Mobile elements that constantly vary the aspect of the building. These mobile elements, changing positions and casting different shadows when acted upon by wind or machinery are the source of new architectural effects.

During night hours, colour and forms are projected on vast surfaces. Such displays could be projected upon buildings for purposes of publicity or propaganda. The building has large plane surfaces planned for this purpose.

Such big animated surfaces planned for this purpose.

Such big animated surfaces with the use of colour and movement offer a new spirit. Elements of nature, such as trees, plants and water would complete the picture.

Monumental architecture is something more than strictly functional.

6.3. ARCHITECTURAL STRUCTURES

A structure can be defined as a body capable of resisting applied loads without any appreciable deformation of one part relative to another.

The function of a structure, therefore, is to transmit forces from one point in space to another, and one of the objects of structural analysis is the determination of the force actions in a structure.

For structural stability the static and dynamic loading of dead, live and wind loads are taken into consideration. In structural engineering parlance, a building is defined as tall when the horizontal loading due to wind or seismic loading becomes an important consideration in design. The structure must be stiff enough to resist deflection to an acceptable value.

The triangle is the plane figure which has maximum rigidity accomplished with least effort, and symmetrical triangular systems provide the most economical energy flow. The geodesic dome is normally a network of triangles, so that the maximum strength and rigidity are obtained with the minimum amount of material. Fuller's domes are local application of a comprehensive system which he calls energetic geometry and which deals with the

most economical relationships of points in universe and their transformation tendencies.

A spherical triangle is a portion of the curved surface of a sphere, formed by the intersection of three great circles. (A great circle has a diameter equal to the diameter of the sphere). If the vertices A,B,C of the triangle are joined by straight lines (chords) a plane triangle is formed and a net work of such triangles can be constructed to form a geodesic dome. The greater the number of triangles, the greater resistance is offered to collapse of the structure.

In the geodesic dome, the strenght of the dome is given entirely by the triangular framework. Light weight roof covering such as thin aluminium sheeting or some form of plastic would not be assumed to contribute towards the strength of the structure. The Kaiser Aluminium dome is a space or 3-D truss which makes use of the roof covering as a stressed skin as well as employing the advantages of the

According to the Kaiser Aluminium Co; the aluminium panels account for approximately 75 per cent of the structural integrity of the space truss'. This system uses diamond-shaped panels of aluminium sheet which incorporates struts along the edges forming integral parts of the diamonds.

(a)

The figure (6) represents a diamond sheet. If this shape is cut from paper or cardboard and then folded along the diagonal OG, a 'bent' diamond results with points A,B. as high corners and points G,O as low corners. Now, referring to figure (a) which represents part of an actual dome, six of these panels are joined together at each low point, eg. O,G, H, etc, by an aluminium gusset, and three panels are joined at each high point by an aluminium hub. Also joining the high points are exterior struts such as AB, BC, CD, etc.

It is to be noted that geodesic domes, although light in weight, are very stiff and rigid. Deflection is not normally a problem as it is with conventional beams and trusses; therefore it is possible to use materials which have low elastic moduli. Aluminium is very suitable for geodesic domes, whereas it would not be practicable in most cases for beams. Plastic, which also have low elastic moduli (ie a small stress produces comparatively large alterations in dimensions), are suitable for geodesic domes because of the great rigidity and freedom from deflection of the domes.

(1) GENERAL DESCRIPTION OF THE GEOSPHERE:

Diameter == 45m.

The sphere in its first state of construction is a spatial steel structure having a network of triangles being as much as possible equal in the surface and being approximate equilateral.

The dome is two separate spherical structures, one inside the other. The inner sphere is composed of about 1,250 structural steel members arranged in typical geodesic form. It contains the deckings and is covered by a waterproof membrane to protect the inner workings. The outer sphere is held 60cm away from the inner core by aluminium hubs and contain aluminium support frames for 750 triangular aluminium panels.

(2) SPATIAL STEEL GRID SYSTEM:

The surface of the spherical segment having a equal dedd load is divided by latitudinal circles in 32 areas and by diagonal bars (60°) in 566 triangles. There are 2929 junctions. The basis polygon is 192-angular. This geometry doesn't lead to continuous meridians the milled heads of the bars are connected by hitching in ring- shaped groves of two disks pressed together by a bolt. The weight of such a juction is only 200g.

