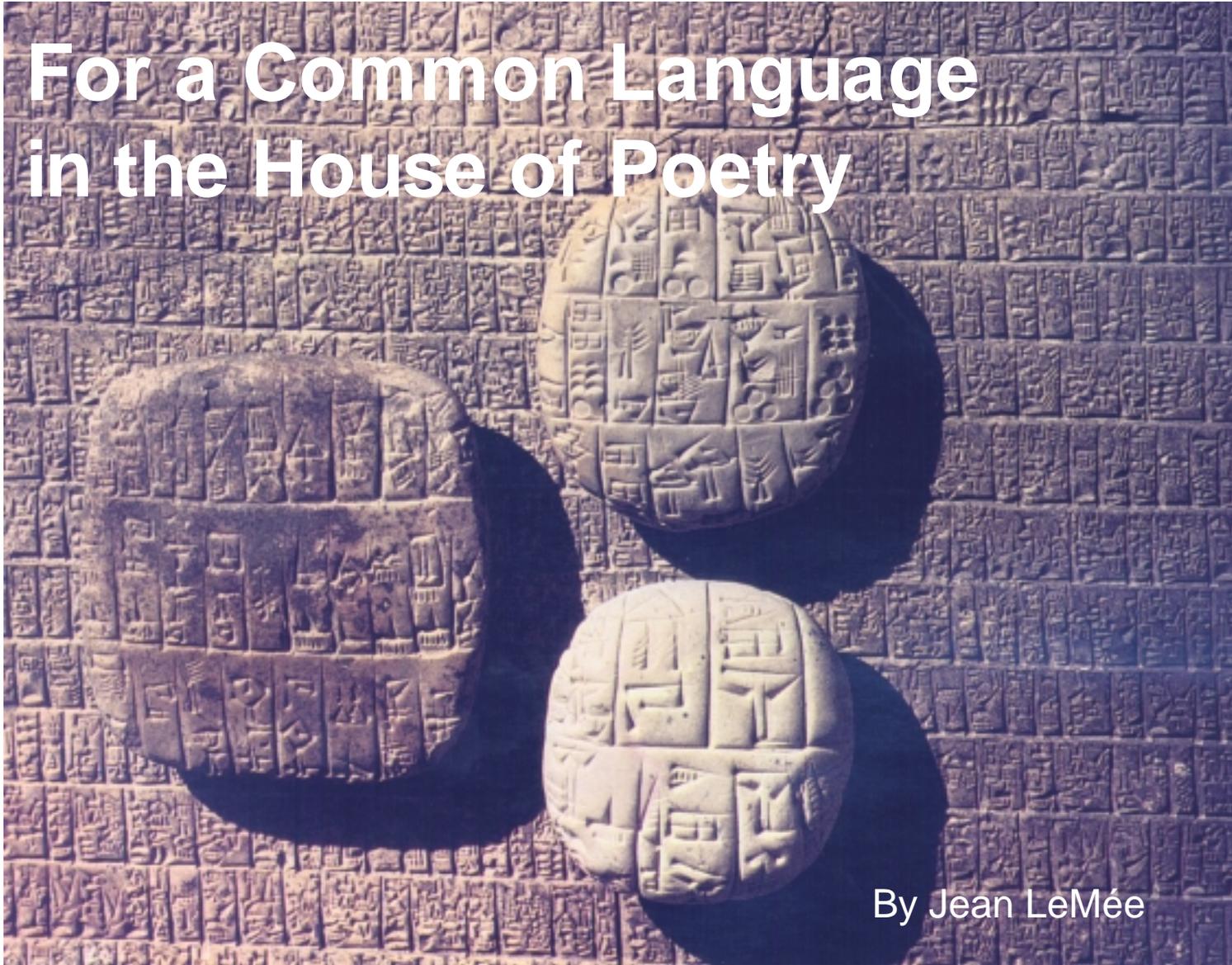# For a Common Language in the House of Poetry

By Jean LeMée

FOR A COMMON LANGUAGE

IN THE HOUSE OF POETRY

by
Jean Le Mée

Contents

ACKNOWLEDGMENTS

PREFACE

The title "The House of Poetry" was that adopted for an exciting Leo Leonni Seminar offered for a couple of years in 1995 and 1996 to a small group of students at the Cooper Union (eight from each of the schools of engineering, art and architecture each year). Faculty and speakers from the three schools and from the faculty of Humanities and Social Science collaborated in the design and implementation of the seminar. Each year I presented a couple of lectures in these seminars in addition to those presented in my course on Design Illusion and Reality (EID 111). This last course, which I have taught regularly over the last 25 years, has a similar goal of bringing together students from the three schools to work collaboratively on various projects. The present opuscule is a compilation of lecture notes that have been used on these occasions, organized in a more unified and systematic way than had been possible before. The slide presentation format and the terse and at times perhaps even cryptic wording have been retained from the lecture notes. This permits a quick glance at the material but is also an invitation to reflection and argumentation between pages on a page-to-page reading as it would in an oral presentation.

The format is therefore flexible and allows for private musings as well as for classroom presentations. In the latter any order or selection seen fit by instructors can be followed to suit their needs. On the other hand if a more systematic, reasoned approach with time for discussion is desired, the order of presentation suggested here may be helpful. It may easily provide material for four sessions, grouping sections 1 to 4; 5 to 8; 9 to 11 and 12 to 14 respectively together. The material is obviously more in the nature of an appetizer than a main dish on the nature of design. It will suggest no doubt plenty of additional material to the instructors and may serve as a framework to provide concurring and opposing ideas and experiences to come in lively debate. Its purpose is to introduce students of engineering in particular but also of architecture and art, to a wider concept of design than they may generally meet in their more specialized courses. It is an effort to widen their horizon and help them see design in places where they might not expect it, as well as to frame it within a more philosophical and poetic context than they may be used to.

The argument is made for the commonality of the creative process and the recognition that techniques, traditions, habits and jargons peculiar to a discipline are but techniques, traditions, habits and jargons. However useful, they ought not to hide the profound unity underlying them: The common language in The House of Poetry.

1. A COMMON HOUSE

Bringing Architecture, Art, Engineering, Science, and the Humanities Together

Artists, architects, engineers, scientists, humanists, want to comprehend and apprehend reality, however conceived, and re-express it to form it, re-form it and shape it according to their own inner necessity in response to perceived needs. It is a living, breathing, process of inspiration and expiration in which something always dies with the expiration but something is always reborn from the inspiration.

Comprehension and apprehension imply reaching, embracing, grasping, getting hold of some external entities, be they physical, emotional, intellectual or spiritual. Especially for artists, architects and engineers, part at least of their inner necessity is that

"irresistible urge to make things"

as Leo Lionni put it.

But beyond or behind "making things" is the idea.

The idea may manifest itself into "The Thing" …

Or "something" else.

"The idea is prior to the thing" said Kepler

or as Emerson put it:

"The ancestor of every action is a thought"

It is here, at the origin, that not only

Artists, Architects, Engineers meet but also Humanists and Scientists.

This origin is the "House of Poetry."

A house is a structure serving as a dwelling

i.e. a resting place, a place of renewal,

a place for being.

Outside the house we DO, inside, we ARE.

"Poetry" as a word, and its cognates "poesy," "poem," "poet"

are related to the Greek *poiesis*.

Poiesis = "a making," a "creation"

From the verb *poiein*: "to make," "to create"

As indeed "Maker," the anglo-scottish word for Poet, still bear witness.

Therefore, in the beginning, any true maker is a poet.

"As a trained racing horse gathering momentum

Such is the carpenter pondering his project

Such was I channeling this hymn's inspiration."

-- says Vishvamitra, the Vedic seer of Hymn III-38

in the Rig-Veda, circa 1500 B.C.

अ॒ग्निमी॑ळे पु॒रोहि॑तं य॒ज्ञस्य॑ दे॒वमृत्विज॑म् ।
होता॑रं रत्नधात॑मम् ॥१॥

अ॒ग्निः पूर्वे॑भिॠषि॑भिरीड्यो॒ नूत॑नैरु॒त ।
स दे॒वाँ एह व॑क्षति ॥२॥

५ अ॒ग्निना॑ र॒यिम॑श्नव॒त्पोष॑मे॒व दि॒वेदि॑वे ।
य॒शसं॑ वी॒रव॑त्तमम् ॥३॥

अग्ने॒ यं य॒ज्ञम॑ध्व॒रं वि॒श्वतः॑ परि॒भूरसि॑ ।
स इद्दे॒वेषु॑ गच्छति ॥४॥

अ॒ग्निर्होता॑ क॒विक्र॑तुः स॒त्यश्चि॒त्रश्र॑वस्तमः ।
१० दे॒वो दे॒वेभि॒रा ग॑मत् ॥५॥

यद॒ङ्ग दा॒शुषे॒ त्वमग्ने॑ भ॒द्रं क॑रि॒ष्यसि॑ ।
तवेत्तत्स॒त्यम॑ङ्गिरः ॥६॥

उप॑ त्वाग्ने दि॒वेदि॑वे॒ दोषा॑वस्त॒र्धि॒या व॒यम् ।
नमो॒ भरं॑त॒ एम॑सि ॥७॥

१५ राज॑न्तमध्व॒राणां॑ गो॒पामृत॑स्य॒ दीदि॑विम् ।
वर्ध॑मानं॒ स्वे दमे॑ ॥८॥

स नः॑ पि॒तेव॑ सू॒नवे॒ऽग्ने॑ सूपाय॒नो भ॑व ।
सच॑स्वा नः स्व॒स्तये॑ ॥९॥

The First Hymn of the Rig Veda, 1500 B.C.

Sanskrit Reader, Charles Rockwell Lanman

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HYMN XXXVIII. *Indra.*

1. HASTING like some strong courser good at drawing, a thought have I imagined like a workman.
   Pondering what is dearest and most noble, I long to see the sages full of wisdom.

2. Ask of the sages' mighty generations: firm-minded and devout they framed the heaven.
   These are thy heart-sought strengthening directions, and they have come to be sky's upholders.

3. Assuming in this world mysterious natures, they decked the heaven and earth for high dominion,
   Measured with measures, fixed their broad expanses, set the great worlds apart held firm for safety.

4. Even as he mounted up they all adorned him: self-luminous he travels clothed in splendour.
   That is the Bull's, the Asura's mighty figure: he, omniform, hath reached the eternal waters.

5. First the more ancient Bull engendered offspring: these are his many draughts that lent him vigour.
   From days of old ye Kings, two Sons of Heaven, by hymns of sacrifice have won dominion.

6. Three seats ye Sovrans, in the Holy synod, many, yea, all, ye honour with your presence.

॥३८॥ अभि तष्टेऽव दीधय मनीषां अत्यं न वाजी सुधुरं जिहानः अभि प्रियाणि ममृशत परांणि कवीन इच्छामि सं- दृशे सुमेधाः ॥१॥ इना उत पृच्छ जनिम कवीनां मनःधृतः सुकृतः तक्षत द्या इमाः ऊं ते प्रस्यः वर्धमानाः मनःवाताः अर्धं नु धर्मणि गमन् ॥२॥ नि सीं इत् अर्घ गुह्या दधानाः उत क्षा- याय रोदसी सं अंजन सं मात्राभिः ममिरे येमुः उर्वी अंतरिक्ष मही

Hymn 38 of the Rig Veda

R.T.H. Griffith (1889)

Sanskrit verse 1 & 2

Hymns of the Rig Veda, Chowkhamba Sanskrit Series

And closer to us, Robert Fulton, of

Steam boat memory, graphic artist, painter

And engineer writes:
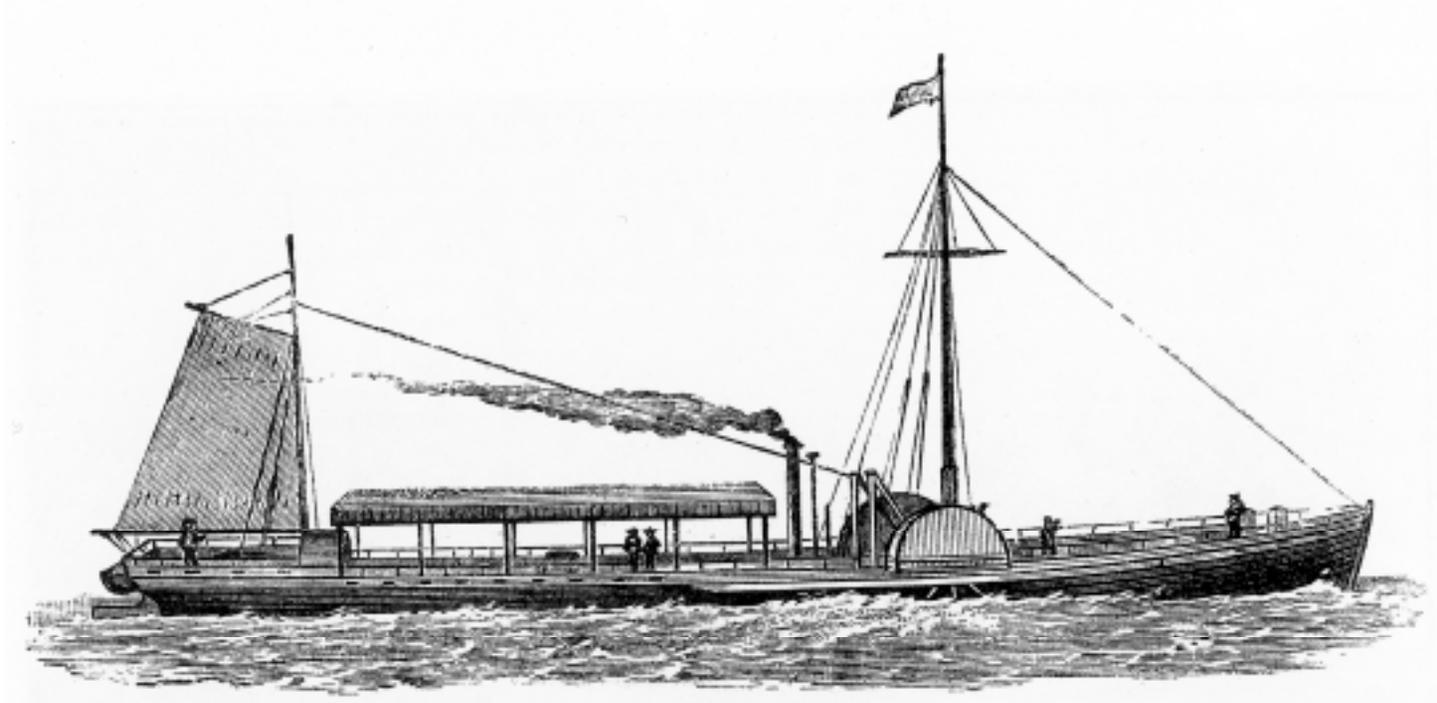
The *Clermont*, Robert Fulton's steamship

The Tradition of Technology, Leonard C. Bruno

Robert Fulton

Inventors, Philip Gengembre Hubert

12

"The mechanics should sit down among levers, screws, wedges, wheels, etc…Like a poet among letters of the alphabet, considering them as the exhibition of his thoughts, in which a new arrangement transmits a new Idea to the world."
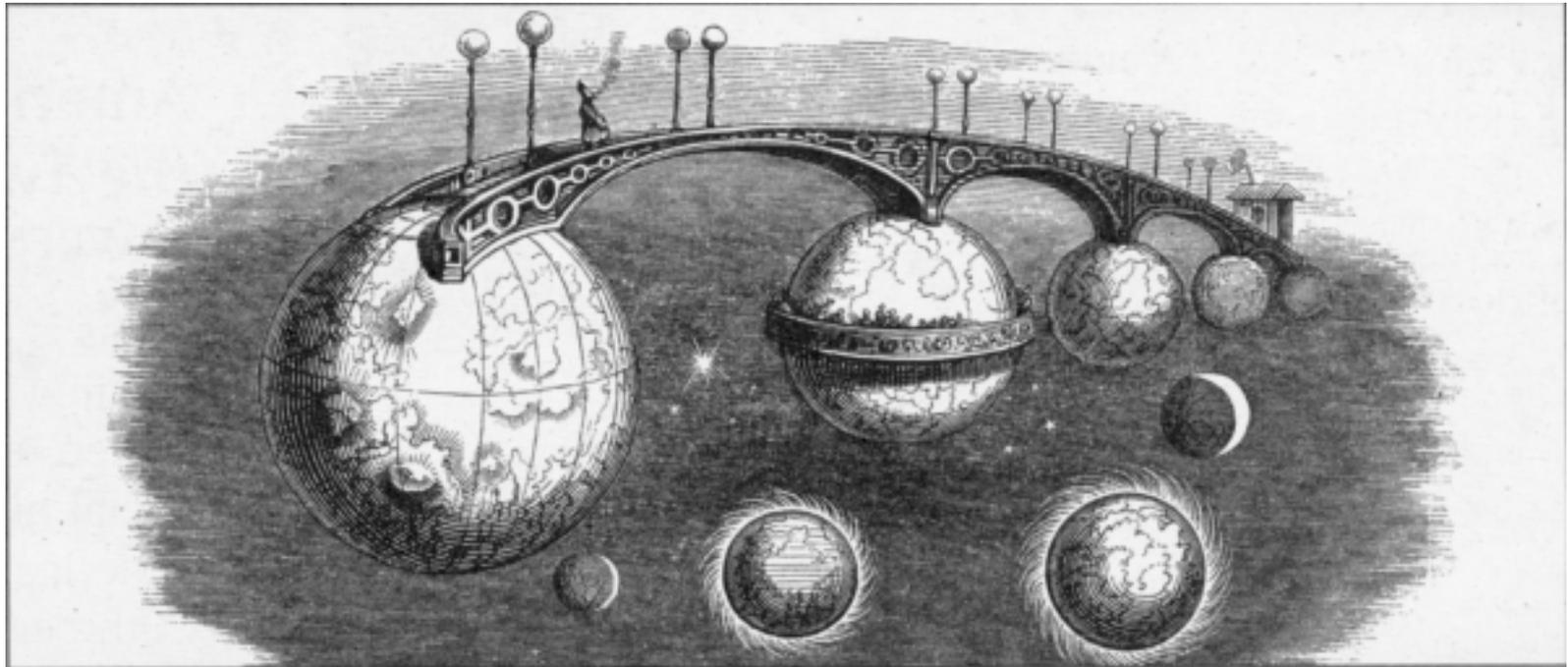
Bridges to other worlds
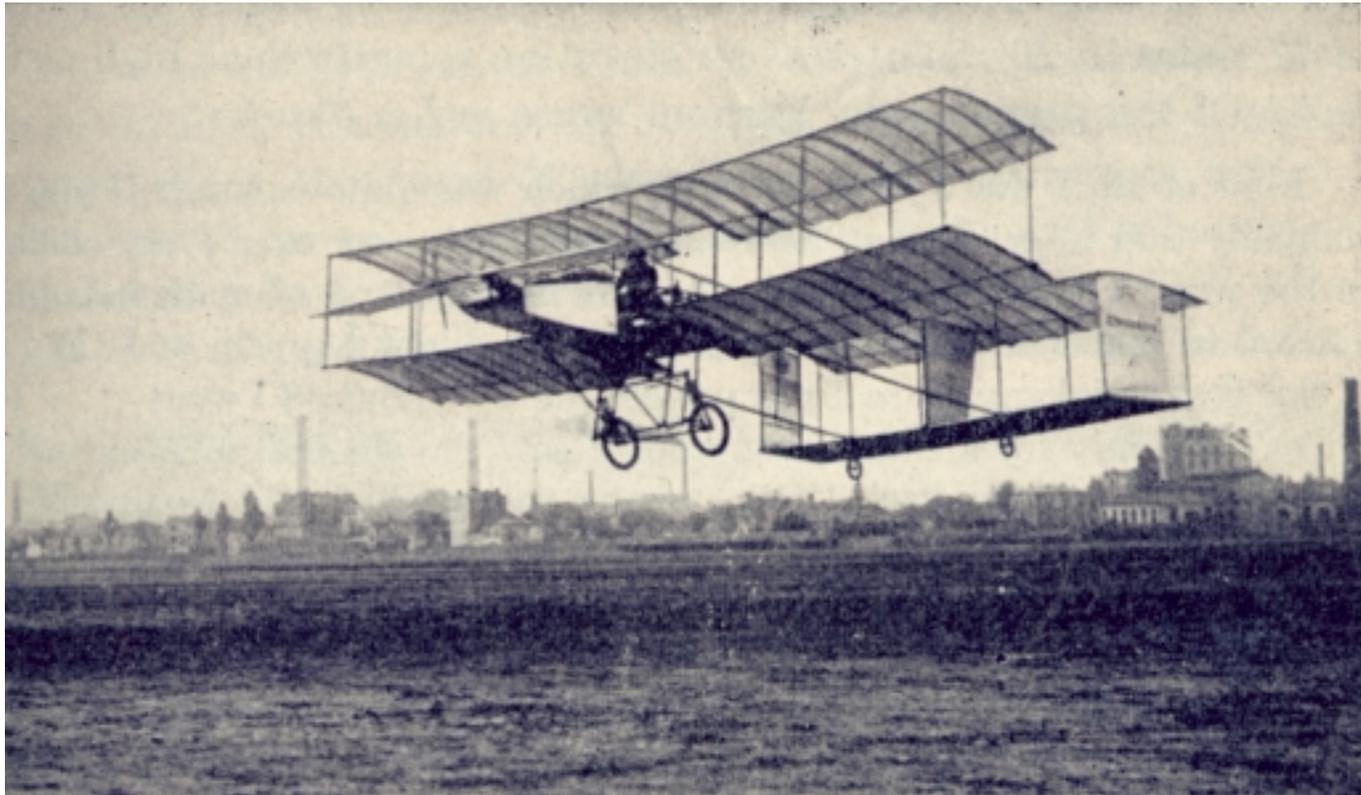
A Voisin Plane of 1907

History of Aircraft, F. Alexander Magoun

2. WHAT SEPARATES THEM?

If Architecture, Art, Engineering were Poetry

to start with

what separates them now?

A Long History

And a failure of memory.

A failure of memory caused by absorption

Into surface details through an attention scattered in diversity

rather than centered into unity.

A Long History that goes back to ancient Greece

And beyond and forward to modern times.

A dichotomy between:

Liberal Arts and Servile Arts in the ancient world

University and Workshop cultures in the Renaissance

Fine Arts and Mechanical Arts in the Industrial Revolution and its sequels.

And an ever increasing and desiccating specialization

The Servile Arts of antiquity became the Fine and the Mechanical Arts of Later

Centuries. Leonardo emancipates painting: "The painter may work in finery

listening to music, the sculptor (engineer or architect) listens to the sounds of

hammers."

In the 17th Century, Academy and School of fine Arts are founded for

Painting, Sculpture and Architecture.

The 18th and 19th centuries see the first modern schools of engineering in Paris:

Civil Engineering (1743)

Mines (1747)

Polytechnique (1794)

Manufacturing (1828)

These schools establish the fine and mechanical arts on a

firm theoretical basis. But, by their practical orientation,

their very purpose to teach *how to do* and *make* "things,"

they establish themselves in contradistinction to the Universities.