Weight of the steel grid system: 9640kp or $=7\text{kp/m}^2$.

PRESCRIPTIONS CONCERNING THE LOADING

1. GRAVITY FORCES:

A = Gravity Loading = dead weight + weight of all attached equipment.

B = In assessing the self weight of the structure, the specific weight of the concrete = 22.5 KN/m^3

It is desirable to minimize the loads brought by permanent fixings.

I = the dead load must be determined on the basis of the actual specific weight of materials. The weight of any attached equipment is added.

2. WIND FORCES:

A = Wind Effect on Tall Buildings

(i) A building significantly taller than its surroundings can experience high wind loads and concentrated pedestrian level winds see fig.

(ii) A tall building concentrates wind at its base. fig.

(iii) A circular building may reduce frame loads and pedestrian winds but increase cladded loads at the points where the wind separates from the building fig.

B. WIND LOADS:

Wind load increases with height in accordance with the factor S_2 for ground roughness, building size and height above ground.

From code the dynamic pressure

$$q = 0.613V_s^2$$

where $V_s = S_1 S_2 S_3$ = design speed

S_1 = topography factor = 1.0

S_3 = statistical factor = 1.0

V = basic wind speed which depends on locations the variation in the factor S_2 . With height for ground roughness 4 and building class C, that is, where either the greatest horizontal or vertical dimension exceeds 50m.

$$\text{wind force} = CqA$$

where C = pressure coefficient and A is area of building surface considered.

Towers of more than 120m height or more than 100m diameter, or towers built at closer groupings, shall be subjected to aero-elastic model testing in wind tunnel, including all adjacent local topographical features, building and other structures.

3. CONSTRUCTIONAL LOADINGS:

B = the design is checked for temporary loadings that occur during construction.

Factors causing temporary loadings may include: barrowing or concrete, scaffolding and formwork, correcting shutter alignment, hoist fixings storage of material on scaffold, temporary access,

tower crane fixings, work temporarily omitted for access purposes.

4. NATURAL FREQUENCY:

The natural frequency is inversely proportional to the size. The larger the tower, the greater the consideration that should be given to design against wind-induced vibration. A finite element method is satisfactory, but for an accurate estimate of the dynamic stress field a segmental integration method is recommended.

The natural frequencies are very sensitive to meridional shape. Meridional curvature is beneficial, but the amount that can be introduced without circumferential prestressing of the foundations is limited.

= the natural frequency should be determined from a dynamic analysis. Alternatively, a chart gives the natural frequency corresponding to the lowest longitudinal mode as a function of the meridional curvature parameter, the height of the tower, the throat radius and the vertical distance between throat and top. The chart is based on the assumption of a shell fixed at the base. Columns reduce the frequency in the range of 10 to 15%.

For the dynamic response, the critical damping factor will be taken as 0.02 for the working state and between 0.02 and 0.04 for the ultimate state.

5. THERMAL FORCES:

A = A linear thermal gradient across the thickness of the shell with no circumferential variation is assumed.

B = consideration is given to the strain resulting from a temperature gradient across the shell thickness, as well as the strain resulting from variations of temperature caused by, for example, sunshine on one side of the tower or partial operation.

I = Circumferential variations of the mean temperature of the shell may be created by different conditions of exposure to the sun.

6. MOISTURE CONTENT:

B = Consideration is given to the strain resulting from moisture content variations through the shell thickness, as well as the strain resulting from variations of moisture content caused by, for example, rain on one side of the tower or partial operation.

7. DIFFERENTIAL SETTLEMENT:

A, I = Differential Settlement of the foundation is considered.

PRESCRIPTION CONCERNING DESIGN

(1) GEOMETRY

A, I = the actual geometric profile, thickness variations and support conditions of the shell should be considered in the structural analysis.

B = Structural studies show that the hyperboloid offers very substantial material economies compared with other shapes.

Most common proportions are:

$$\begin{array}{lll} 1.2 & H/D & 1.55 \text{ and } 0.15 \\ & Zt/H & 0.25. \end{array}$$

(2) SAFETY FACTORS:

I = the design stress created by the load combinations multiplied by load factors & shall not be greater than the design strength f_d . The design strength is obtained by dividing the characteristic strength by a safety factor .

(3) FOUNDATIONS:

B = Under conditions of very high exposure or with very large towers uplift forces may be induced.

The underside of a concrete foundation shall preferably be normal to and symmetrical about the projected centre line of the lowest part of the shell.

(4) A = For wind load, the critical buckling pressure may be estimated from test results; alternatively a buckling analysis for wind forces should be made using the theoretical tower geometry and boundary conditions and including the influence of dead weight.

ANALYSIS:

This type of framed dome is highly redundant and their analysis can be carried out using space frame programme. The standard programmes should be applied only to relatively stiff small domes or double layer domes where deflections are small. The behaviour of flexible domes may be markedly non-linear and the effect of deflection should be taken into account.

Stability: Flexible domes present a stability problem. Three distinct types of buckling can occur in the framed dome. These are;

- (a) General buckling where a larger part of the surface buckles.
- (b) Snap through or local buckling where one loaded node deflects and the dome curvature is reversed between adjacent nodes.
- (c) Member buckling where an individual member buckles as a strut under axial load. This is taken into account in the normal member design.

STRUCTURAL SYSTEMS: The classification into various types is based primarily on the structural form or method adopted to resist horizontal loading.

Concrete shear walls and core are used to provide stability.

DOMES LOADING:

(a) Dead Load: this varies from about 0.5 to 1.0 KN/m^2 of the dome surface area depending on the type of cladding used.

(b) Imposed Load: This is 0.75 KN/m^2 of the plan area in accordance with CP₃. It is necessary to consider cases where the load covers only part of the dome.

(c) Wind Load: The wind loading code gives typical distribution patterns and values of the external pressure coefficients C_{pe} and the lift coefficient C_l for various ratios y/d and h/d . The pressure distribution varies with the wind speed and type of surface. The wind causes uplift over most of the dome surface with a small area of pressure on the windward surface. Values for the coefficient C_{pe} from the above reference are shown in fig..... The total uplift force can be calculated from the lift coefficient.

For a large dome construction of this type, specialist advice must be sought. Wind tunnel tests on models may also be necessary.

(a) FLOORS -- the dead load includes the slab, creed, finish, steel beams, ceiling and services. Dead loads range from 4.7 KN/m^2 depending on the type of construction used and the span of floor slabs.

(b) WALLS -- the weight of external walls are as follows:

Curtain walls 1-0 - 2.0 KN/m^2

Glazing - single and double respectively $0.3 - 0.6 \text{ KN/m}^2$

Cavity brick walls - 254mm thick, plastered one side 5 KN/m^2 . The weight of internal walls depend on the thickness of materials used and type of construction.

Non load bearing walls 100mm thick plastered both sides 2.4 KN/m^2 .

Greeze block -- 2.2 KN/m^2 .

Moveable partitions - allow 1 KN/m^2 of floor area.

IMPOSED LOAD: The imposed load on flat roofs where access is provided is 1.5 KN/m^2 .

The imposed load on floors depends on the occupancy of the building.

Note that heavier loads must be used on floors where filing and storage space is provided or data processing equipment is installed. The loading may be reduced on multi-storey buildings, this is allowed because it is unlikely that all floors will be fully loaded at the same time.

LIFTS:

The loading on a building caused by a lift is carried at the top of the lift shaft on columns or the Reinforced concrete walls in the core. The load consists of the life drive motor controls and machinery, the lift car, counter weight and ropes, etc. The load lifted, that is, people or goods and the inertia loads from starting and stopping. The total loading is expressed as an equivalent dead load which depends on the capacity of the lift. The lift capacity is the net load hoisted expressed as either the number of persons or weight of goods carried, the equivalent dead load includes all the loads hoisted above, except the structural support floor slab and members.

SERVICES:

Other services include lighting, heating, ventilation, air conditioning, water supply for human and industrial use and fire fighting and waste disposal.

Services in floors are included by an appropriate allowance in the floor dead load services in the shaft compartment in the core require supporting at appropriate floor levels. Large items such as water tanks are at the roof level and in intermediate levels in tall buildings. The load depends on the capacity required.

CONCLUSION

The modern life displays its great dynamics. Therefore, it is not by chance that architecture often acquires really dynamic forms to keep pace with the life requirements. Living nature offers reliable and diverse examples of structures transforming in time and space, that are accepted creatively by architects.

In any period of transition, there is always backing and filling and ambiguity. The biologist Lewis Thomas has called ambiguity an essential and indispensable part of the process of discovery. The more important the new information, the greater the sense of strangeness and askewness that it carries with it until such time as the pieces all fit together which is an unending and never completed process.