And even, when later in the UK and the US they are founded within

Universities, they will remain to our days peripheral to the core concerns

of the Universities and divided more and more deeply among themselves.

3. WHAT BRINGS THEM TOGETHER?

Being so separated, what brings Architecture, Art, Engineering,

Science and the Humanities together?

A Long History

And a common activity – Design.
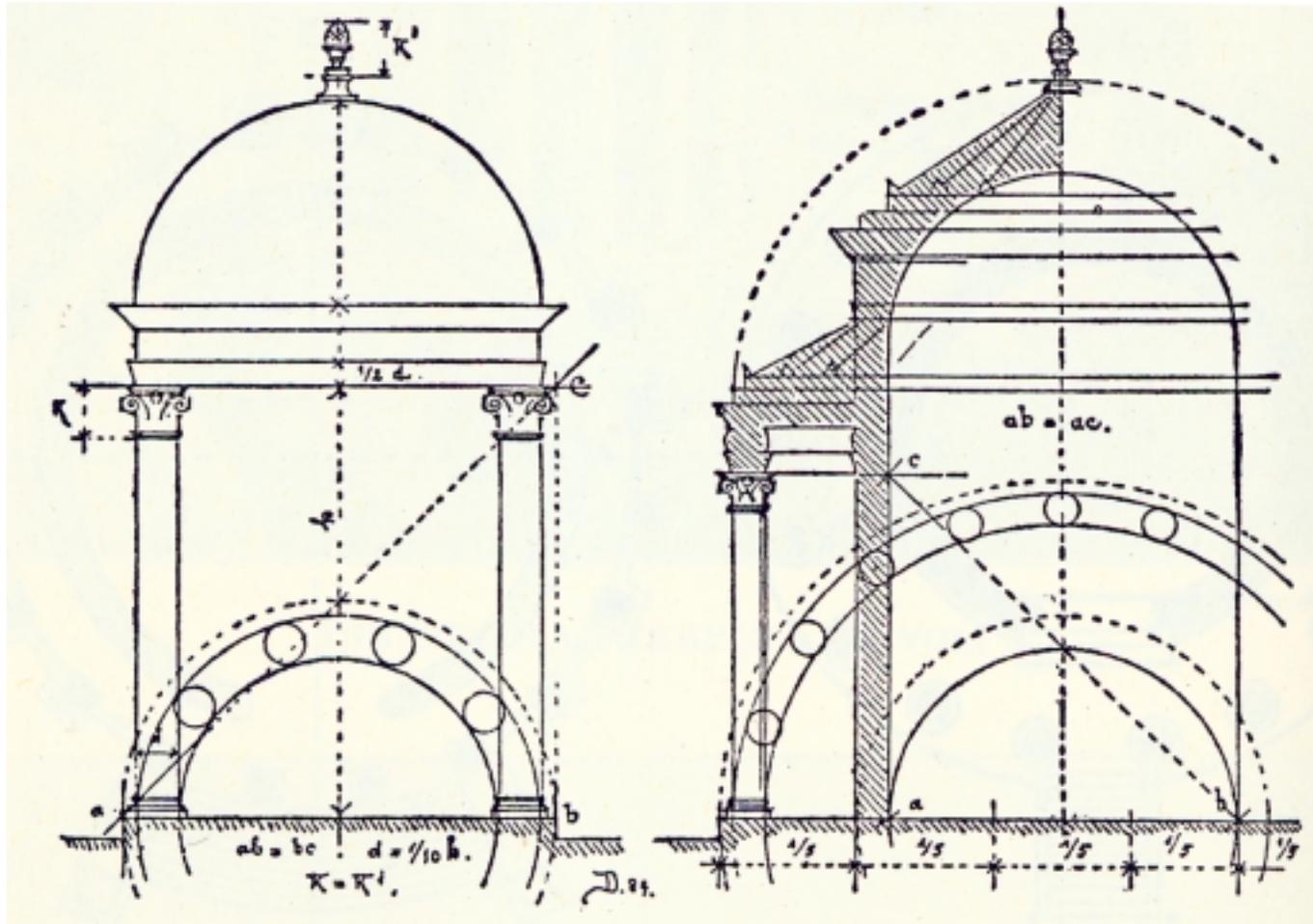
The circular temple according to Vitruvius

The Ten Books on Architecture, Vitruvius Pollio, p 126

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One of the earliest Architects on record,

Vitruvius (First Century B.C.E.) states:

"The architect should be equipped with knowledge

of many branches of study and various kinds of learning…

This knowledge is the child of practice and theory."

Note that for Vitruvius and up to well past the Renaissance architectural and

engineering work are but facets of the same activity. The man who plans the

building also plans the machinery for erecting it and is responsible for its

operation. The man who builds the aqueducts also tunes the ballistae.

Brunelleschi designs and builds the dome in Florence but also the machinery to

raise stones, materials and men where the work is to be done.
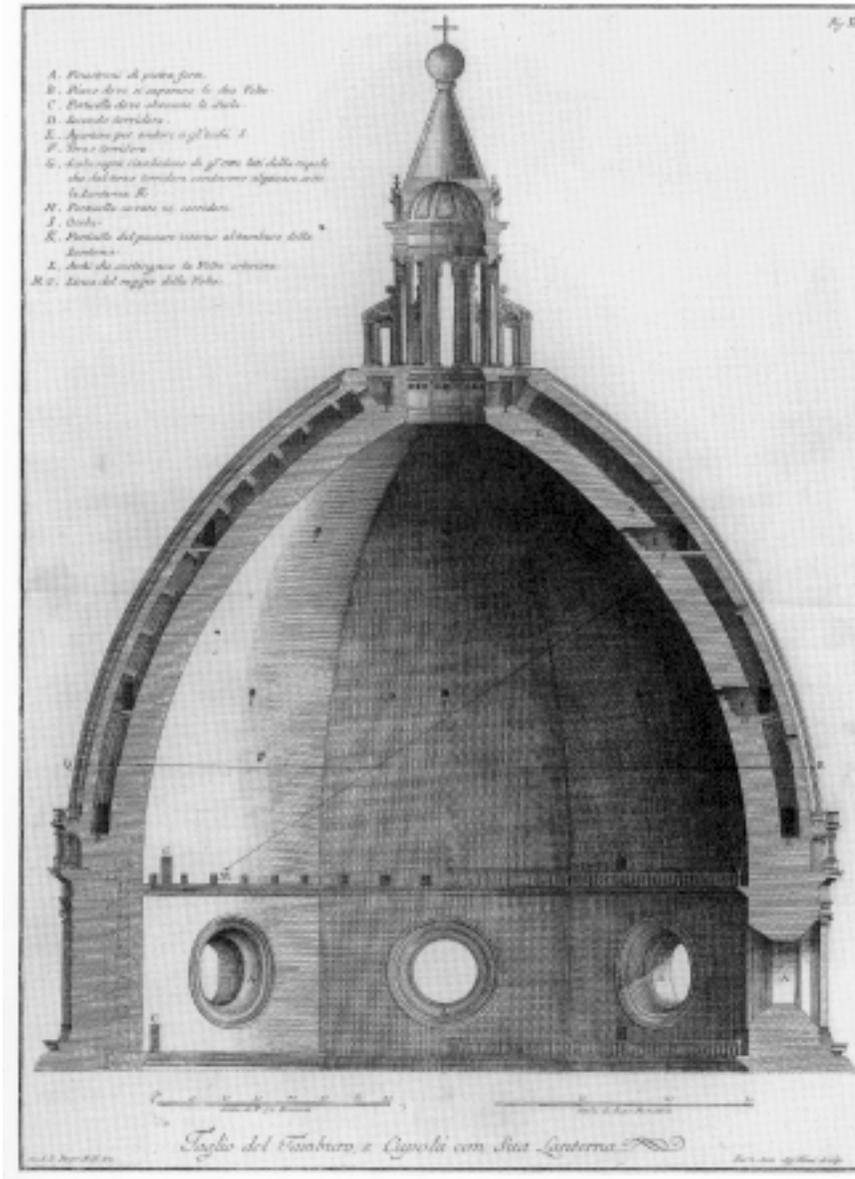
Cross-section of Filippo Brunelleschi's Santa Maria de Fiore Cathedral

The Tradition of Technology, Leonard C. Bruno

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Vitruvius goes on to say that:

"*Practice*" is the continuous and regular exercise of employment where manual

work is done with any necessary material according to the design of the drawing.

Theory, on the other hand, is the ability to demonstrate and explain the

productions of dexterity on the principles of proportion."

An early semiologist, he pursues:

"In all matters there are these two points – the thing signified, and that which gives it its significance. That which is signified is the subject of which we may be speaking; and that which gives significance is a demonstration on scientific principles."
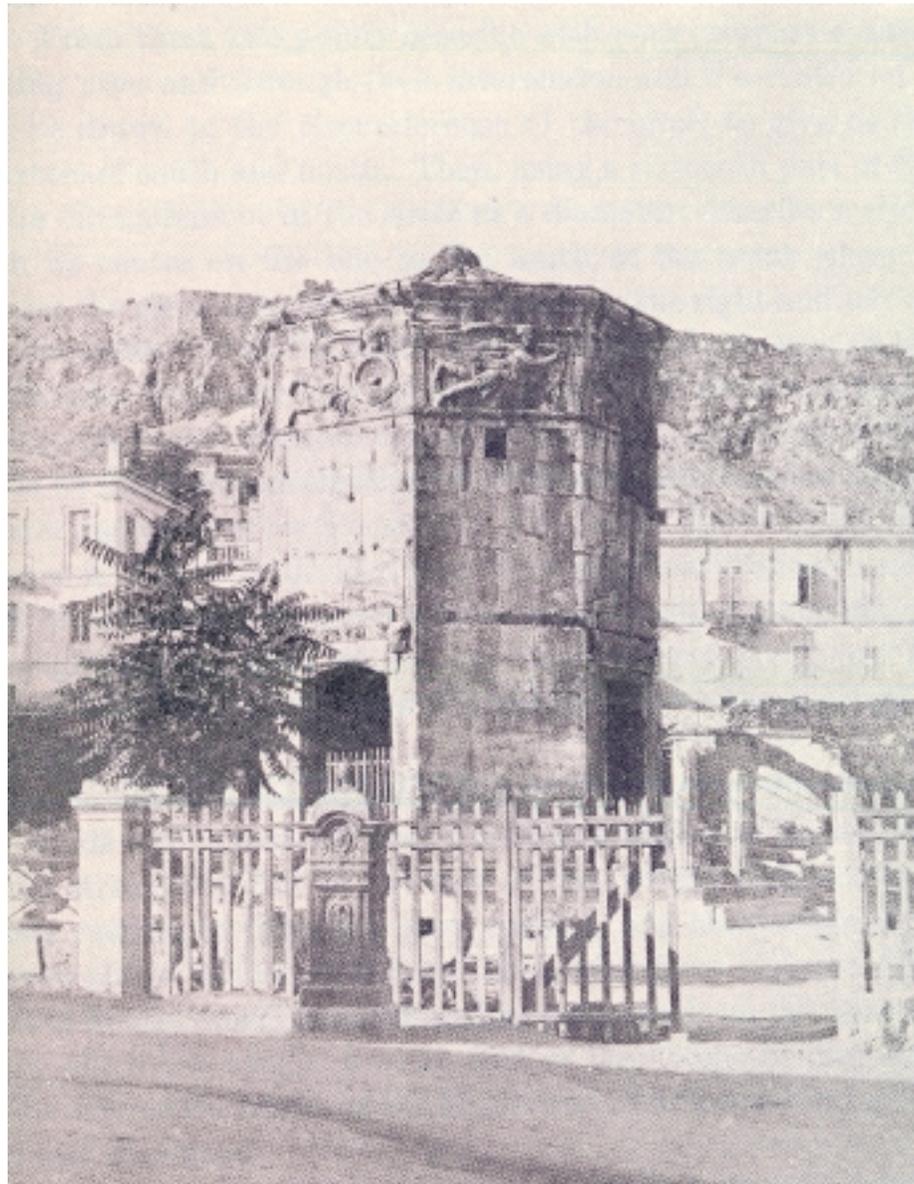
Tower of the Winds at Athens

The Ten Books on Architecture, Vitruvius Pollio, p 26

As to what the architect should know, Vitruvius says:

"Let him be educated, skillful with the pencil (so that he can readily make sketches to show the appearance of the works he proposes), instructed in geometry (and optics), know much history, have followed the philosophers with attention, understand music (to tune ballistae and design theatres), have some knowledge of medicine (to select healthy sites), know the opinions of the jurists, and be acquainted with astronomy and the theory of the heavens (to orient his works).

And, like a proponent of modern integrative education, he adds:

"The observation that all studies have a common bond of union and intercourse with one another will lead to the belief that this can easily be realized. For a liberal education forms, as it were, a single body made up of these members."
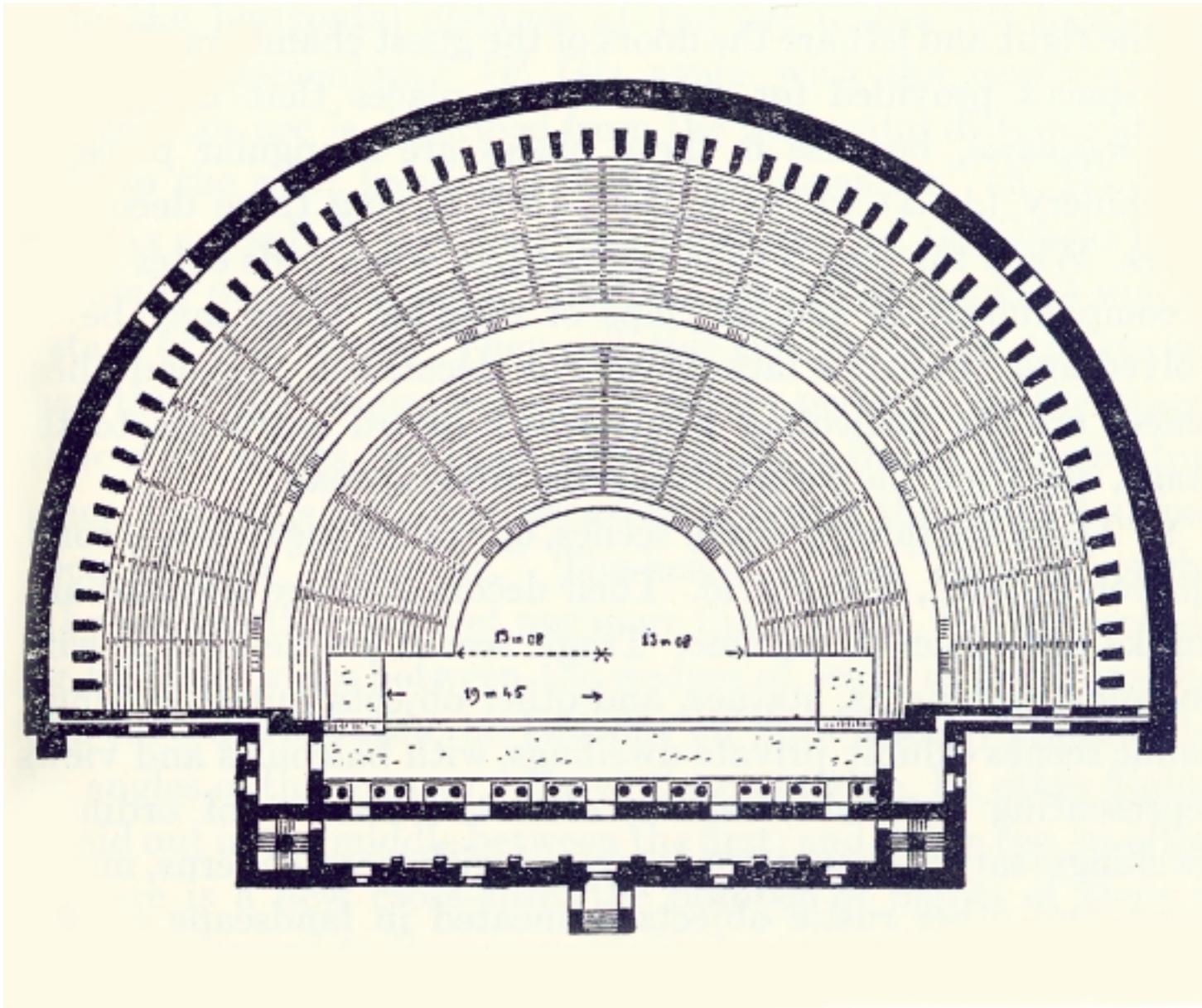
Theatre of Aspendus

The Ten Books on Architecture, Vitruvius Pollio, p 149

To Vitruvius, the architect ought to know something of the art and science of the philologist (word derivation, grammar, and language). Of the musician, the painter, the sculptor, the physician, and other sciences (arithmetic, in particular).

However, with the onset of the Dark Ages, the building arts as well as the Liberal

Arts went into decline. They were kept as embers under the ashes by the

monastic orders whose motto *Ora et labora*, "Prayer and work," honored the work

of the mind,

the heart and the hand.

It led eventually to the Carolingian renaissance of the 9th century, with its

Romanesque revival and ultimately to the outburst of creativity and learning of

the 12th century with the birth of the Gothic.
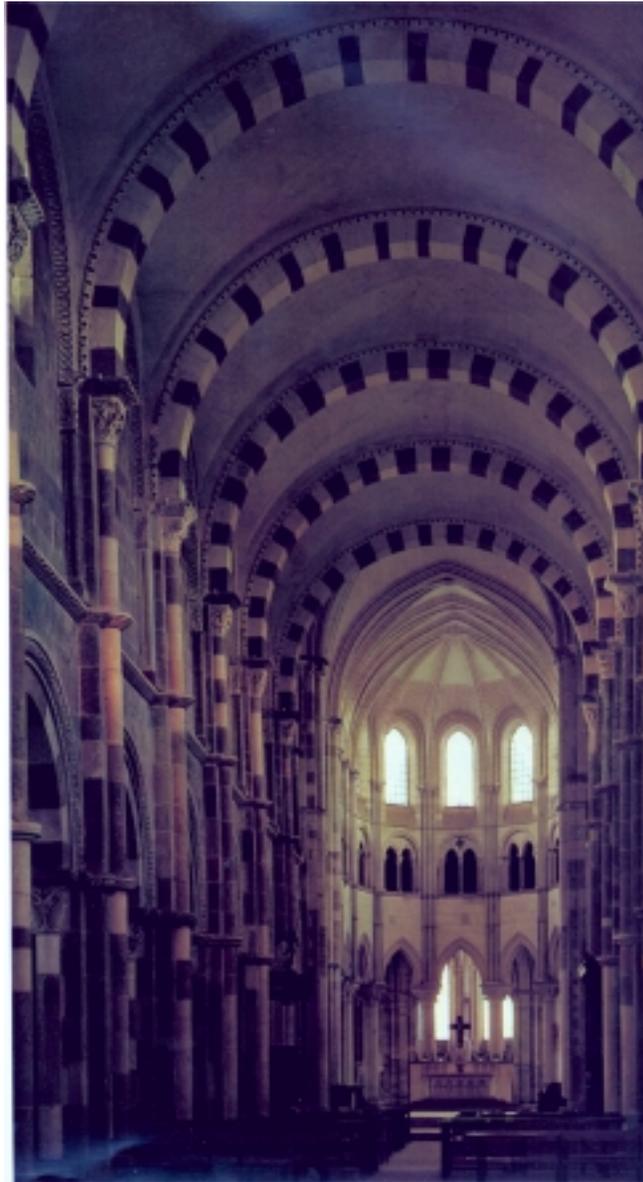
St. Madeleine Church, Vezelay (Yonne), from 1120

The Flowering of the Middle Ages, Joans Evans (Ed.)

Here Liberal Arts (the trivium of grammar, rhetoric and dialectic and the quadrivium of arithmetic, geometry, music and astronomy) together with the disciplines of civil and canon law, medicine, philosophy and theology inspired and guided the practical arts of erecting and decorating buildings, of devising machinery from cranes to clocks. Though few names have come down to us, that of the monk Hildouard, the architect of Chartres, Libergier, the master builder of St. Nicaise in Rheims and Villard de Honnecourt, architect and notebook writer remains with us.
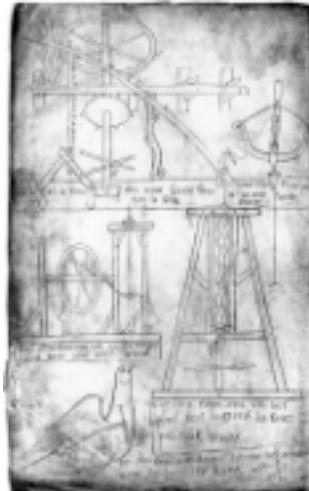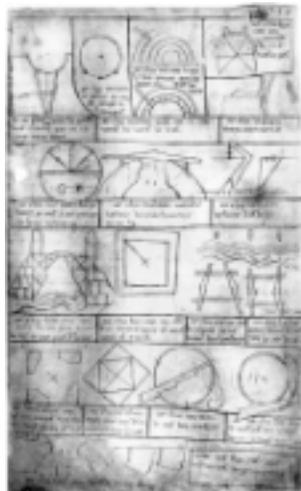
Excerpts from the notebook of Villard de Honnecourt, c. 1230 – 35

Villard de Honnecourt--the artist and his drawings, Carl F. Barnes, Jr

But it was Filippo Brunelleschi (1377-1446) designer of the dome of the Cathedral of Florence, the inventor of perspective, and grantee of the first patent (in 1421 by the Florence City Council for a hoist) who, more than anyone in the Renaissance, was truly the architect of the union of art, architecture, engineering and of historical studies.

The latter he undertook to analyze ancient monuments.

Leon Battista Alberti (1404-72) was perhaps the first, however, to bring together

university education with the technical training. A doctor of canon and civil law

from the University of Bologna and a member of the Roman Curia, he became

extremely interested in mathematics while a student, and came under the

influence of the mathematician-engineer-geographer-physician Paolo Toscanelli.

According to Vasari, his first biographer,

"[Alberti] was an accomplished mathematician and geometrician and he wrote in Latin a work on architecture, in ten books: *De Re aedificatoria;* he left a work on painting in three books: *De pictura* (in which he set out the new method, first formulated by Brunelleschi, of constructing three-dimensional space on two-dimensional plane by the use of monocular perspective). Alberti also composed a treatise on traction and the rules for calculating heights, as well as the four books on the *vita civile (Della Famiglia)* and some erotic works in prose and verse."

Architecture, Painting, Engineering, Sociology, Law, Poetry:

what better guest could we have in our house of poetry than Leon Battista

Alberti?

It is perhaps in him that we see best what unites all these disciplines together,

what their common ground is, namely, Design.