Sometimes the end scarcely justifies the complexities of the means and sometimes the means is hard to justify at all.

It takes a creative act, not ~~Clever~~ cannibalism to turn a building into art. It must do more than satisfy a roving eye.

UGO NWAKUDU
JUNE, 1983

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PHYSIOGRAPHY



TOPOGRAPHY REPERTED BY
UNPOPULATED TERRAIN. HEIGHT
VARIATIONS AROUND 50 M.
VIEWS ARE SHOCK.

GEOLGIC

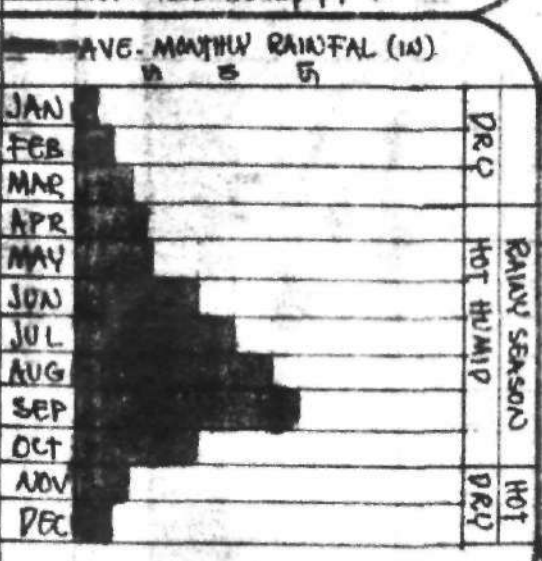
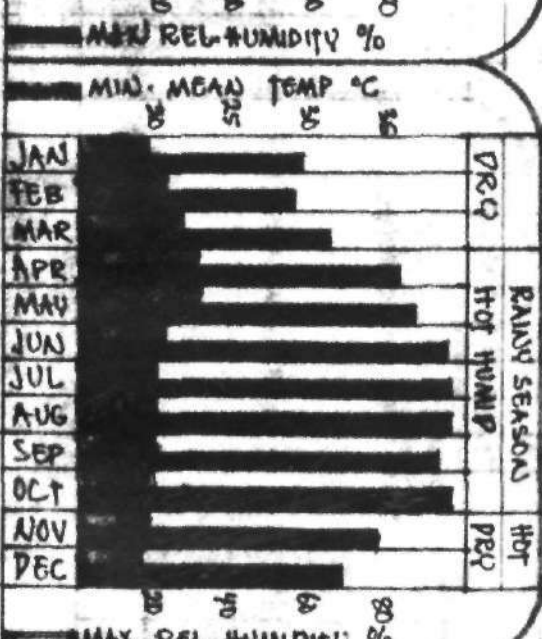
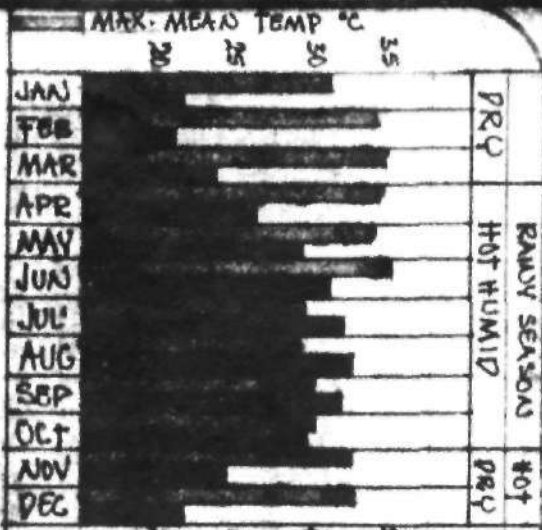


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SOIL



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MEAN MONTHLY TEMPERATURE AND HUMIDITY

FOR RECORDS HIGHEST TEMP. PICTURED DRY SEASON - LOW REL. HUMIDITY.

MEAN MONTHLY RAINFALL

DURATION OF RAINY SEASON - 180-190 D.

Drainage Pattern

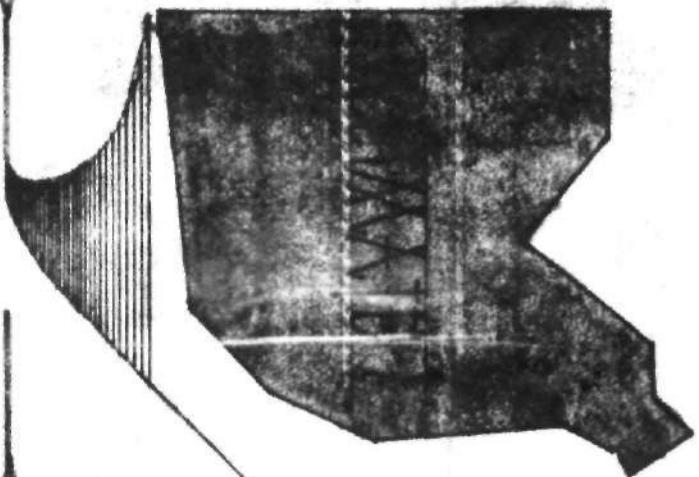


Site can readily be provided with small contiguous water sheds. All converging on one point.

Vegetation



Generally characterized by park savanna. Good value as an aesthetic and recreation resource.



Possible significant air pocket

Abuja Hills



Dry season 5-6 months

Maritime winds



Abuja Hills

Dry air 5-6 months

Tharmattan winds

Abuja Hills

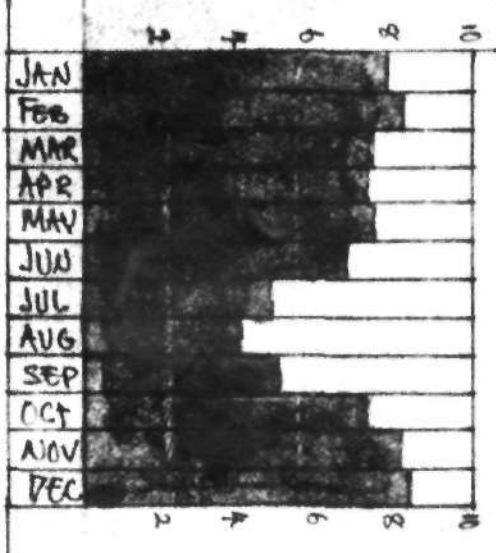
Orographic rain zone



Abuja Hills

Wet season 6-7 months

Mean monthly sunshine duration



Site exposed to 2500 sunshine hours annually.

THE SITE:

MEAN ANNUAL TEMPERATURE: 80°F HUMID: 70%
 FLOODS: HEAVY-TEMP. RISES: DRY SEASON-LOW RE:

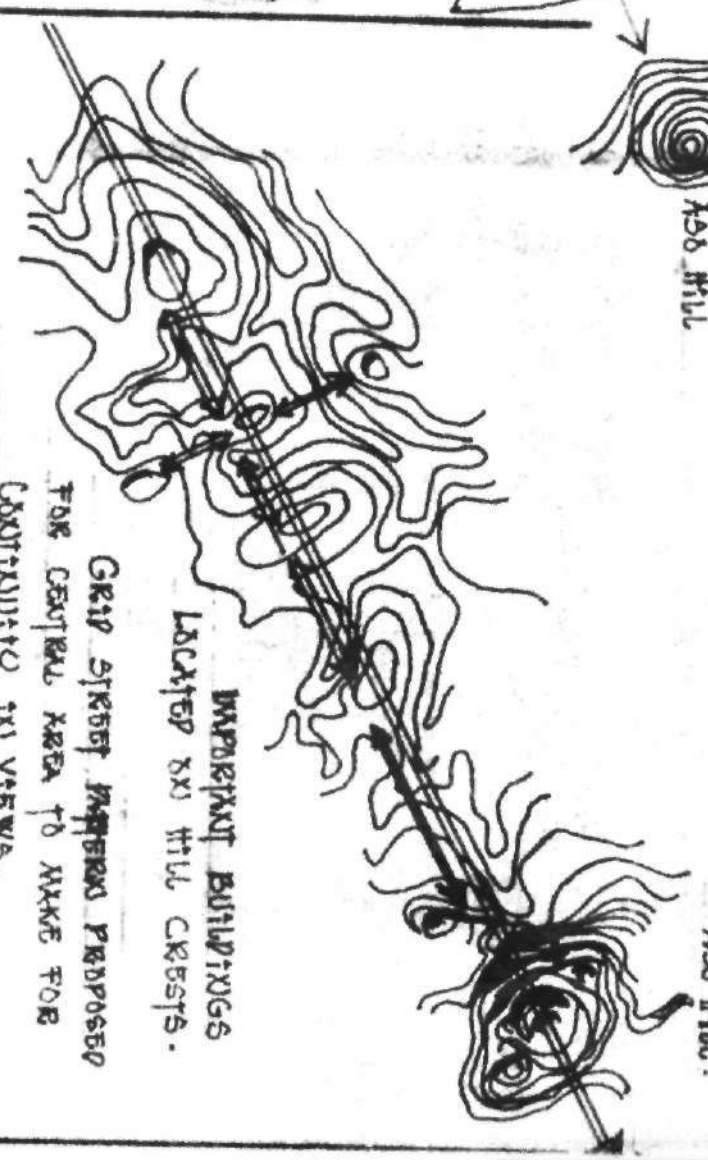
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SPATIAL QUALITIES OF BUILDING TYPES.