4. A FIRST OVERVIEW OF THE DESIGN PROCESS

DE-SIGN

(out)   (cut) $<$ $\sqrt{SEK}$ (cut, split)

To cut out (physically)

SCIENCE

$< \sqrt{\text{SEK}}$ (cut, split)

To cut out (mentally), separate one thing from another, discern, discriminate
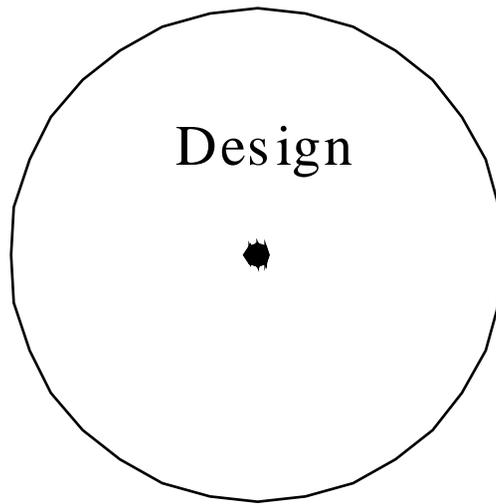
Design

Design is an activity

Design

•
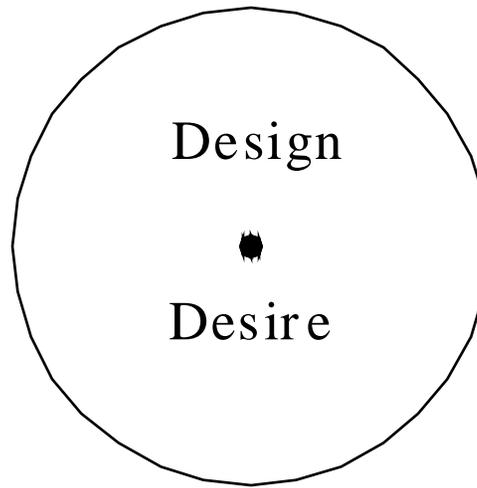
Desire

springing out of desire

Need

Design

Desire
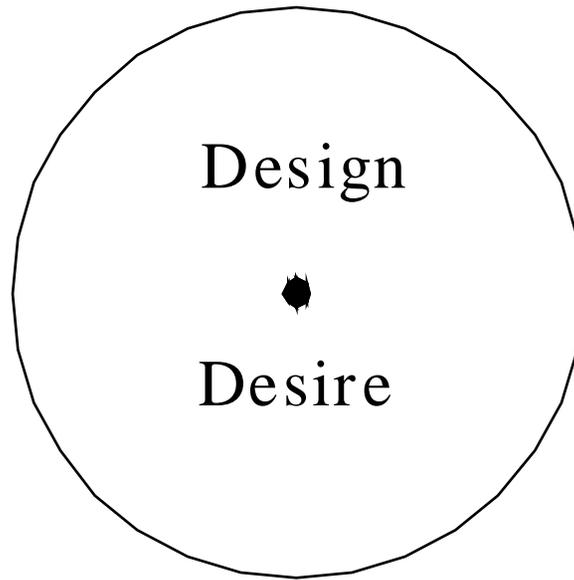
to satisfy a need

Need

Design

Desire
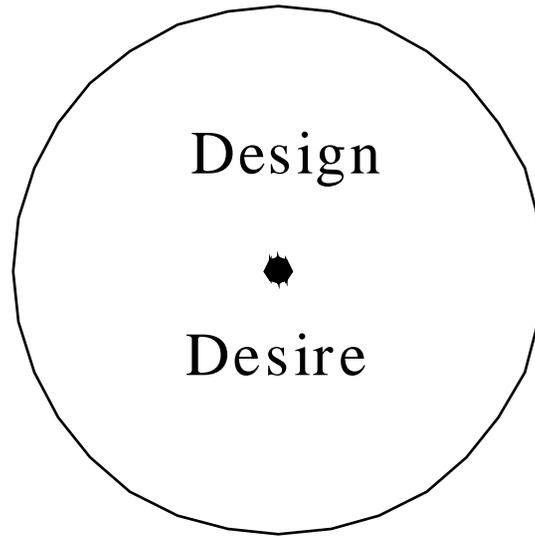
Standpoint

Viewpoint

It takes place between a viewpoint and a standpoint

Need

Design

Desire
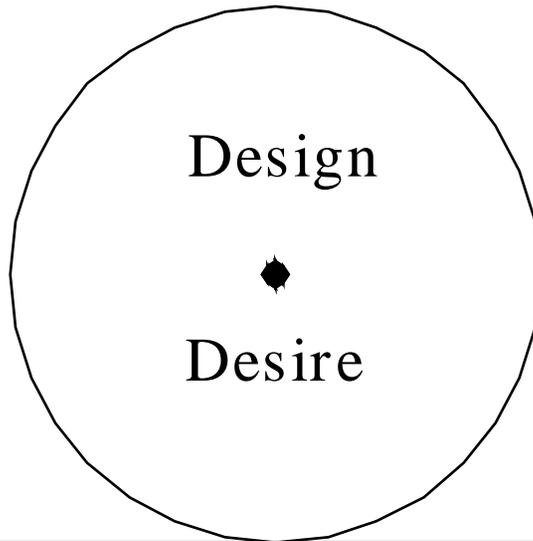
Standpoint   Language   Viewpoint

It rests on language

Need

Constraints

Imagination

Design

Desire

Standpoint

Language

Viewpoint
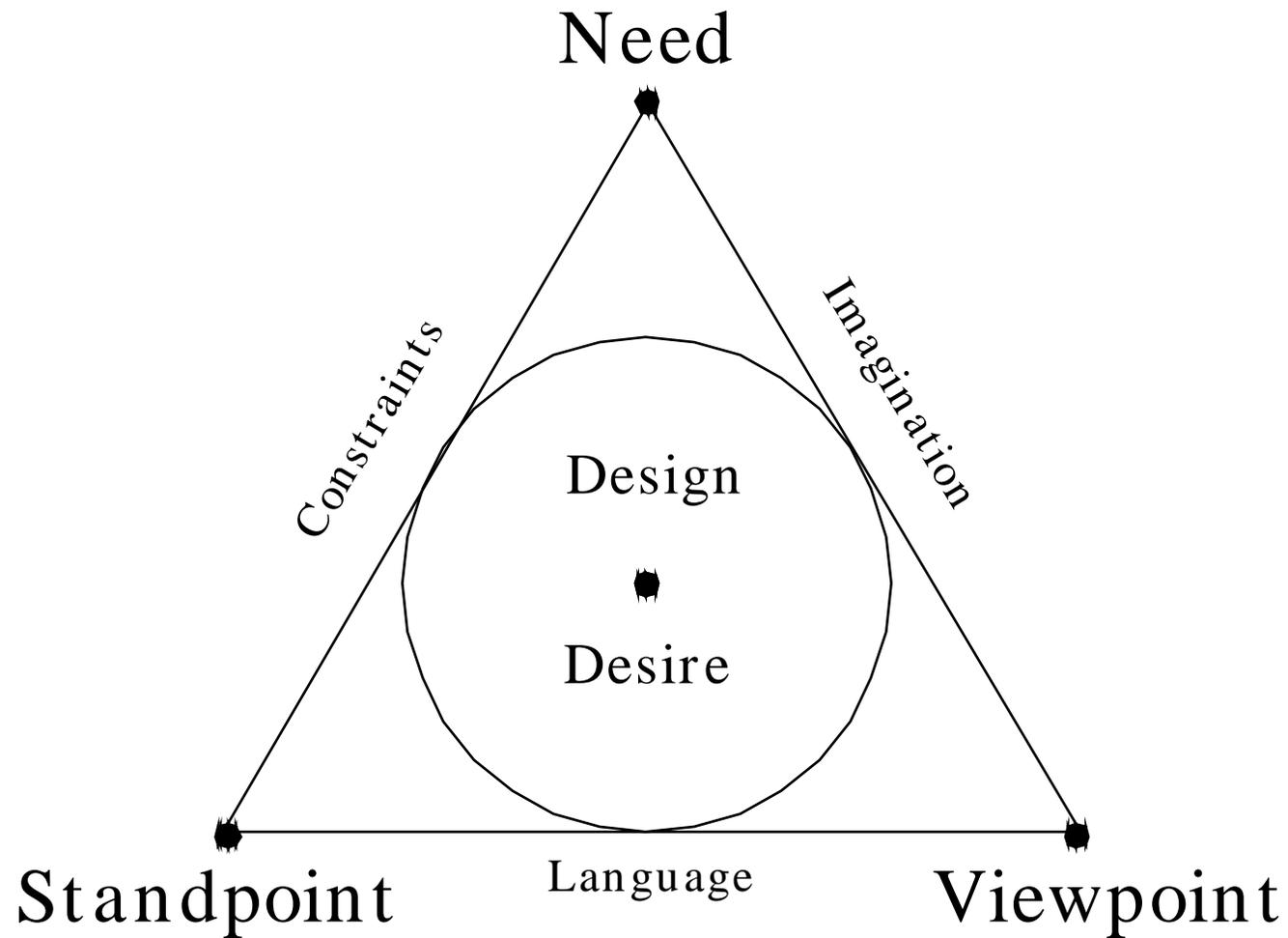
And is limited by constraints and imagination

5. IMPORTANCE OF LANGUAGE

Particularly at the beginning of a project

We won't inquire as to what Language is, for that is another topic, but the fact is that we have to use language to think and communicate about our topic.

Language is not restricted to sound time-series or written texts. It includes all we use to think and communicate.

Language is a complex edifice built on shifty and dangerous grounds.

It is also a living organism, structured in our very consciousness,

yet also a marvelous instrument, a poetic machine of great power.

"Poems are usually small highly structured distinctively rhythmical,

rhetorical machines that are primed to explode on impact with the ear."[1]

Some traditions affirm Language as the origin of the worlds.

Our human condition is inextricably bound with it.

Transcending language means transcending the mind.

Language is somewhat like Time, of which St. Augustine said that

he did perfectly know what it was as long as he was not asked,

but when asked, he could not really say what it was.

Cunei form tablets from Ebla, c. 2500 B.C.

Wonders of the Ancient World, National Geographic Atlas of Archaeology

So it is with language.

As long as you let words glide lightly upon your tongue as you might jump over

the stepping stones across a stream, you perfectly know what language is, is for,

and is about. But if you want to investigate each stepping stone, its foundation,

basis, equilibrium, origin, composition, etc., not only may you not know anymore

what it really is, but you might be in grave danger of falling in the stream,

and never make it across.

Nevertheless, human speech produces the human world.

Thus, for Lorenzo Valla (1407-1457) "Speech is not a representation or imitation

of existing things, rather, it brings them into existence in the first place.

Speech is the human creation of the world, the design for reality."[2]

Florence

57
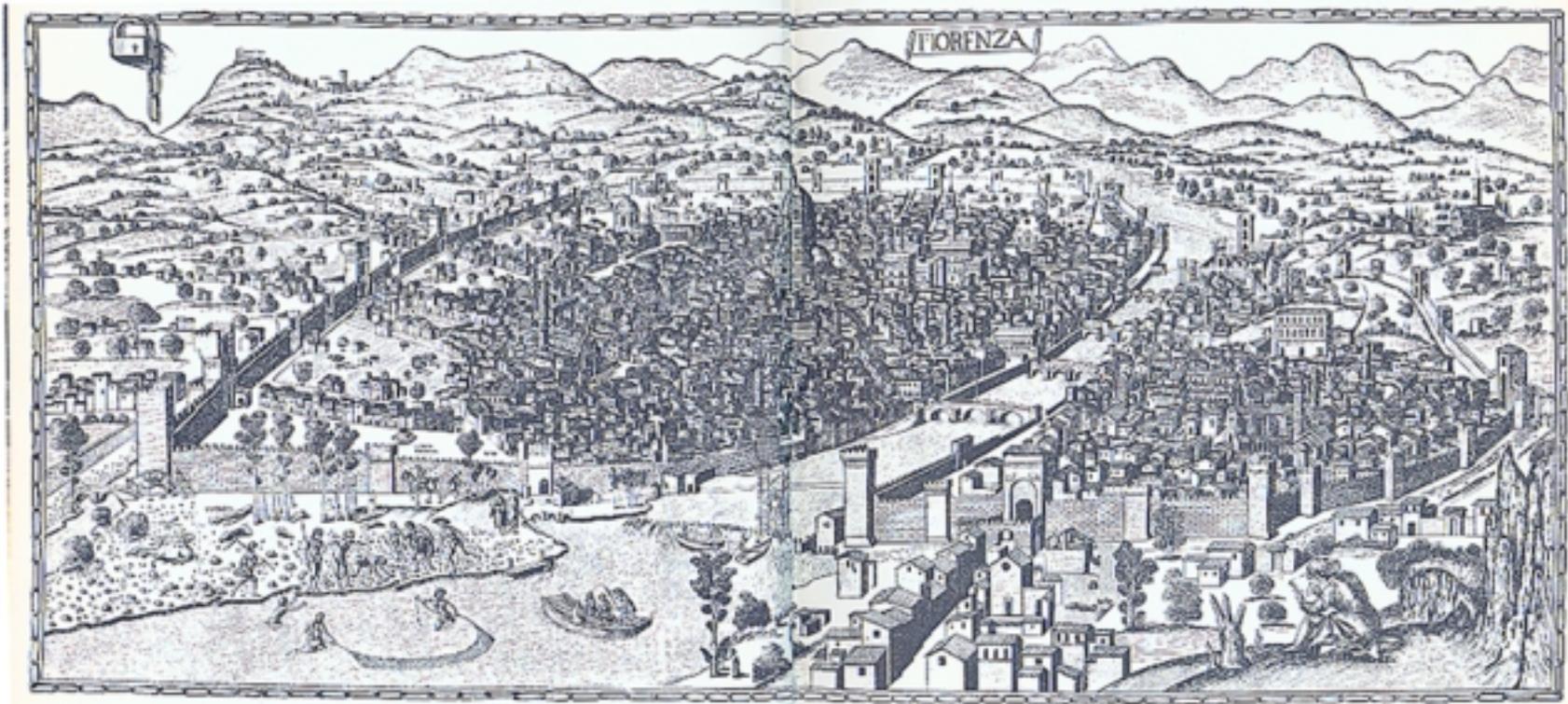
6. ENGINEERING AND POETICS

Two words which, at first, may seem incompatible in our minds,

yet…
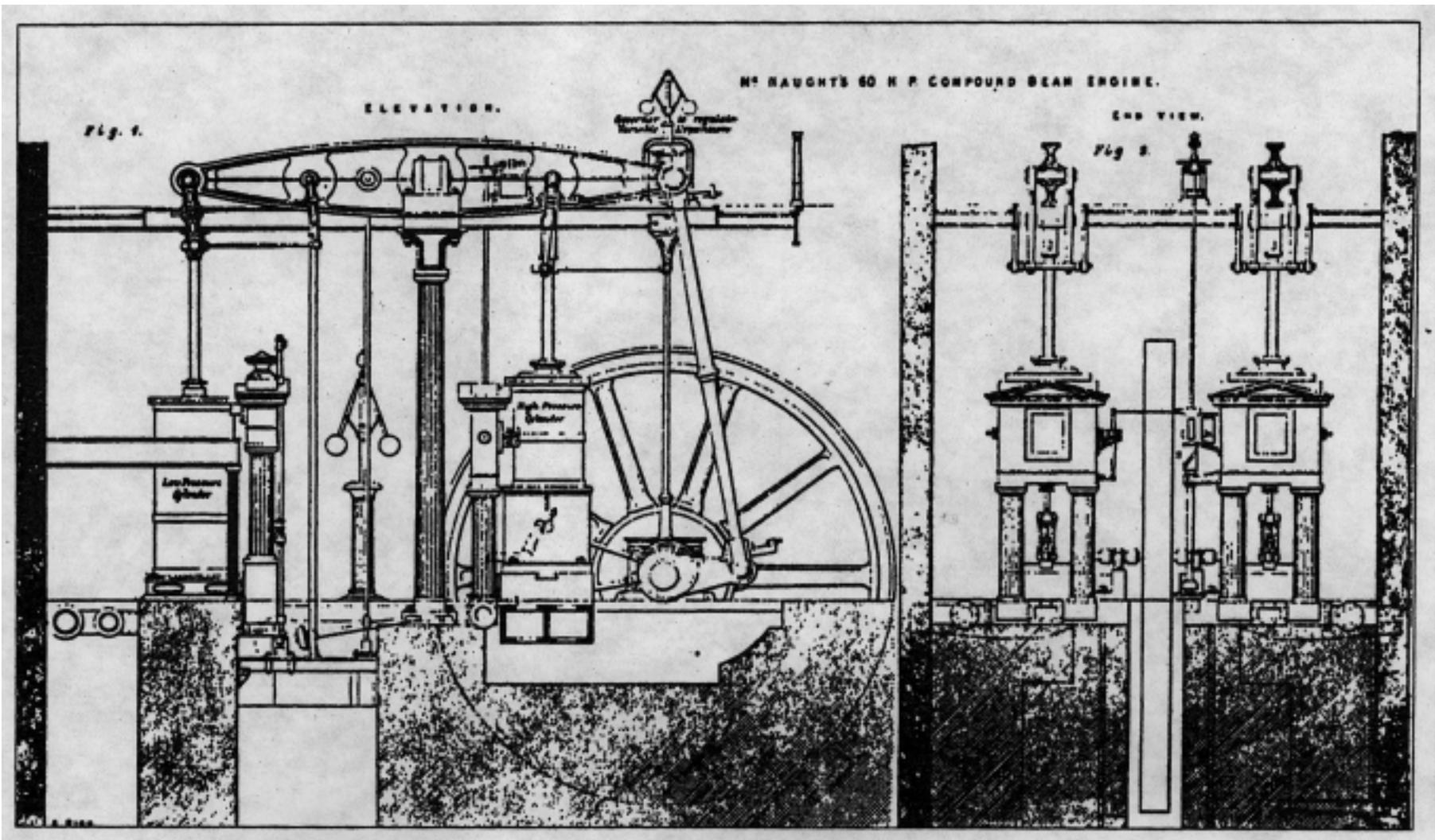
McNaught compound stream engine

Steam Engine, Riggs

Poetics

The tics of Poets

Or what makes Poets tick

…to rules.

Goethe in the country

Poetics, like all words in –tics, from

Arithmetics to mathematics,

Axiomatics to linguistics

And many others besides

Indicate "a science of _____"

i.e. a systematic theory or doctrine of _____

_____ Poetry, in this case.

Aristotle may have been the first to articulate it in the West.

In any case, his work, "peri-poietikes" (on poetic [Art])

has been the basis and prototype for later Poetics.

He defines it as dealing with

"Poetry itself and its kinds and the specific power of each, the way in which the

plot is to be constructed if the poem is to be beautiful, of how many and of what

parts it is composed, and anything else that falls within the same inquiry."

Or as more succinctly put by Umberto Eco [3] :

"The plan for shaping and structuring the work."

Of course, before Aristotle, there was poetry. Thousands of years before,

Chinese, Hebrews, Celts, and obviously many other peoples, composed poetry

according to rules: Rules passed from Poet to Poet, picked up by imitation

or invented from time to time to solve particular challenges.

Perhaps the most systematic people about their poetic activities were the Indians.

The Vedic Poets spoke of their art in their hymns:

…Speech is refined in the intellect as flour through a sieve…

…Words are beautified and fitted together in a measured sentence

as pieces of chiseled wood are fitted together to make a chariot…

One carries the spirit, the other the body.

The Vedic poets are Rishis, i.e. seers

And Kavi, or "sounders"

And designers.

So are all true Poets.

Those in words and those in deeds.

As Poetics is to Poetry,

Engineering is to Technology.

Engineering embodies the systematic theory, the science and art

that informs and produces the objects of technologies.

Technologies are methods and know-how for exploiting

the products of engineering.

Of course, technologies were before engineering was

As poems were before poetics was

And language before grammar.

The engineer uses engineering as the poet uses poetics

For support and guidance,

But if new technologies have to come through,

The engineer must be ready to step out of his engineering.

As poets have stepped out of Aristotle's poetics

to create our modern languages and their great poems,

Be it the anonymous bard of the Song of Roland,

Dante Alighieri or Shakespeare,

so have engineers stepped out of traditional engineering,

or non-engineers jumped into engineering, to create aircrafts and

transistors, structures or biotechnologies,

some yet to be developed and that will

change our world as drastically as electronics has changed the world

in the last half century.

It is this stepping out which brings new life in the professions.

Columbus did not discover a new world by staying in the streets of Genoa.

Through one's specialty one learns discipline and appreciates depth.

By stepping out, one sees interrelatedness, appreciates similarities,

recognizes common ground and the underlying unity.
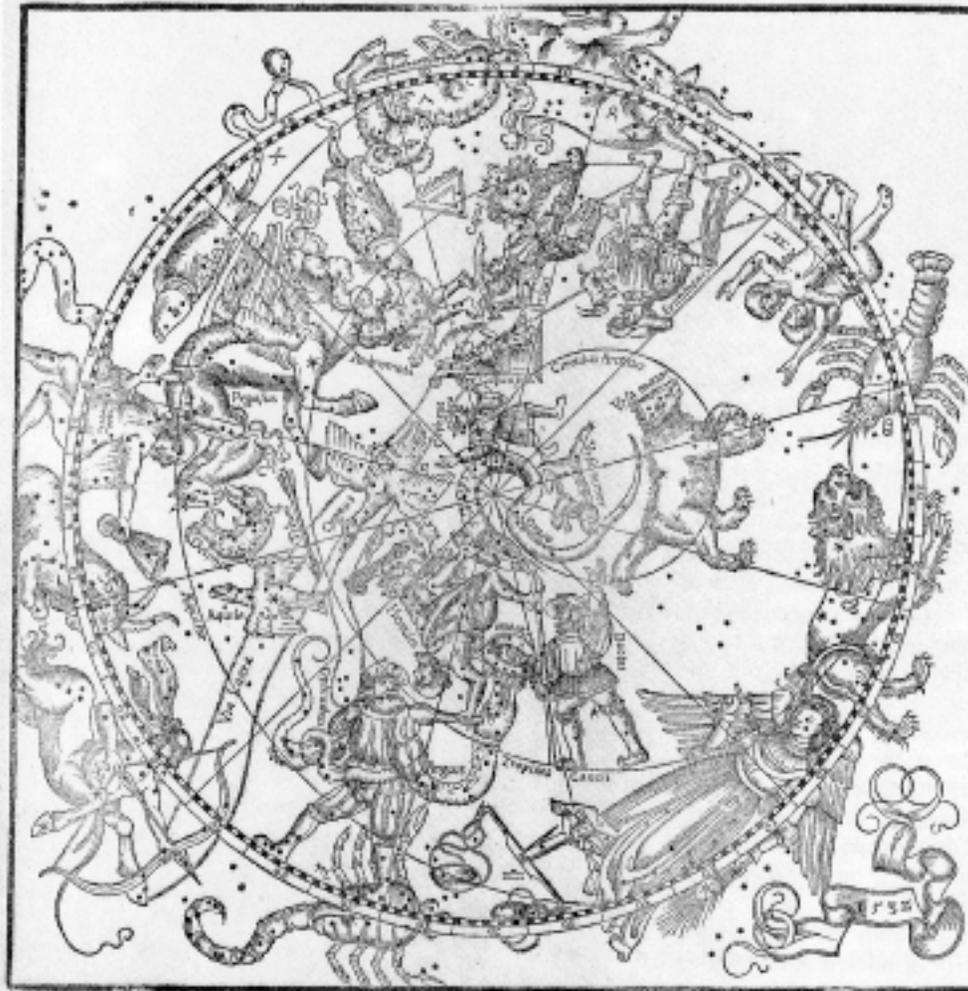
Constellation map by Johannes Hunter, 1532

Antique Maps, Jonathan Potter, p. 173

7. ON THE CONCEPT OF MACHINE

Consider a Machine

It's a little like one of the definitions of pornography:

You know it when you see it.