550 ft. HILL

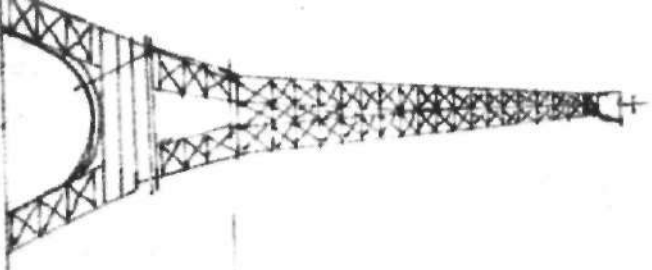


CENTRAL AREA TOPOGRAPHY.

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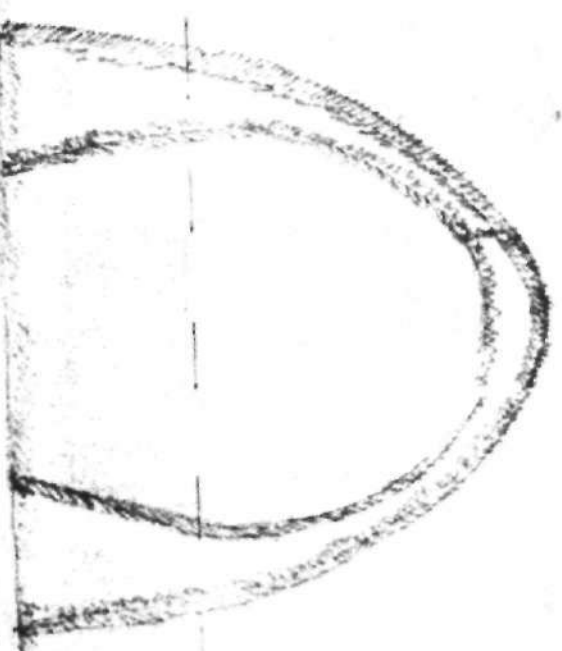
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STRUCTURAL CONTEXT



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PROJECT 2
TOWER



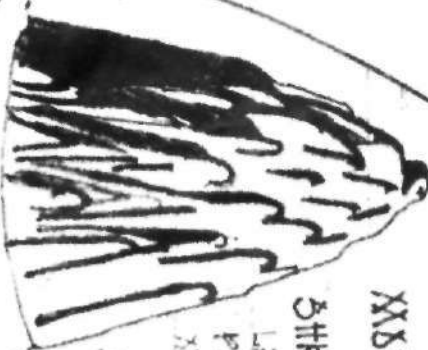
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MONUMENT
 - A big structure, natural or artificial, considered as an object of beauty or of interest as a work of the past, especially historic and especially futuristic.
 - In architecture, the aspect of monumentalism stands out in the idea of buildings. MONUMENT.

ARCHITECTURE
 is
MONUMENT
 DEFINITION:
 LARGES CONCRETE PLANNING → MONUMENTAL PERFORMANCES
 NOT ARCHITECTURAL MONUMENT.