Closet Suite, 1890

Eureka, E. Debono, p. 184

But ask yourself the question,

What is a Machine?

Or do you really need to know?

Should you decide that you do,

listen to a passage from Bach's Brandenburg Concertos.

Colette, a French writer of the first half of the twentieth century,

called this *"J.S. Bach's sublime sewing machine!"*

So here is a musical machine.
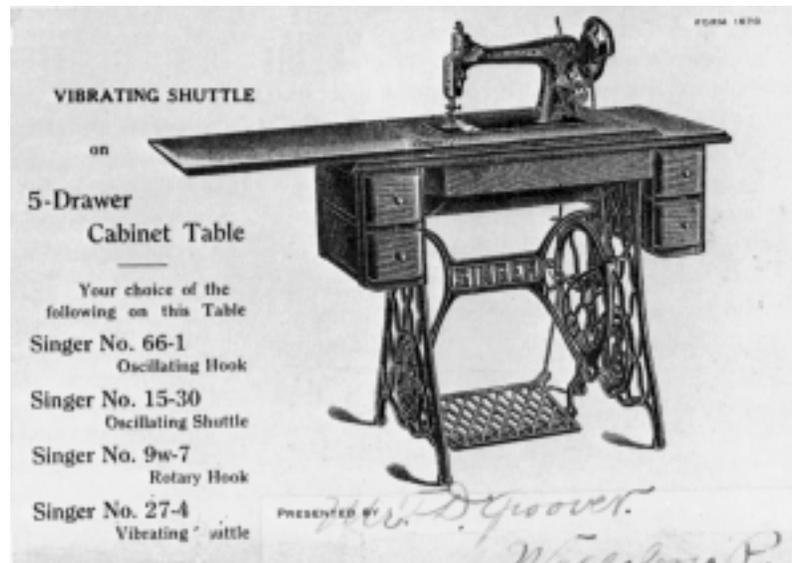
Singer sewing machine

American Design Ethic, Arthur J. Pulos, p.169

Here is cartoon by Leonardo Da Vinci for the

"Adoration of the Magi"

Adoration of the Magi, Leonardo Da Vinci

And here a copy by Rubens of a cartoon, also by Leonardo da Vinci For

The Battle of Anghiari

Copy of Da Vinci's The Battle of Anghiari by Peter Paul Rubens

Of these, the Italian scholar Allessandro Vezzosi writes:

"Certainly the painting of the "*Adoration of the Magi*" is already a *"machine"* like

the "*Battle of Anghiari*" which was also to be considered his (Leonardo's)

personal expression as a "poet of impetus."

Vezzosi pursues:

"Drawing is the key that the artist-scientist uses to penetrate

into the world of phenomena:

registration of knowledge, mirror for the experience of the world;

a troubling hieroglyph of the mysteries of the *machine of nature*

revealed and reorganized in artificial forms and artificial machines;

a precious, lyrical and instinctive processing of the data of reality."

And finally one of Leonardo's sublime machines –

The Last Supper
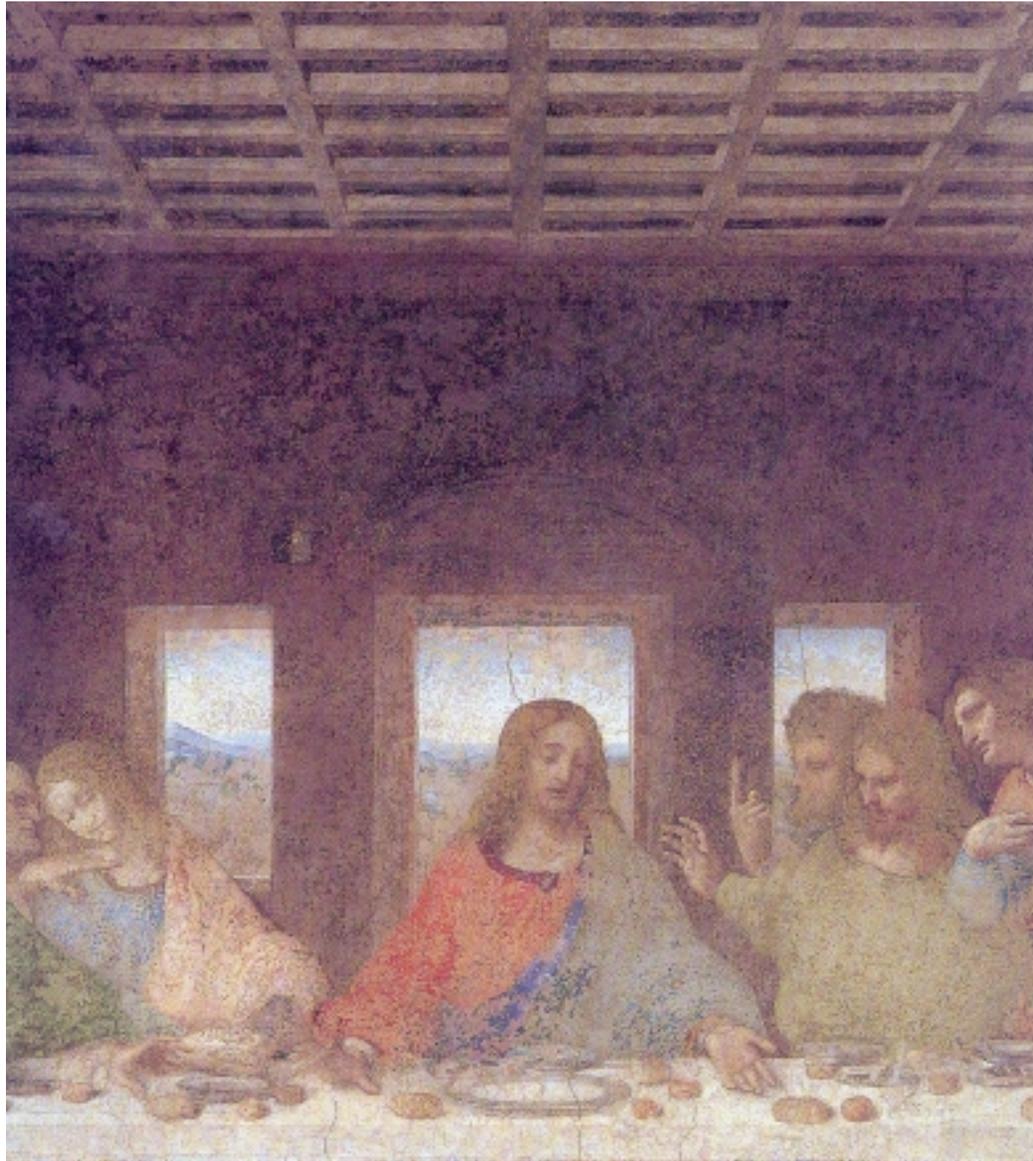
The Last Supper, Leonardo Da Vinci

Some more modern machines

by a more modern master.

Picasso's

Les demoiselles d'Avignon

Les demoiselles d'Avignon, Picasso

As Paul Valéry puts it:

"Thus the *work of art* takes on the character of *a machine*

to impress a public;

to arouse emotions and their corresponding images."

(break)

In its negative aspect, this can be seen blatantly at work in commercial art,

e.g., *Joe Camel* as a cigarette pusher to the young.

Or in political art, e.g. Stalinist or Nazi art.

Nazi Propaganda Poster

Art of the Third Reich, Peter Adam, p. 278

In its positive aspect, we see it at work in sacred art.

Jacques Maritain considering Indian sacred art, writes:

"No doubt Indian art, like Indian philosophy,

is permeated with spiritual, practical purpose.

What is done by the artist is less a work of art than

an instrument for some invisible result to be produced within the mind.

I am thinking not only of those hieratic diagrams which are,

so to speak, ecstatic gadgets of yoga but also of the spiritual expression

and smile through which so many images of Buddha aim to

induce peace and contemplation in the beholder."

seated buddah. Sandstone from Sarnath, 5th century

Ancient India, D.D. Kosambi , p. 116

This discussion brings to mind the distinction that

P.D. Ouspensky and Gurdieff make between

objective art and subjective art.

"In objective art the artist really does 'create,' that is,

he makes what he intended, he puts into his work whatever ideas

and feelings he wants to put into it.

And the action of his work upon men is absolutely definite;

they will, of course, each according to his own level,

receive the same ideas and the same feelings

that the artist wanted to transmit to them.

There can be nothing accidental either in the creation

or in the impression of objective art." [4]

The Great Sphinx, ca. 1870

The Great Pyramids of Giza, Alain D'Hooghe & Marie-Cecile Bruwier , p.67

"In subjective art everything is accidental.

The artist does not create, with him 'it creates itself.'

This means that he is in the power of ideas, thoughts,

and moods which he himself does not understand and

over which he has no control whatever.

They rule him and they express themselves

in one form or another….

There is nothing invariable, nothing is *definite* here.

In objective art nothing is *indefinite*." [5]

Returning to Leonardo,

here are not "machines" as such

but *representations* of

"organic machines."
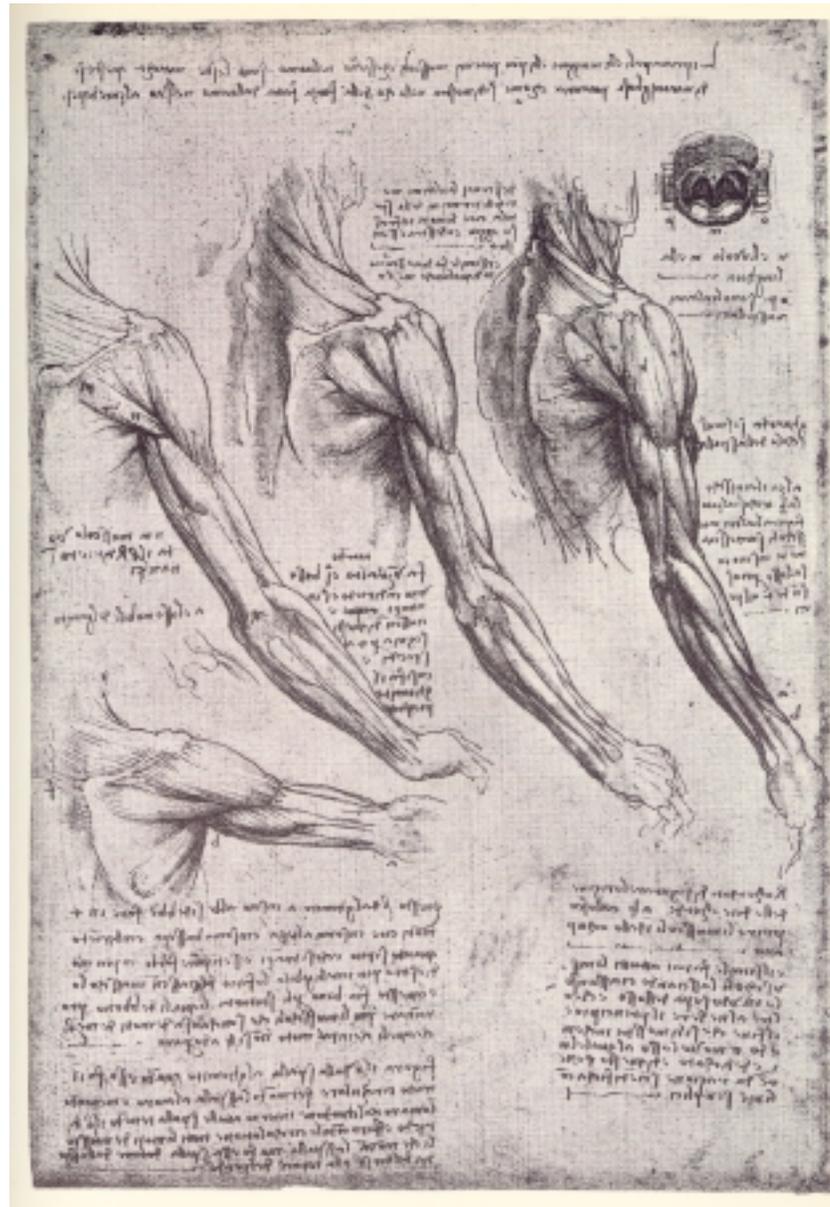
Anatomy of the arm, Leonardo Da Vinci

Closer to us in time, but farther from us in experience,

David Goodsell, in his book "The Machinery of Life,"

shows us some basic elements of that machinery.
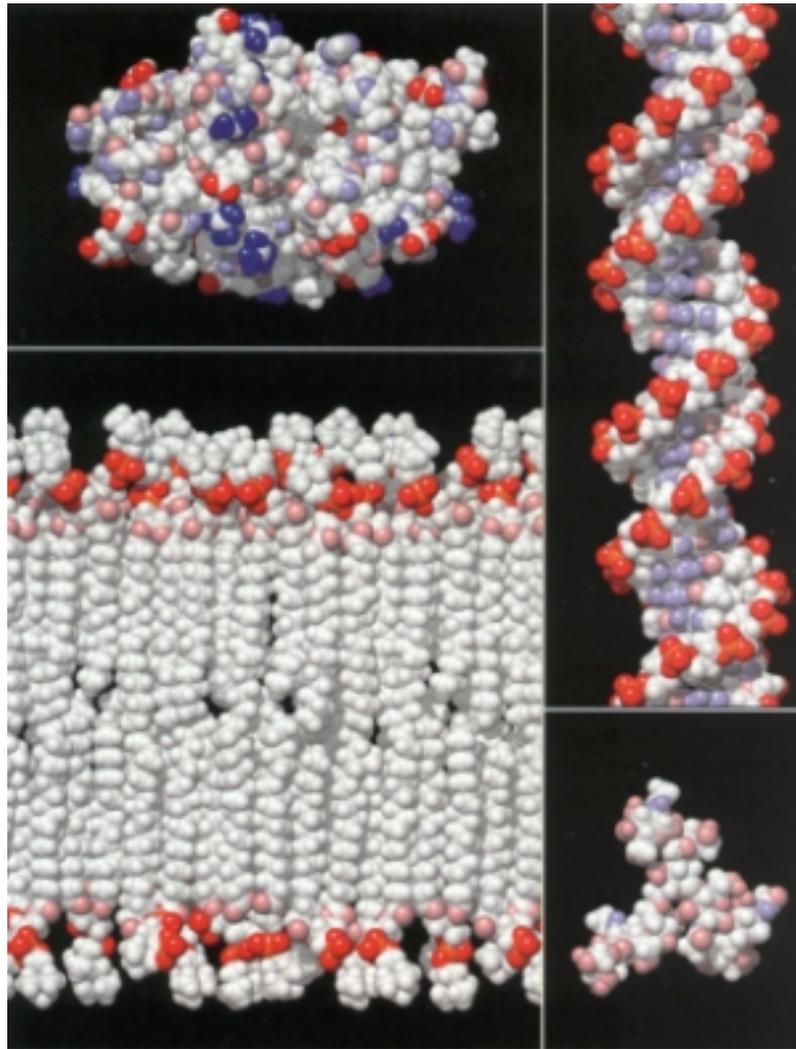
Protein, Nucleic Acid, Lipid, & Polysacharide

(from *The Machinery of Life*, by David Goodsell)

Machines, of course, have also more familiar,

more conventional forms.

Here is a series of models of machines proposed

again by Leonardo…and some…

and some he would have enjoyed seeing in action.
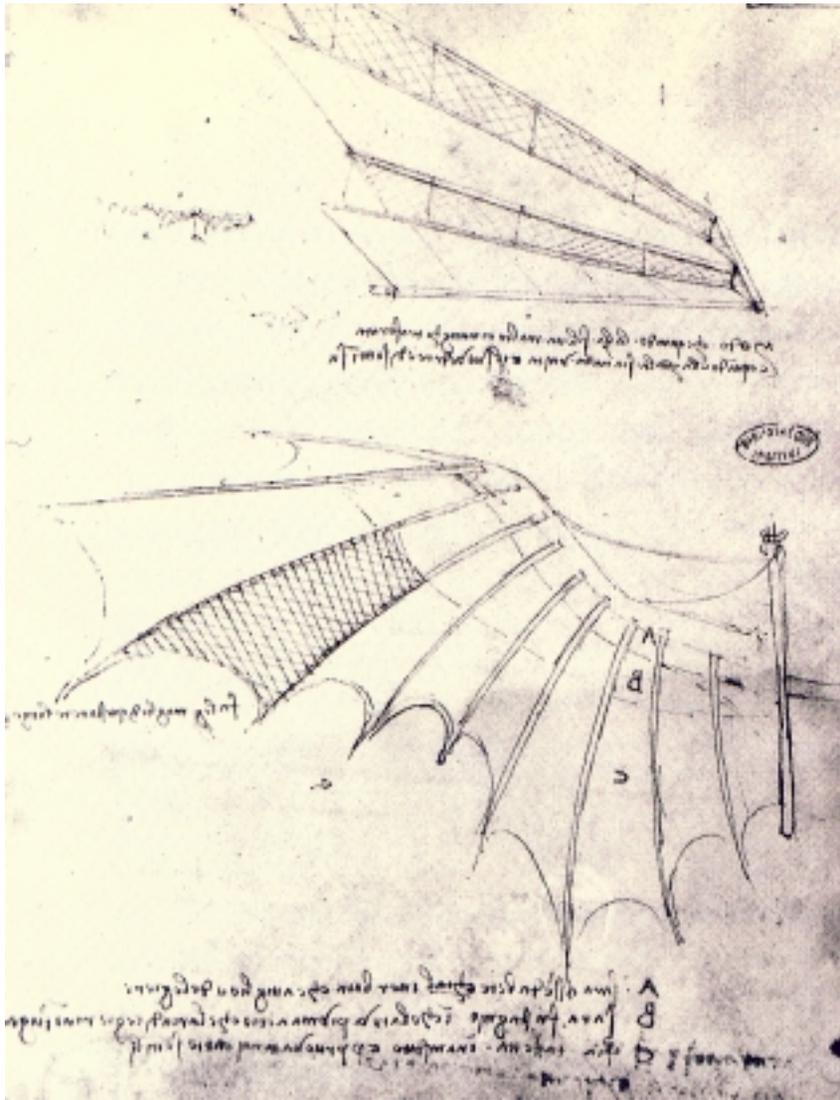
Flying Machine, Leonardo Da Vinci

Closer still to us, here are models of steam engines,

the quintessence of the machine as we usually conceive of it.
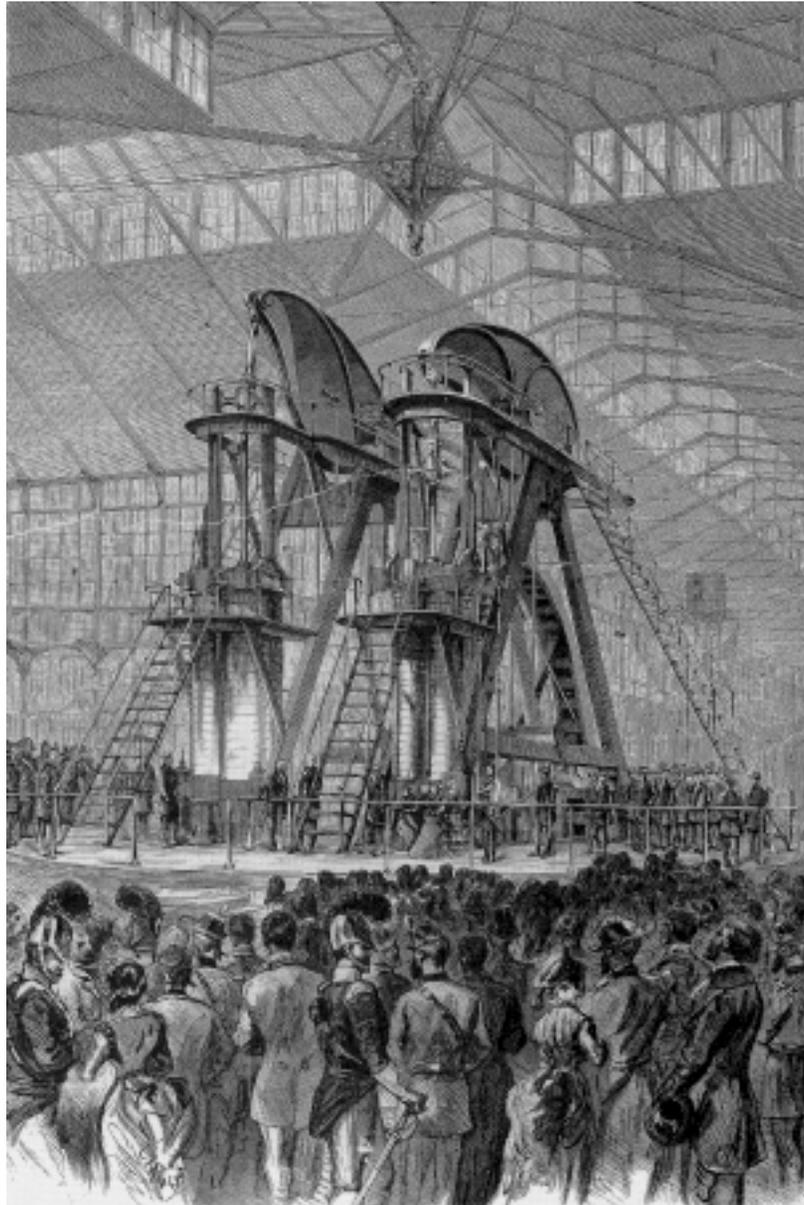
Unveiling of the Corliss Steam Engine, 1876
The Tradition of Technology, Leanard C. Bruno, p.228

From paintings and drawings to living organisms

From devices assisting human work

To flying machines, steam engines and steam hammers

From generators to the national grid

From computers to the world wide web.

All these, *machines*.

What do they have in common?

Two things:

1. They are devices that produce a desired and calculated result.

   They are therefore pieces of objective art. But also,

2. They are transformers.

   They transform one type of energy into another.

   They transform one type of substance into another.

   They transform one type of information into another.

   They transform one type of knowledge into another.

   They transform consciousness.

   They transform substance into energy, energy into information.

   They inform substance or energy up and down, sideways and crosswise!

?

Consciousness ⟷

    Wisdom

Knowledge ⟷

    Learning

Information ⟷

    Entropy

Energy ⟷

    Force

Substance ⟷
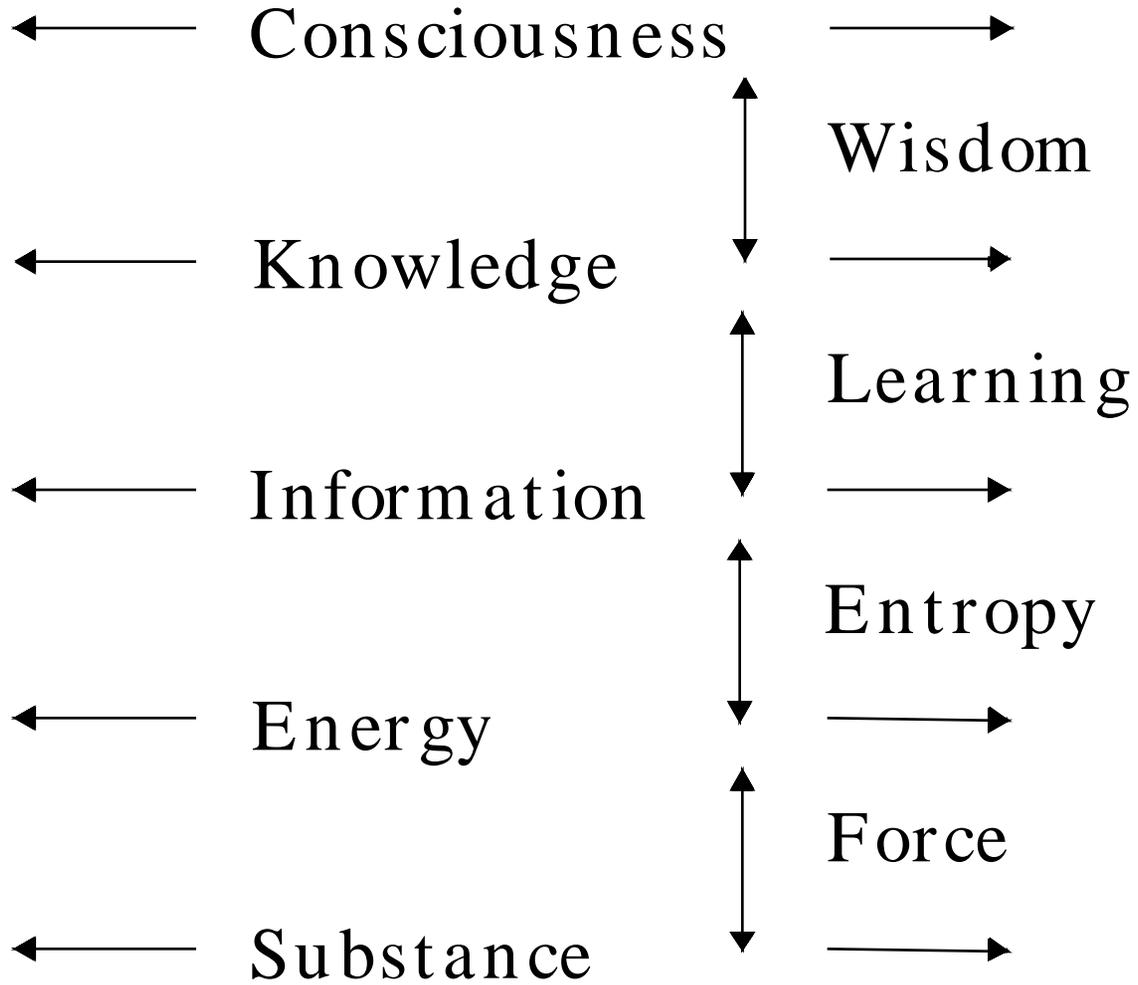
A machine is therefore a *transformer* that achieves a *goal*.

Or as Paul Claudel puts it:

"*The Machine is but an arrangement of means*

between two terms that it assumes." [6]

Namely, between a cause and an effect or, as in a proportion, between two terms

resolved through their mean.

Such is an astronomical observatory,

such are cathedrals, temples, and icons.
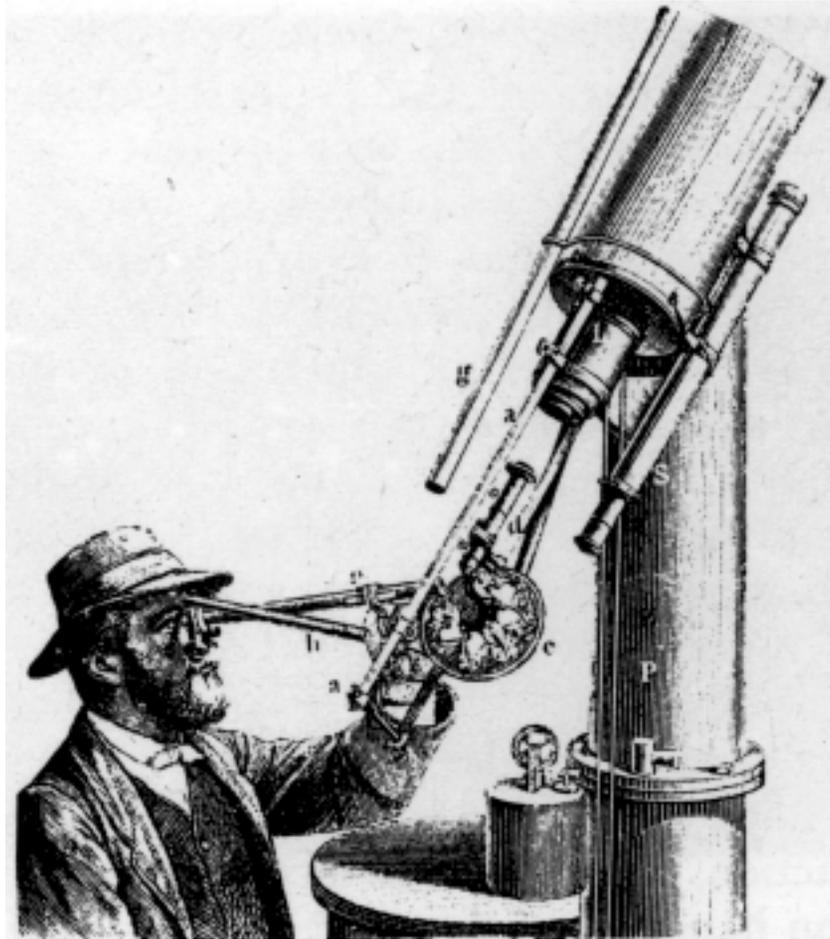
Observing the solar system, 1870

Eureka, E. DeBono, p. 197

Such is the human body as conceived by Yogis,

where in energy centers called *chakras* can be visualized

certain *yantras* to achieve certain spiritual ends.

Now in Sanskrit the word yantra means a machine

(literally a device for control (Yam –tra),

an engine, an instrument of power.
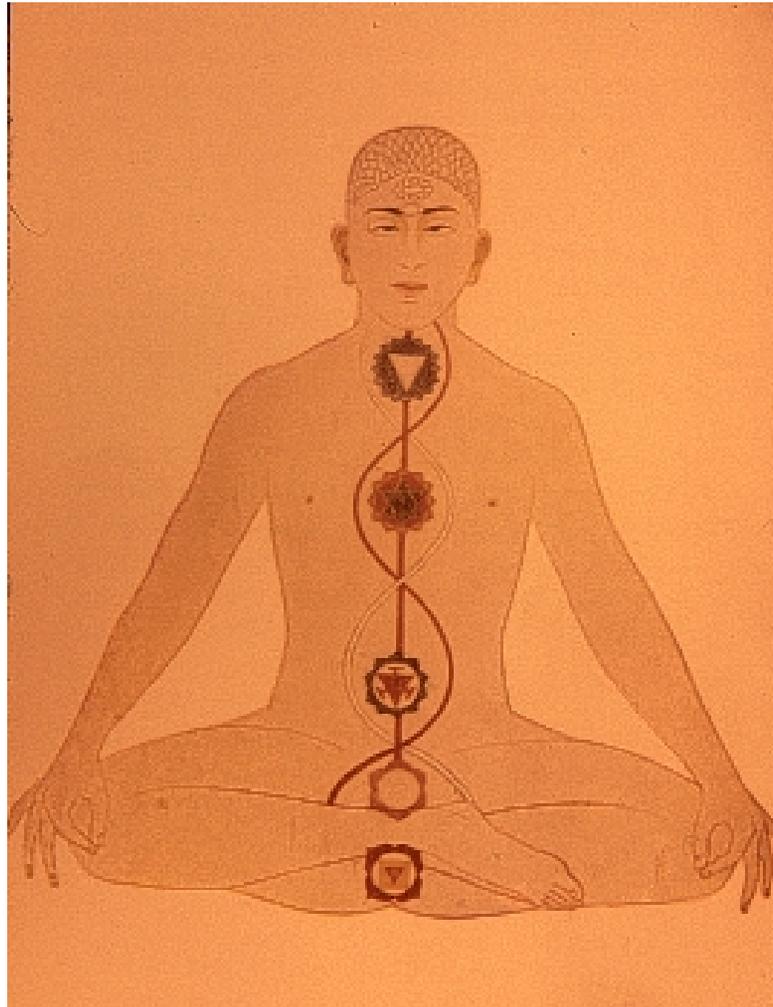
The center of lotuses, Chakra diagram

To conclude, therefore, with the machine,

The word *machine* itself, through French, Latin and Greek, comes from an indo-

European root Magh (idea of power)

Gr. Mêkhos=means;

Mêkhanê=ingenious means; machine

Lat: machina = invention, contrivance

Fr.: machine = machine

English cognates: might, may, main, magic, mechanics, mechanical, etc.

Machines are therefore *instruments of power.*

Their reach is unbounded –

Our bodies and minds in all their extensions

in hardware and software –

Instruments for our use.

"And I say that the whole universe is but a machine to mark Time." [7]
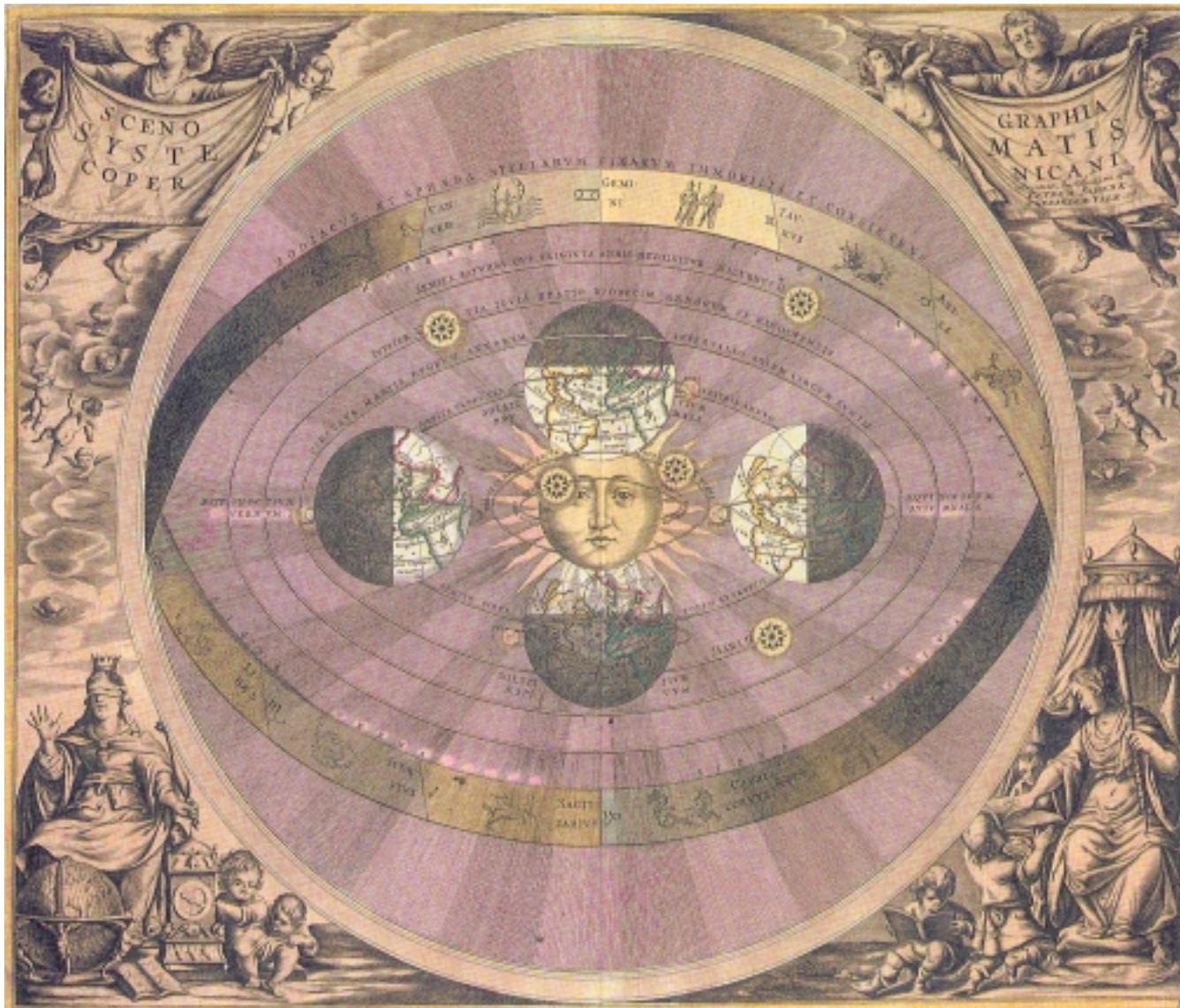
Sceno graphia systematis copernicani, 1660

Antique Maps, Jonathan Potter, p. 179

8. CONSTRUCTION OF THE MACHINE

Having come to some understanding of what a machine is,

how do we go about constructing one?

A machine is a transformer that produces a desired,

calculated result. To construct a machine, therefore,

one has to be clear about the purpose.

Here are sample questions that should be asked:

- What is to be transformed into what, and for what purpose?

- Under what kinds of conditions and circumstances?

- What are the *best* means to achieve it?

- Who is the beneficiary of this transformation?

- From where does the desire or need for this transformation

  come?

- Who is the best agent to carry it out?

"Constructing," writes Paul Valéry,

"takes place between a project or a particular vision

and the materials that one has chosen.

For one order of things, which is initial,

we substitute another order, whatever may be

the objects rearranged:

stones, colors, words, concepts, men, etc."
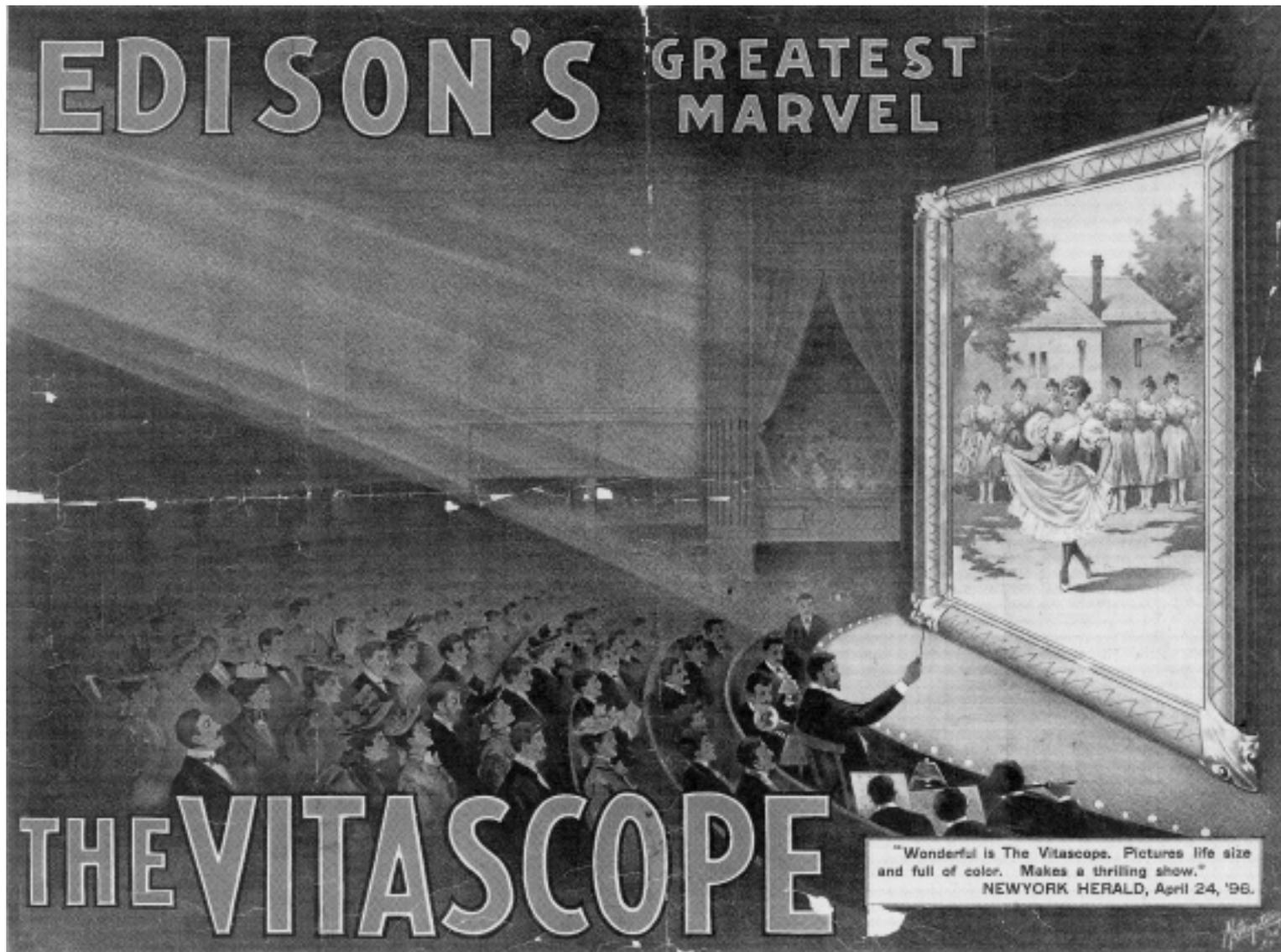
The Vitascope by Thomas Armelt

The Tradition of Technology, Leonard C. Bruno, p.250

Construction: action of piling up materials together.

I.E., root STER ('strew' as well as 'piling up materials').

Hence English cognates: strew, straw, strand, street,

destroy, structure, construction, destruction, instruction,

obstruction, instrument, etc.

A rich and suggestive family.

The methods for 'piling up materials together,' to achieve desired transformations presently used in engineering, appear to be tremendously crude and inefficient when compared with those of nature.

George A. Seielstad, in *At the Heart of the Web* writes,

"On the average twenty tons of mineral materials must be excavated annually

for each man, woman, and child who lives in the modern industrial world.

Since there are a billion (10^9) such people, their total annual consumption

approximately equals the sum of the masses annually moved by the major

natural geological processes of ocean crust formation, mountain building,

and erosion. And this calculation doesn't even include the amount of matter

moved in agriculture!"

The point is that all our actions and our

constructions in particular, are subject to

The Second Law of Thermodynamics:

For whatever degree of order introduced into our constructions,

an even greater degree of disorder has to be generated

outside of it.
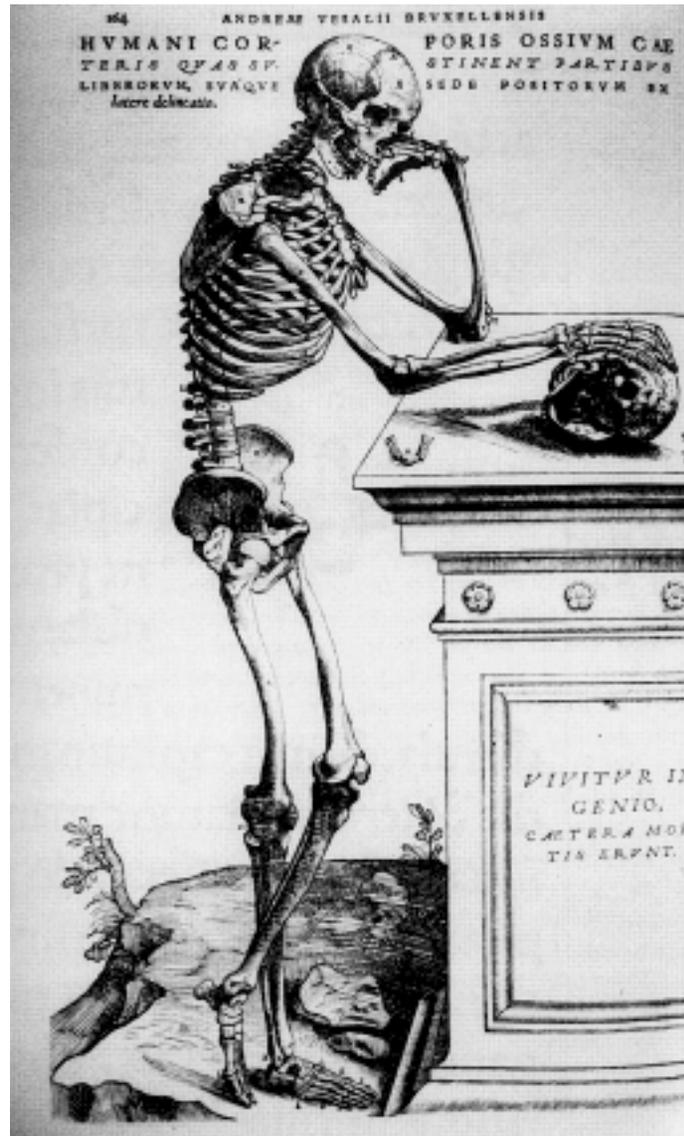
Skeleton contemplating, Andreas Vesalius, 1543

Picturing Knowledge, Brian S. Balgriz (Ed) , p.55

On that basis, you can't win, but you can limit the damage:

"Consider the lilies of the fields, they spin not, neither do they toil. Yet, I tell you,

Solomon in all his glory was not arrayed like one of these."

So consider your Mother – the Earth – in her intelligent constructions: plants,

trees, animals, people; she doesn't use high temperatures, excessive pressures,

or hard materials. She uses what is at hand, locally, in *solution* so that even hard

shells and bones, wood fibers and nails, are patiently assembled, particle by

particle, at ambient temperature and pressure. None of the fiery furnaces here to

produce steel, glass or aluminum. None of the mining at the far corners of the

earth, transportation and transformation, shaping and machining, but a quiet,

noiseless steady and irresistible process that accommodates for growth,

expansion, duration, decay, and recycling.

To give you some encouragement in the construction of a machine,

here is Paul Valéry again:

"The man who has not been haunted by the intoxication of a distant aim,

by anxiety as to means, by the foreknowledge of delays and despair,

by the calculating of successive phases…

That man, however great his knowledge,

will never know the riches or the broad intellectual domains

that are illuminated by the conscious act of constructing."