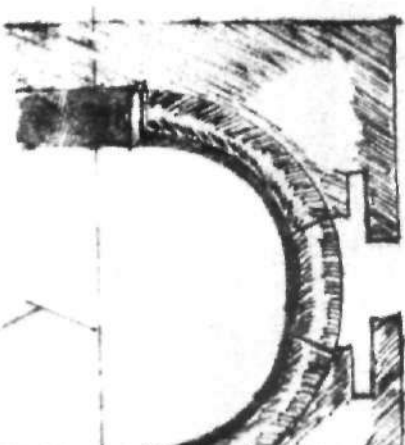


MONUMENT
Architecture
 THE PYRAMID OF ZOSER, GIZA, EGYPT.
 THE FIRST MAJOR EXAMPLE OF MONUMENTAL DESIGN AND PLANNING.
 ARCHITECT → MONUMENT



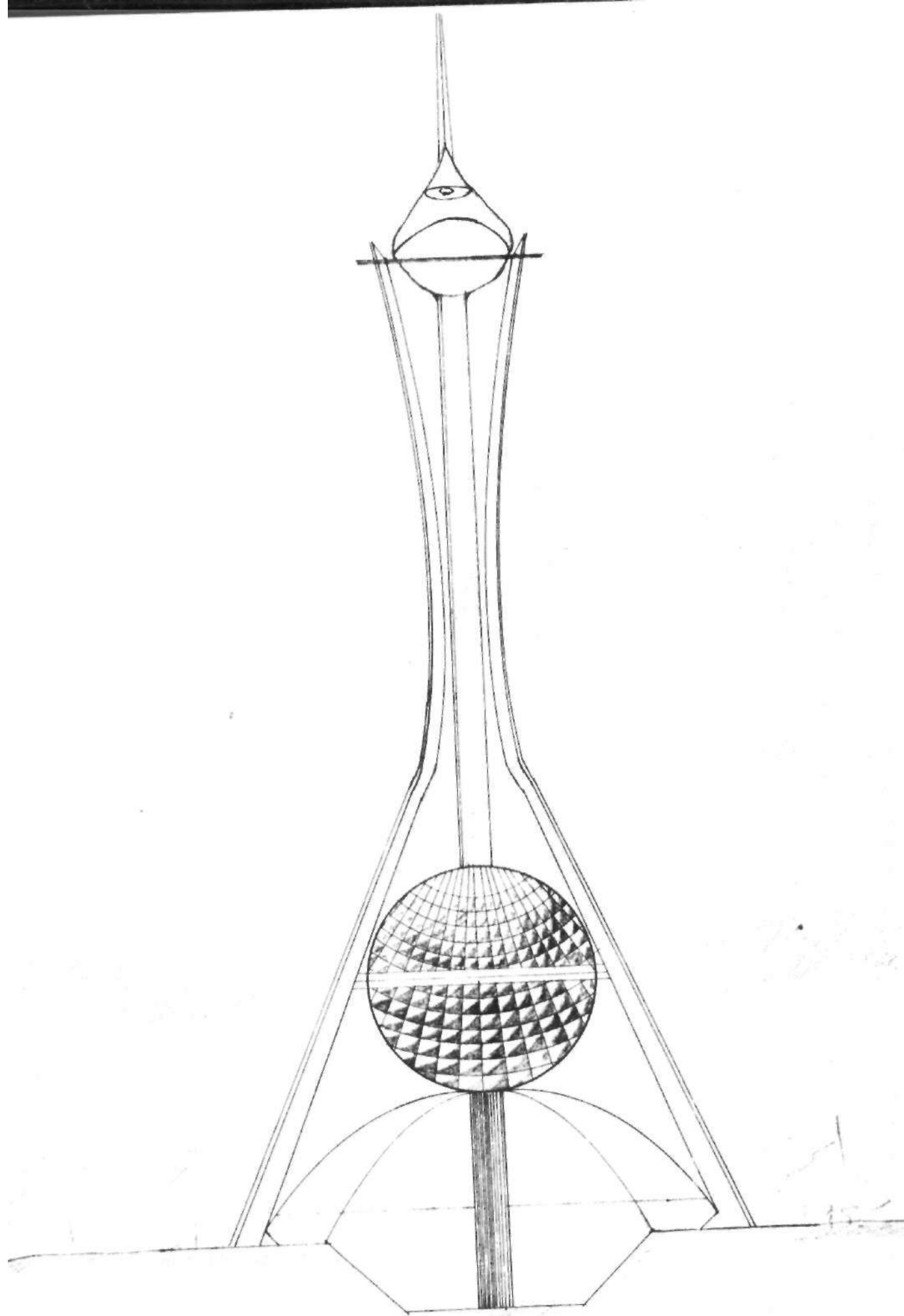
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MONUMENTALITY
HISTORICAL CONTEXT
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 At HELIOPOLIS, EGYPT
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 IS THE SUBST.