The point is to design wisely, naturally.
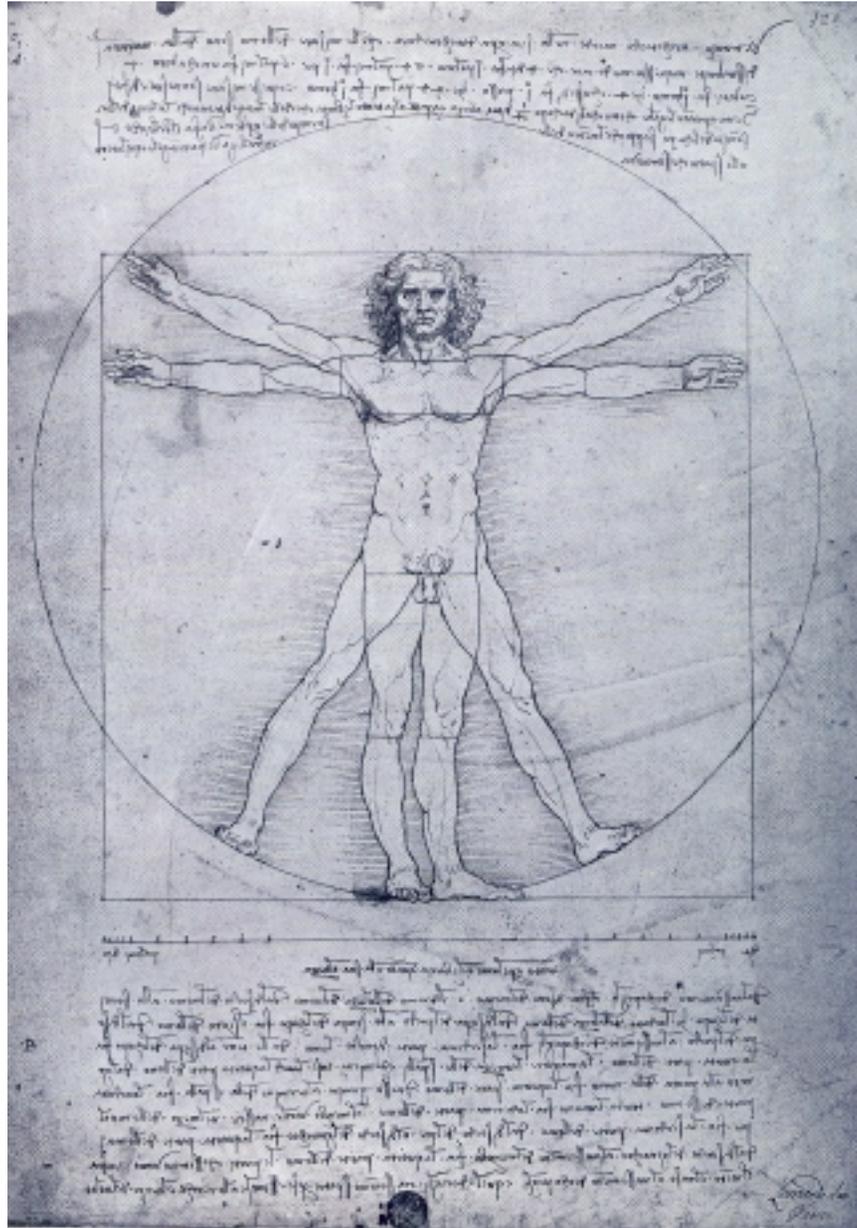
Leonardo Da Vinci…Human Proportions

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Construction is the physical manifestation of design.

And design is what we should consider next.

God as architect of the Universe, Old Testament

The Flowering of the Middle Ages, Joan Evans (Ed), p. 83

9. METAPHYSICS OF DESIGN

For Frederico Zuccari (1540-1609): *Disegno e segno di dio in noi*,

i.e., Design is the sign of God in us. [8]

For his contemporary art theoreticians,

"The concrete work of Art, the *disegno esterno* (external design)

is seen as dependent on the *disegno interno* (internal design)

which is its inner and prior conception; its model and source,

and which corresponds to the a priori apprehension of a beautiful form

and constitutes an act of production rather than reproduction." [9]

In essence, designing is providing a set of prescriptive rules for reorganizing the

elements of the environment according to some purpose.

Purpose is determined through a dialog between a "designer" and a "client."

Design is therefore based on a dialectical process founded on Language.

Designer and client may be individuals or groups.

They may indeed be the same individual.

Design is a reflective, iterative, feedback process.

D •———————————⟩———————————• C
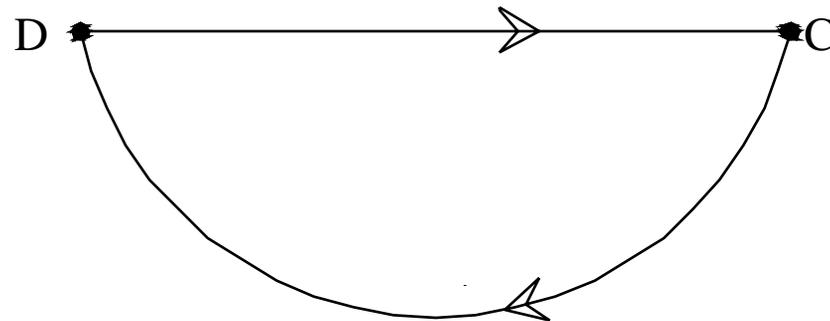
From the dialog arises common goals: *Functional requirements* (FR's) which

frame the "Internal design," the intention and purpose, and are refined and made

more precise through iteration.

This iteration is a feedback process of synthesis and analysis between designer

and client which takes place in the present. It establishes the <u>*view point*</u>.

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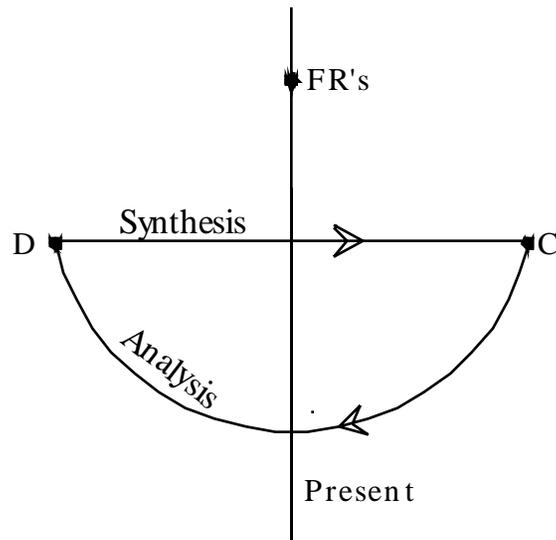
These FR's being agreed upon; the designer, through reflection, inspiration (creative process), experience, and discussion, proposes tentative solutions (sets of *Design Parameters* [DP's]) which constitute the "external design," satisfying the FR's.
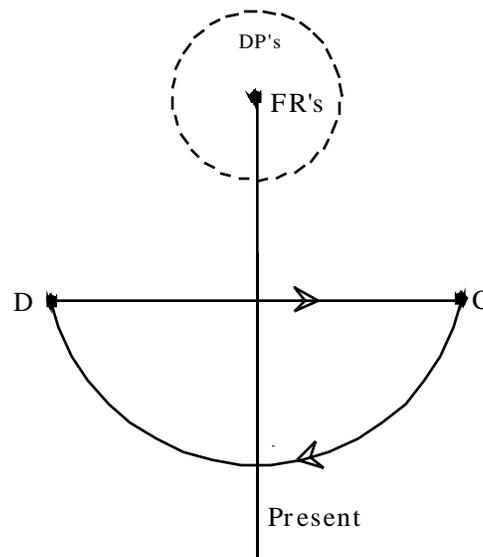
Through a similar dialectical process, Designer and Client recognize the

constraints. Constraints are of three kinds:

1. **Human constraints**, which result from the dialectical relationship present

between designer and client. These constraints, being in consciousness,

always manifest in the *present* of the action.

2. **Extrinsic constraints**, which result from the state of the world in which the

action takes place (e.g. result of history, laws, regulations, pre-existing

physical conditions). They are governed by the *past*.

3. **Intrinsic constraints**, which are constraints imposed by the very nature of

the proposed design itself, and determine its *future*.

This determines the envelope of design

and establishes the **standpoint** from which the designer can act.
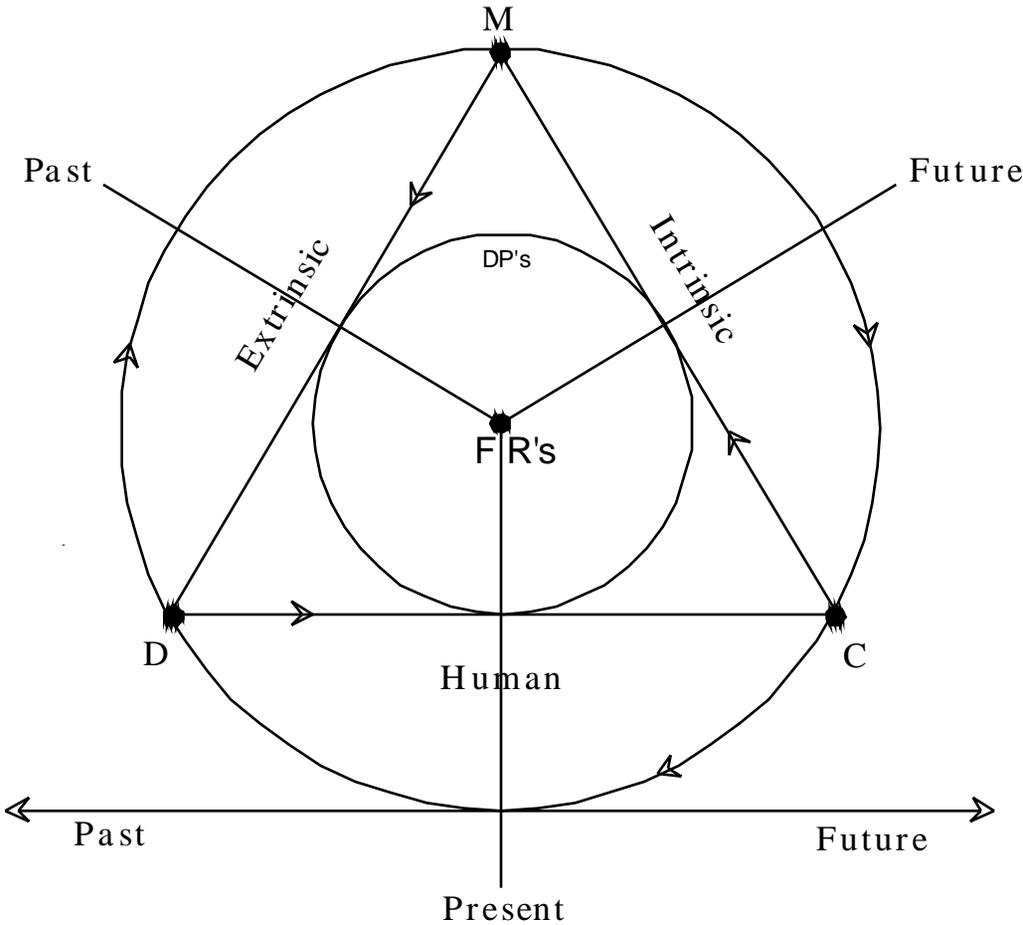
Another dialectical process determines the modus operandi, M,

the method, the matching between FR's and DP's,

between thought and reality.

This, by the way, is a representation of the grammatical structure of any

sentence in any of the Indo-European languages and since other languages can

be mapped into these, we can affirm, to all intents and purposes, the universality

of the scheme.

FR's	=	ablative (point of departure)
DP's	=	object
Designer	=	agent
Client	=	dative (recipient)
Method	=	instrumental
Constraints	=	locative

The whole feedback circle being the representation of the action: The Verb.

The design process can therefore be seen as an interaction between three levels of activity:

- A <u>conceptual</u> level (the functional domain). [FR'S]

- A <u>physical</u> level where the functional requirements find themselves translated into Design Parameters embodied in a particular realization. [DP's]

- An <u>intermediary </u>level where discussions regarding the design, the matching or mapping of the conceptual level takes place. This is the level at which the mental activity of the designer takes place. [M]

Now there exists a paradigm matching the process exactly.

The Sanskrit philosophers of grammar attribute levels to language which

perfectly match the design domain. They distinguish a **physical level** *(vaikhārī)*

where sounds are produced and heard, where the "design parameters" of

the language (e.g., choice of words, forms, etc.) are embodied.

Next, they consider a **conceptual level** where the "seeing," the inspiration,

the idea, thought or feeling occurs; a "functional domain" so to speak,

that they call *paśyantī* (The Seeing One). Linking both is an **intermediate**

state (called *madhyamā*, the "middle one") where the translation, the mapping

of the *paśyantī* (the functional domain) into the *vaikhārī* (the physical domain)

occurs through the rules of the particular language spoken.
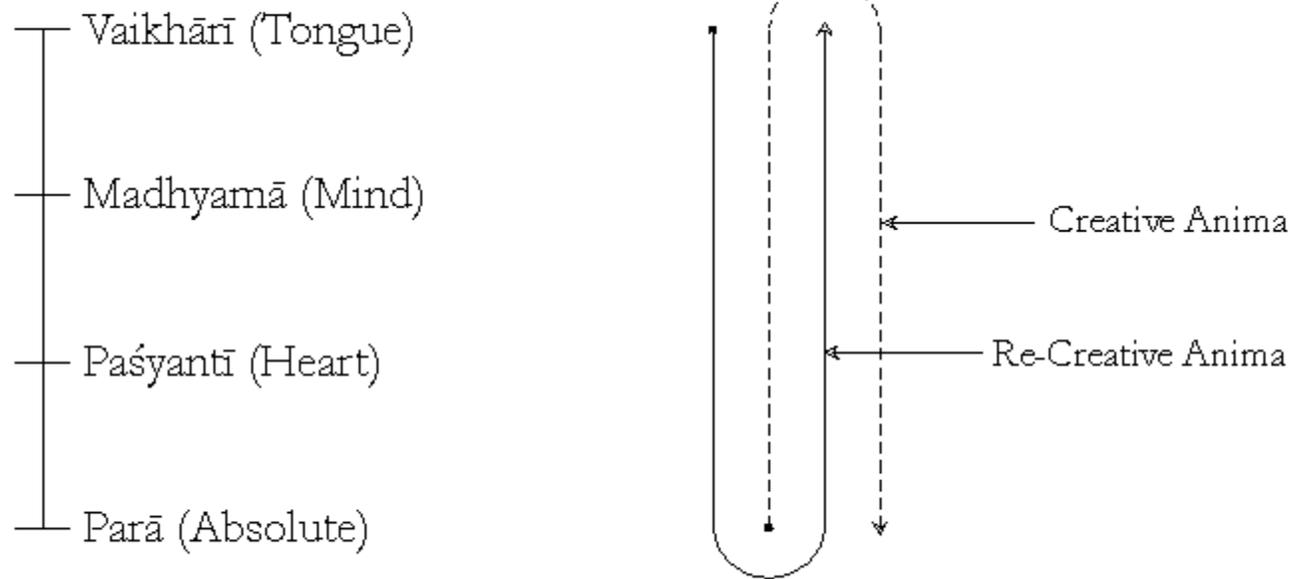
The Levels of Language

In a sense, we are therefore all potential designers, designing sentence after sentence; but rarely, save on exceptional occasions, do we consciously design our utterances. Much the same can be said about technical design. This correspondence between seemingly such diverse fields should not be surprising since language, being the very articulation of thought, is at the core of the design process. The fundamental rules of language must, therefore, be the fundamental rules of design.

In the West, in the 16th Century,

the theoreticians of Mannerism still understood this process.

"For them, the task of the recipient consists of working back from the exterior design to the interior design, to the *idea* that is signified. By reversing the direction of the flow of meaning, the recipient actualizes an idea that he had potentially within himself. The recreative process finally implies a mutual exchange between creative *anima* and recreative *anima*, both expressing the same *idea* through the transformation of figurative material." [10]

The creative process is therefore essentially the same in all human activities.

That the product of design be a sound time-series, a two-dimensional display

of graphical clusters, a three-dimensional object or any kind of

system or process is not essentially relevant.

In all cases, it is a re-ordering of the elements of the environment according

to some purpose, as we previously noted; and though the superficial properties

of the objects involved and their relationships may differ according to their

respective natures, in each case the "deep structure" of the design-act remains

the same.

Indeed, science can profitably be seen as a design process itself.

Fundamentally, science in the re-ordering of the elements of the intellectual

environment that are part of our world view into a more coherent structure.

Thus, viewing science as a construct – an architecture of thought in progress

towards a system of increased explicative and predictive power and greater

coherence –

it is evident that science as an activity is "Design."

After all, scientists *design* their experiments, *design* their theories, test them,

modify them, optimize them as engineers do their systems, machines and

products and architects and artists their buildings and artifacts.
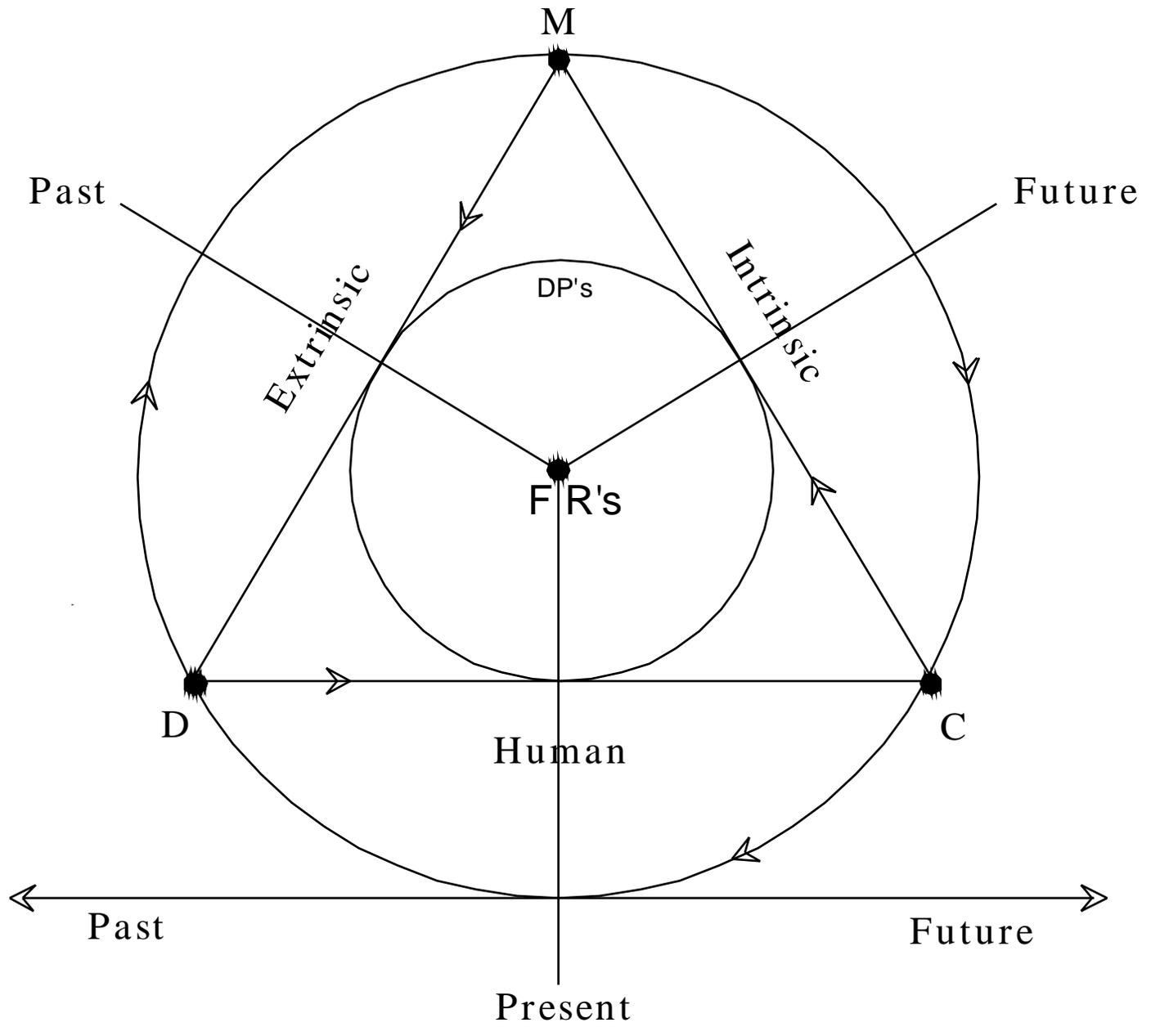
10. DETERMINANTS OF DESIGN

To explicit further the design process let us return to our fundamental diagram.

Design here is seen as the result of a surge, an expansion, from a center, what

Leo Lionni would call "an irresistible urge to make things," held by a set of

constraints.

- Extrinsic

- Intrinsic

- Human

Extrinsic constraints are what they are –

we have but little control on them.

It is hard to amend the law of gravity, change history,

or even a building code.

Leaning Tower of Pisa, Italy

Towers: a historical survey, Erwin Heinle and Fritz Leonhardt

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In the paradigm of language, extrinsic constraints are those of the language

itself: English, French, German or Japanese, its grammar,

the circumstances of the story being told, etc…

Intrinsic constraints are undetermined before the design is given form. And the

form may vary widely in the designer's choice;

be it an arch, a cantilever, or a suspension bridge, for instance.

In the framework of language, intrinsic constraints pertain to the genre chosen by

the author: novella and short story, novel, or poem.

It is therefore within the human constraints

that the freedom of the design exists.

In the machinery of language, the author is up against

usage, style, audiences, poetics, rhetorical devices, etc.

But ultimately it is within his own depth of

understanding that he has to plumb to bring about

what has to be expressed.

Similarly, in the paradigm of the Artefact or Engineering, the designer and the client in their dialectical relationship have to contend with constraints which may be seen as deriving from three fundamental functions that the design must fulfill:

Symbolic

Function

Artefact

Societal Background

Technical
Function

Social
Function
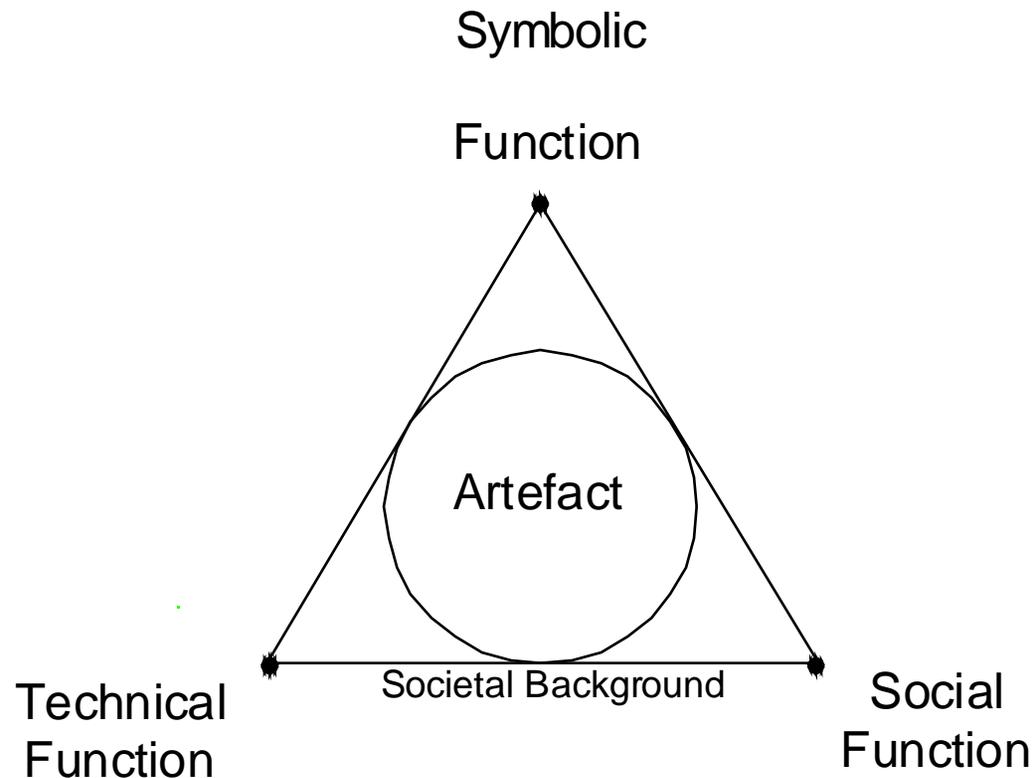
Again, here, the level of sensitivity, precision, or power

expressing these functions will depend on the depth of

understanding arising from the dialectical relationship designer/client.

The Technical Function implies constraints of *Efficiency*,

or as Buckminster Fuller used to say, "Doing More with Less,"

which in turn, means:

- Conservation of natural resources

- Spareness in the use of materials

- Simplicity of design and analysis

- Simplicity of construction and operation

- Ease of maintenance

while maintaining the integrity of the Functional Requirements.

The Social Function implies constraints of *Economy*, i.e.:

- Conservation of public resources, or more simply put: "More Bang for the Buck"

- Constraints of politics, i.e., interest groups accommodation and compatibility

- Demographics

- Local, regional, or national policies

- Politicians' egos, etc.

Conservation and **compatibility**, two keywords when considering these constraints.

The symbolic function implies constraints of *Esthetics*.

Any artefact, structure or machine is a *statement* by its maker or sponsor.

Like any utterance, it has *meaning* and carries a message;

it conveys a vision and expresses values, be they political,

philosophical, religious, commercial, or purely esthetic.

The engineer, the architect, and the artist

all deal with these functions;

each, however, with a different emphasis.

One, of course, must not always assume the obvious

and think that the symbolic function is only secondary,

if not tertiary to the Engineer.

The form of the Brooklyn Bridge, for instance,

owes probably more to the philosophy of Hegel

than to the mechanics of Newton or the mathematics of Euler.

Brooklyn Bridge

The Tradition of Technology, Leonard C. Bruno, p.262

John Augustus Roebling, designer of the Brooklyn Bridge,

prolific writer and idealist, was a student of Hegel while

at the Royal Polytechnic School in Berlin in the early 1820's.

Portrait of John A. Roebling

Design Paradigms, Henry Petroski, p.125

Hegel's insistence that "The idea of each epoch always finds its appropriate and adequate form," seems to have served as Roebling's inspiration. The problem was to find *the form* expressing the harmony or beauty inherent in the idea; *the bridge* between the inner world of life and the outer world of its appearance.

In his search for harmony, Roebling settled on the catenary curve

and the triangle, for "…the catenary curve is perfectly equilibrated

in all its parts, and perfectly at rest, when not disturbed by

outside forces," while "….the triangle is the only

immovable form in geometry."

The Hegelian idea, which developed itself in its elements of

thesis and antithesis resolved in synthesis, was embodied in the

synthesis of the bridge, harmonizing the opposite forces of tension

in the cables and compression in the towers.

Furthermore, the towers stood for the underlying

"divinity of the entire design," its ground of being,

so to speak, hence their gothic arches, a reference to

medieval cathedrals and mankind's aspiration

towards the divine.

Coming back to the three fundamental functions, we note that from their interplay

arise considerations of **safety**, **public service**, and

elegance in the elaboration of the design of the artifact.

Symbolic
Function

Elegance

Public Service

Artefact

Technical
Function

Safety

Social
Function
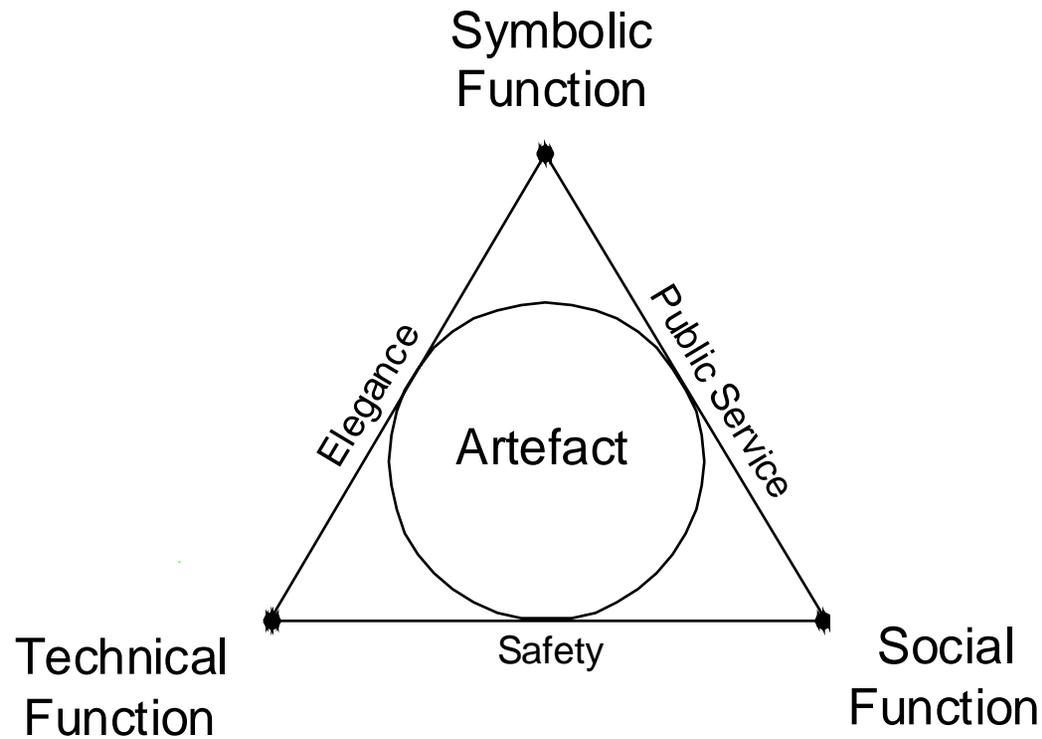
And these, in turn, can be resolved into more elementary components,

more tangible to the designer, the client and their constituents.

For example, **elegance**:

Integration

Elements

Form

Elegance

Spareness

Materials

Contrast
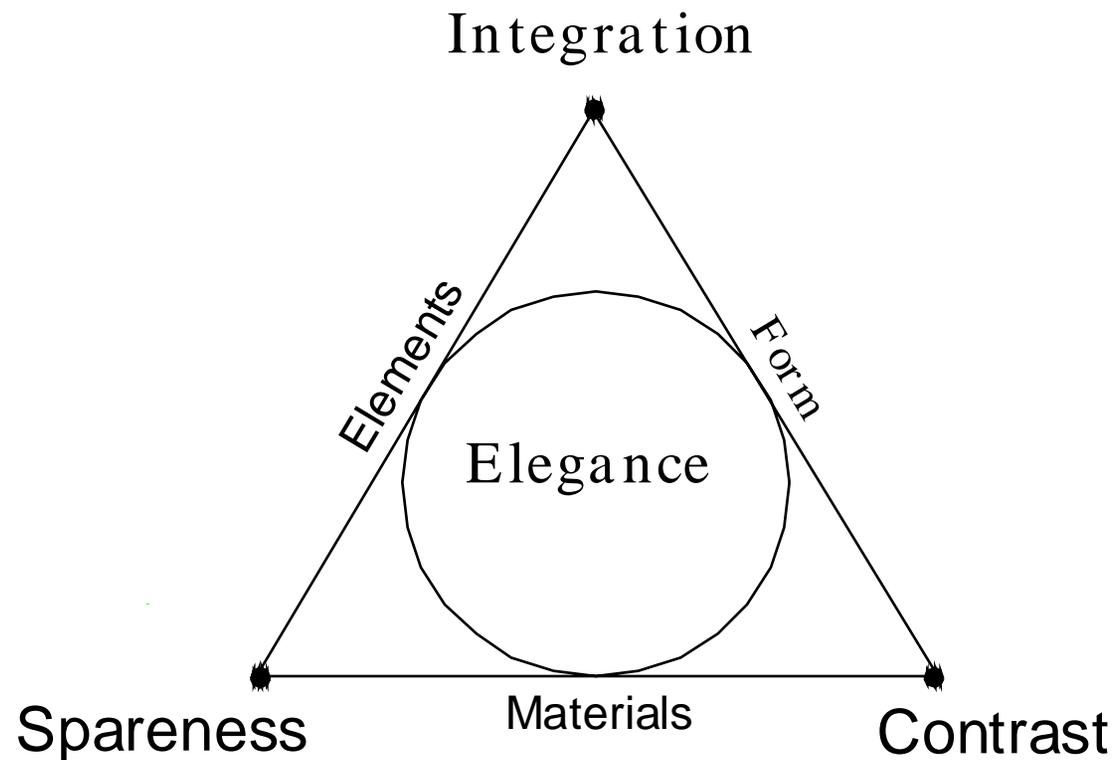
In the example of a bridge,

- *Elements* may refer to such items as arches, trusses, cables or towers which, integrated together, form the bridge.
- *Form*, as to whether it is a suspension, a cantilever, or an arch bridge.
- *Material*, whether steel, reinforced concrete, or wood is used.
- *Spareness* characterizes how materials are used; whether with an eye on maximum efficiency, durability, ease of construction and maintenance, etc.
- *Integration* indicates how the elements come together to form a unified, functioning system, and how the system fits in the environment, natural and societal, in which it finds itself.
- *Contrast* arises out of the tensional relationship between the artifact and its surroundings, between materials and form.

The bridges of Maillart in the Swiss Alps have the pure elegance of a dancer in

high jump. The simplicity and cleanliness of their lines contrasts with the

ruggedness of

the landscape, framing it, dominating it not only by their altitude but by the clarity

of intelligence and sureness of judgment that they reveal:

Euclid's victory over the elements.

Salginatobel Bridge, Maillart

Robert Maillart: builder, designer, and artist, David P. Billington, p. 143

But these leading ideals of Structural Art are not

fundamentally different from those of Poetic Art.

And if David Steinman, bridge designer and occasional poet,

could define a bridge as "a poem stretched across a river,"

then a poem is also a bridge between the world of prosaic

language and that of resonances and correspondences.

Returning to the considerations arising from the

fundamental functions of the design,

Public Service can be resolved thus:

Ethics

Personal Conduct

Public Standards
Codes

Public
Service

Responsibility

Professional
Training

Social Ethos
(Values)
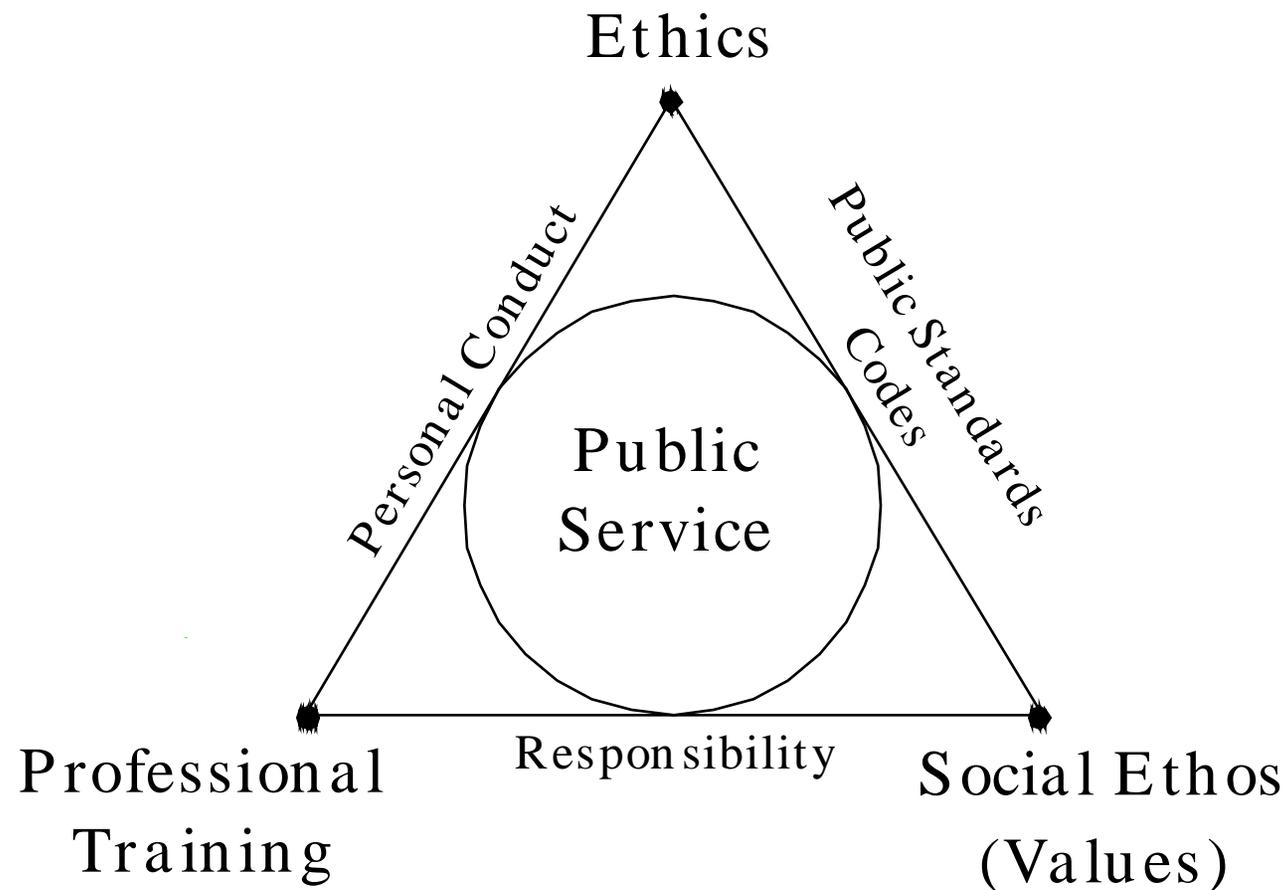
As for Safety, or more accurately perhaps **Public Safety**:

178
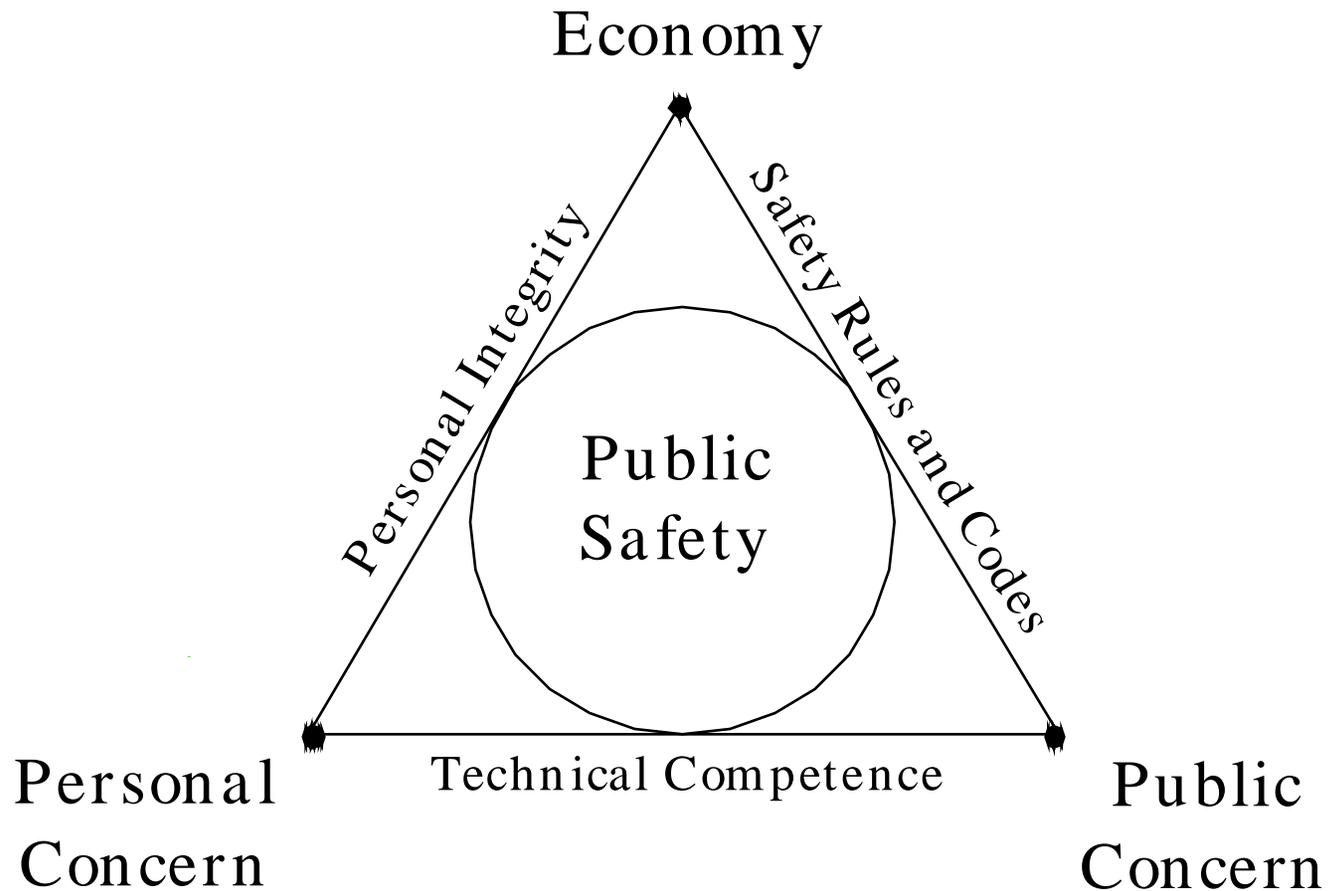
11.   DESIGN OF A BRIDGE

When designing a bridge, actual or metaphorical,

the fundamental question is:

What is a Bridge?
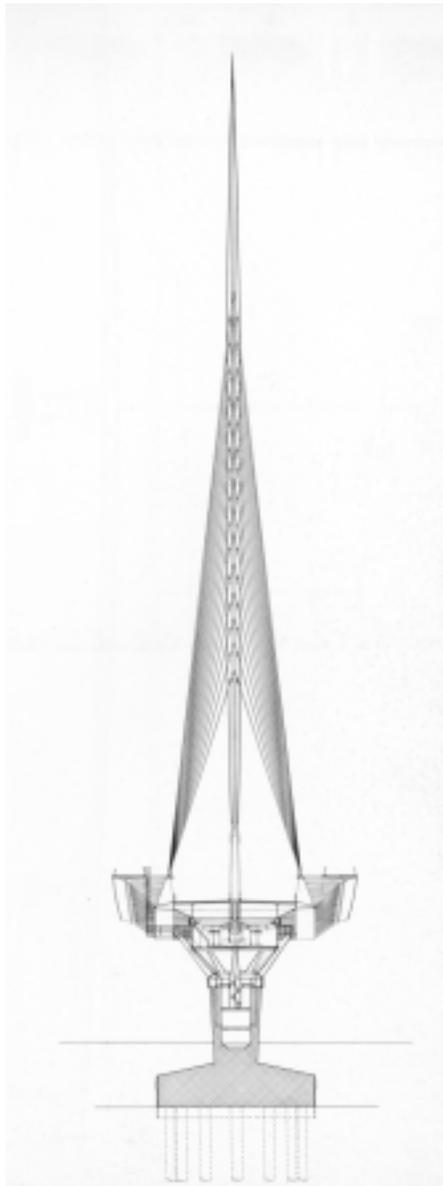
Elevation of Médoc Swing Bridge, Bordeaux, 1991

Santiago Calatrava: Poetics of Movement, Alexander Tzonis, p.232

A bridge:

- Joins two points or several,

- Shrinks distances,

- Transcends the elements (water, air, space, earth, fire, hostility)

- Transforms relations between two points:

    o Physically

    o Economically

    o Culturally

    o Ecologically

    o Spiritually

Calatrava bridge in Seville, Spain, 1987-92

Santiago Calatrava: Poetics of Movement, Alexander Tzonis, p.115

Though static (or nearly so), a bridge functions dynamically.

It is a structure enabling a process. The structure may be concrete

and metal, as in the George Washington Bridge; or it may be just thin air,

as in the Berlin Air Lift.

The Web is a hyper-dimensional bridge in cyber-space.

A bridge may also be entirely non-material.

The act of design itself is a bridge between the here of the

Functional Requirements (FR's) to the there

of the Design Parameters (DP's);

…between Desire and Realization;

…between Illusion and Reality.

Bridge < OE brycg (bridge) < IE bhru (beam, log)

(SKT $\sqrt{bhr}$ (to bear))

Lat. Pons, Pontis (,? Pondus –eris (weight), i.e., able to bear weight)

Pontifex (bridge maker)

Pontifex Maximus (Great Bridge Maker – Head of Roman College of Priests –

maker of bridge between the work of men and that of the Gods - Pope).

Hence, Engl. Pontiff, Pontifical, Pontificate, etc.

The first and primary result of the dialectical process

between designer and client is the selection of the FR's.

This implies a *viewpoint* from which the situation can be seen,

and a *standpoint* from which action can take place.

Since what we see depends as much on *where* we look *from*,

as on *what* we look *at*; the viewpoint is all important for

under*standing* the situation and therefore finding a *standpoint*.