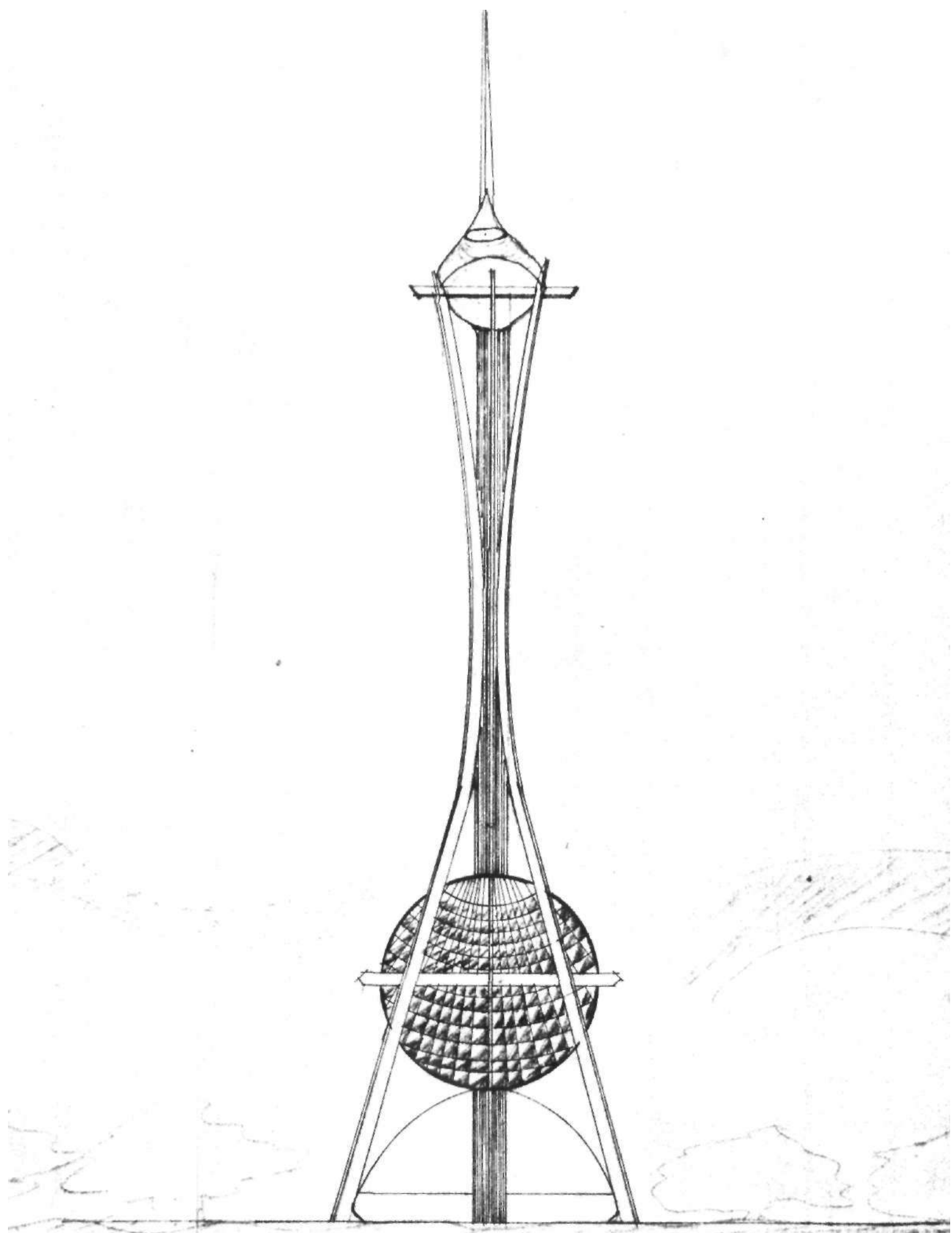



THIRTEENTH / EIGHTEENTH CENTURY AD.
 PROVED 1st CENTURY AD.
 THE USE OF THE DOME-CROWN ARCH STRUCTURED MONUMENTALITY FROM EGYPT

TOWARDS THE MONUMENTALITY



MAXIMUM HEIGHT 280 m.



TOWERING MONUMENTALIS (280m)