Copernicus and Ptolemy looked at the same Universe

but from different view points and the

consequences have been dramatic.
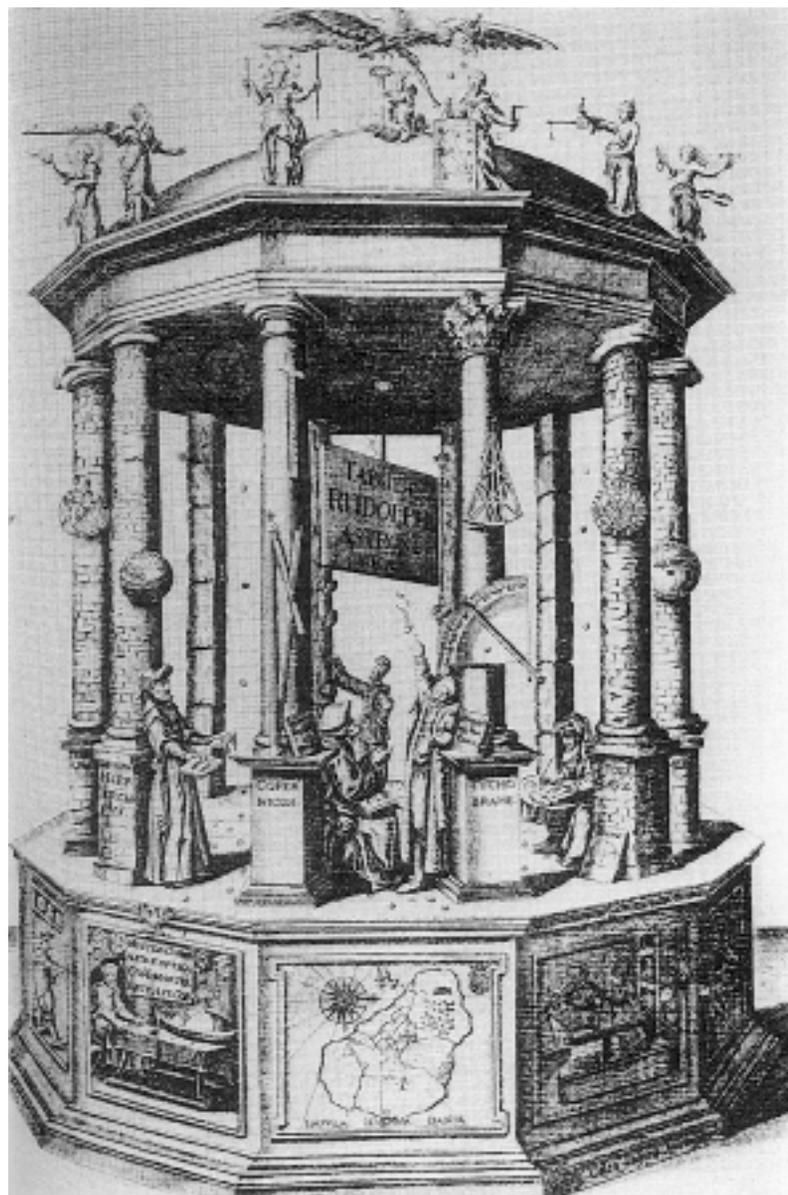
Temple of the Astronomers, 1627

Picturing Knowledge, Brian S. Balgriz (Ed), p.77

Therefore, choose wisely your viewpoint and find a firm standpoint.

Rock cut cistern at Masada, near the Dead Sea

Eureka, E. DeBono, p.138

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12. A RETURN TO POETICS

Jacques Maritain in *Art and Scholasticism* states:

"There are in the intellect virtues whose *sole end* is to *know*. They belong to the *speculative* order.

The *practical order* is opposed to the speculative order because there man tends to something other than knowledge only.

Art belongs to the practical order. It is turned toward creation, not towards the pure interiority of knowledge." (Art here does not differentiate between Fine and Mechanical Arts).

"But the *practical order* itself is divided into two entirely distinct spheres, which the ancients called *The Sphere of Doing (agibile, praktos)* and *The Sphere of Making (factibile, poietos)."*

"Doing" is ordered to the common end of *the whole of human life*,

and it concerns the proper perfection of *the human being*.

The Sphere of Doing is the sphere of *Morality* or of the *human good* as such."

"In contradistinction to *Doing*, the Schoolmen defined *Making* as *productive action,* considered not with regard to the use which we therein make of our freedom, but merely *with regard to the thing produced* or with regard *to the work taken in itself.*

"The Sphere of Making is the sphere of Art,

in the most universal sense of the word."

The *Sphere of Doing* is centered on what we have identified as the *viewpoint*,

The *Sphere of Making* on the *standpoint*.

The tension between these centers gives rise to moral and ethical

considerations.

The Sphere of Doing is the sphere of awareness, of being, of understanding.

It varies with the level of consciousness. Five such levels can be recognized,

each governed by certain values as shown on table 1.

Perhaps the word spectrum rather than level should be used for they overlap, the

more comprehensive including the more restrictive.

(e.g., *family* includes *self*, but *self* may exclude *family*.)

Table 1: Levels of Awareness and their Governing Values

Personal ethics and habits
(Ritual)

Communal and Social Morals
(Rectitude)

Fundamental, Philosophical, and
Religious Questions
(Ultimate Values)

Myself as Individual

My family, or immediate group

My Community (Local, National, Professional)

Mankind

Creation (Universal)
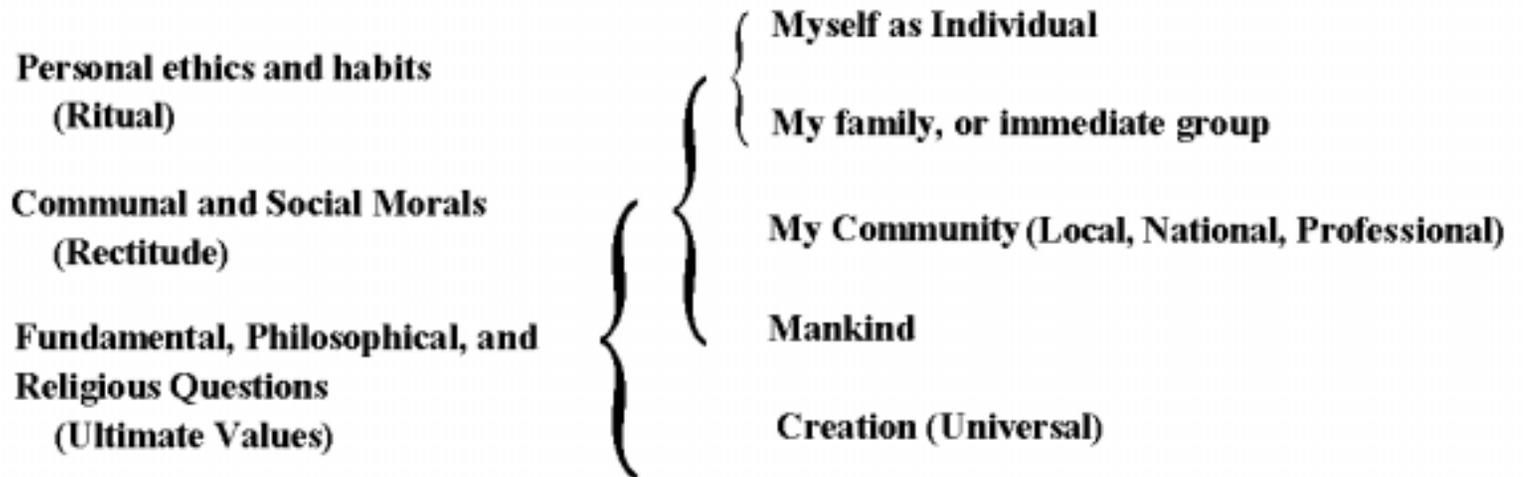
The Sphere of Making is centered on the *standpoint*.

It reaches in both time and space (history and geography)

from instants to millennia, from immediate surroundings to the

whole creation and time constants of the order of the history of

mankind as shown on table 2.

Table 2: Spatio-Temporal Spheres

Time Constants (yrs)	Geographical Radii	Typical Artifacts	Typical Values	Governed By
0.1	Local	Disposable Items	Personal Habits	Habit
1	Regional	Consumer Goods	Social Interactions and Habits	Ritual
10	National	Cities Great Buildings	Patriotism National Law Trade, Culture	Rectitude
100	Continental	Highway Networks Railroads, Factories Infrastructure	Principle of Law and Government, Nature of Society	Ultimate Values
1000	Global	Pyramids, Cathedrals Nuclear Devices	Great Traditions Fundamental Science	

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Architecture, Art, Engineering, Poetry

in a true sense, belong to the Sphere of Making.

But they are also contained in the sphere of doing.

Leo Leonni speaks of

"That magic moment of pure *making*, when suddenly all transcendental

interferences vanish, leaving the hands free to perform their assigned task

swiftly, lightly and with deserved arrogance. Modest though this may seem

compared to the more popular moments of Inspiration with a Capital I, for an

artist it is, I believe, the happiest, most fulfilling moment of the entire creative

process."

And Jacques Maritain echoes this:

"It establishes the *artifex* – artist or artisan in a world apart, closed, limited,

absolute, in which he puts the energy and intelligence of his manhood at the

service of a thing which he makes. This is true of all art; the ennui of living

and willing ceases at the door of every workshop."

Paradoxically, as the monk finds freedom through his rule,

the artifex – the maker of things – finds his liberation

through centered attention on his work.

But the work, the action, is an event occurring at a surface,

or perhaps more exactly between two surfaces.

The point between the surfaces where the action is taking place is always at rest:

Where the hand presses the clay

The pencil, the paper

Where the rubber hits the road.

Or, as T.S. Eliot puts it:

"At the point of the turning world…
…at the still point, there the dance
     is,
     But neither unrest nor movement. And do not call it fixity,
where past and future are gathered. Neither movement
from nor towards,
Neither ascent nor decline. Except for the point, the still
     point,
There would be no dance, and there is only the dance."

Tandava Dance, Siva Nataraja

India; five thousand years of Indian art, Hermann Goetz, p.175

Senses, mind, heart and Nature (as in human nature)

in the ordinary state all move in their own orbits

Disconnected.

Nature

Heart

Mind

Senses
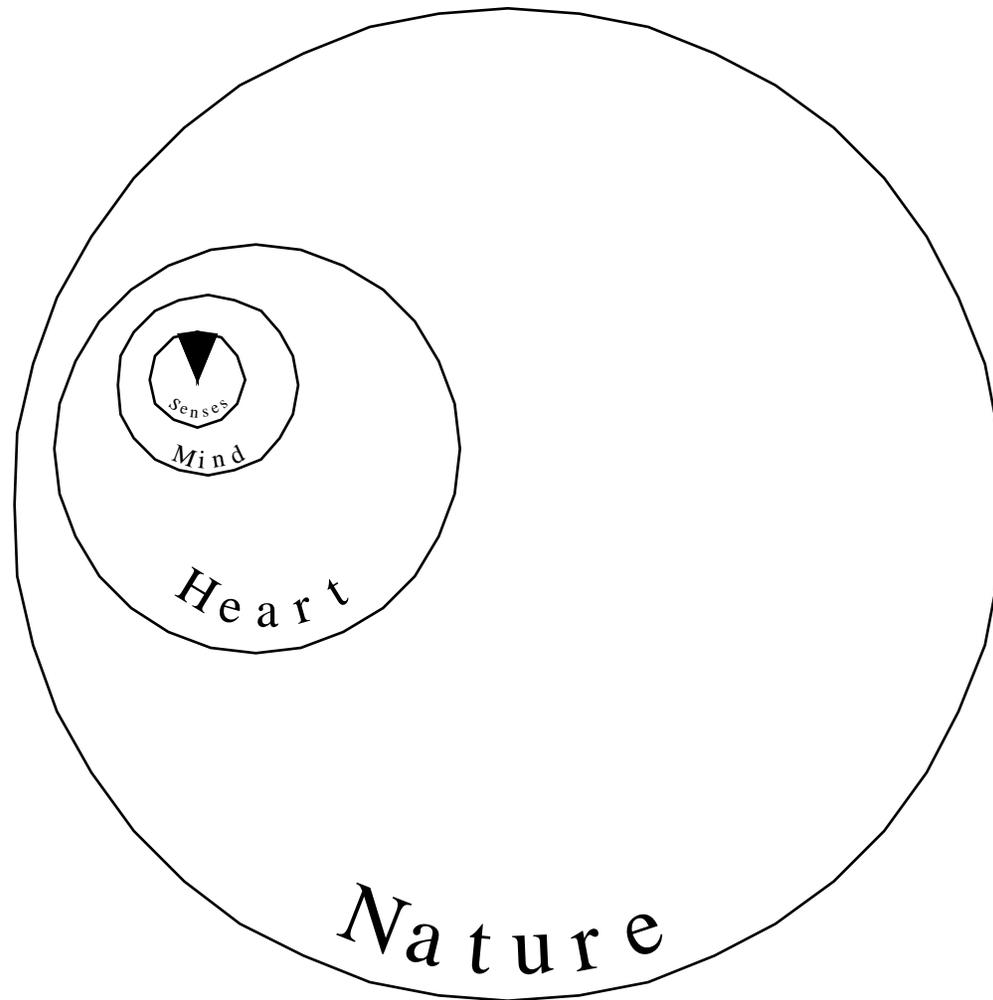
Disconnected State of Attention

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When we collect ourselves

There is concentration

Rest

No action.

Senses

Mind

Heart

Nature
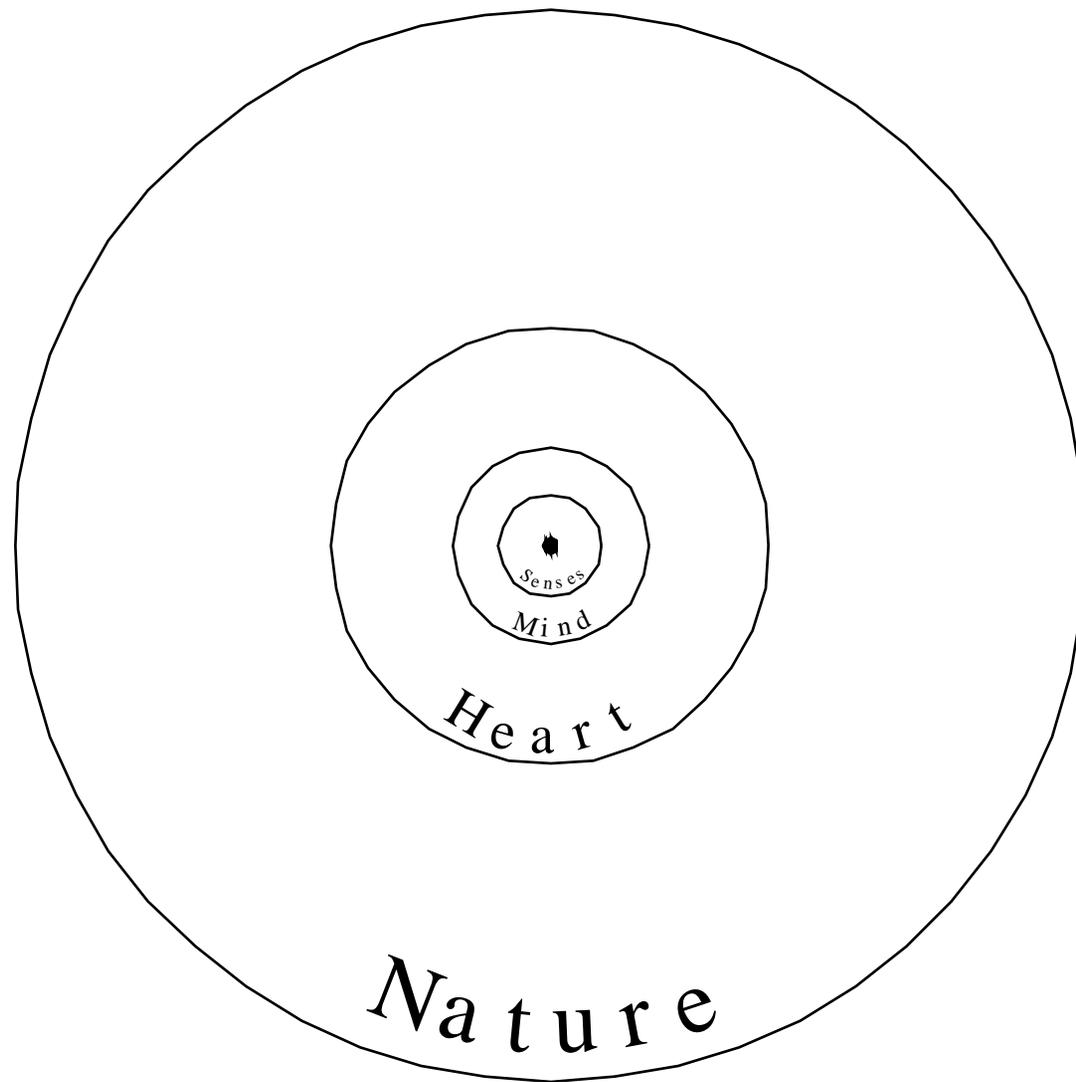
Poised or Concentrated State of Attention

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"In the magic moment of *making*"

When all spheres coincide

There is focus

At the point of work

There the dance

Is.

Senses

Mind

Attention

Heart

Nature
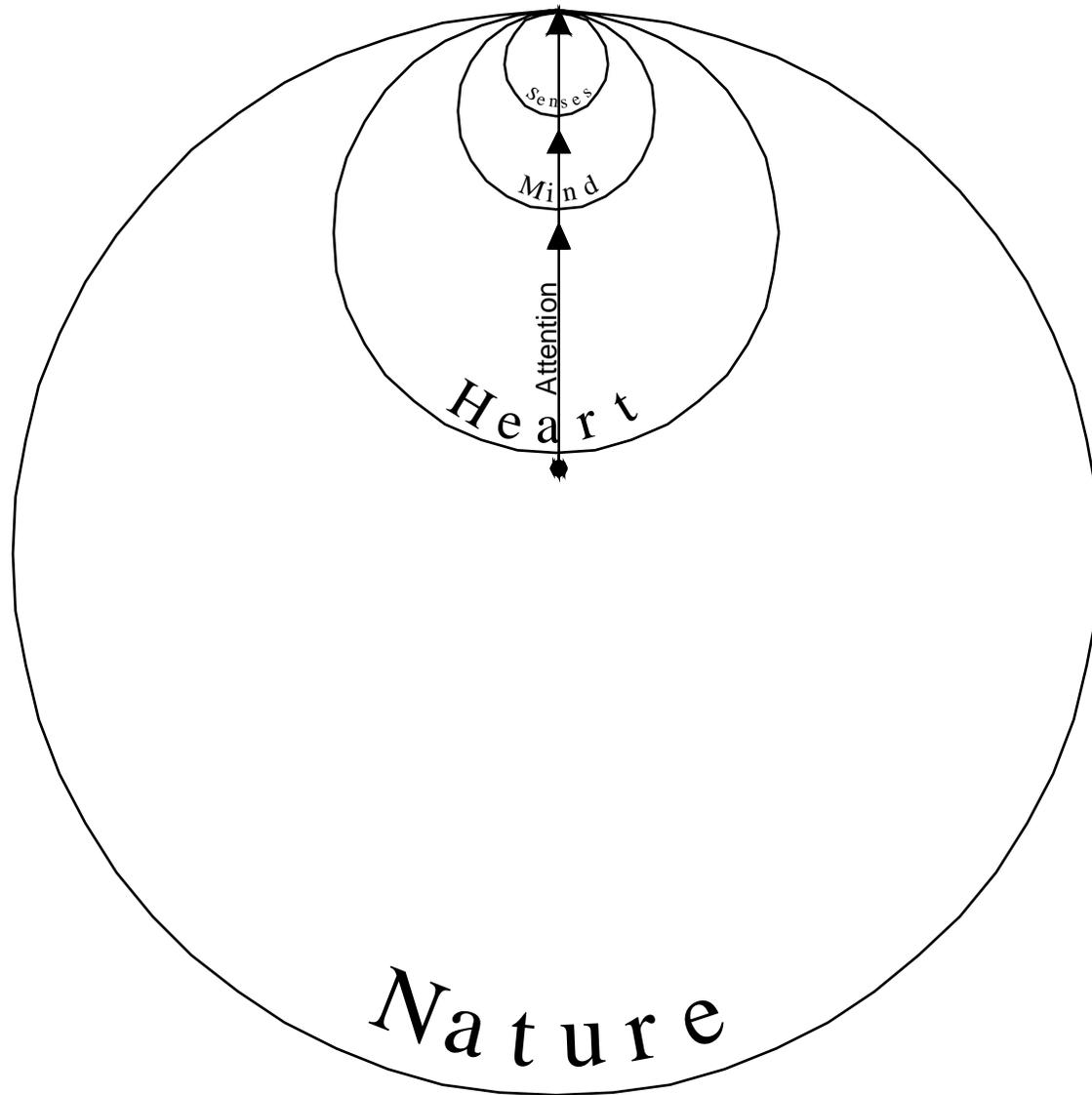
Direction of Active State of Attention

But this aspect of Poetry, in its generic sense of Making,

refers to the maker of things.

However, we do not make things *for* ourselves, in general, but for others.

And furthermore, this making makes no distinction between prose and poetry.

There are, after all prosaic works of art, prosaic machines, and prosaic

structures.

What makes for a poetic one?

What makes an object, a word or a set of words, a machine or a structure poetic?

Taking the most obvious case of a poem, the first mark of poetry is, visually, the

arrangement of the words on the page, or the aural arrangement of sounds in the

time sequence of their production. The poetry springs, in the perception of the

viewer or listener, out of the tensional relationship of words within word-strings

and strings within contexts visually and aurally, beyond and above their

functional or grammatical relationships, i.e., beyond the expected prosaic

expression. By being set, *by design*, in a special relationship with other words in

a visual or an acoustical space, this particular word gains a particular power,

acquires meanings, evokes new resonances in the spectator or listener; in other

words it is transformed like a diamond rotated through diverse orientations in a

beam of light.

Fundamentally, in itself, the object, the word, remains itself, but a new, unexpected facet, reflecting a new aspect of our experience is brought forth, new associations are made, analogies, metaphors; our field of awareness is enriched, deepened, sensitized. Our perception is transformed. New intuitions are born.

One thinks for instance of Marcel Duchamp's bicycle wheel upside down on a stool in the middle of an art gallery. What could be more prosaic than a bicycle wheel mounted on its fork in a garage or a stool in a kitchen. But put them together inside the white cube of a gallery space and you set art critics writing for the next 50 years!

Marcel Duchamp with *Bicycle Wheel*

The Brothers Duchamp, Pierre Cabanne

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As we put it before:

The bridges of Maillart in the Swiss Alps have the pure elegance of a dancer in high jump. The simplicity and cleanliness of their lines contrasts with the ruggedness of the landscape, framing it, dominating it not only by their altitude but by the clarity of intelligence and sureness of judgment that they reveal: Euclid's victory over the elements, tensions between the geometric simplicity of the bridge and the fractal complexity of natural forms.

On the other hand the proposed designs of Calatrava for St. John the Divine

Cathedral in New York are no less poetic for following natural lines. The

organicity, skeletal appearance, of these forms is in perfect resonance with the

gothic arches of the pre-existing building and the bio-shelter proposed for the

roof. We move through these arches as through the rib cage of a vast white

whale. Shades of Ahab!
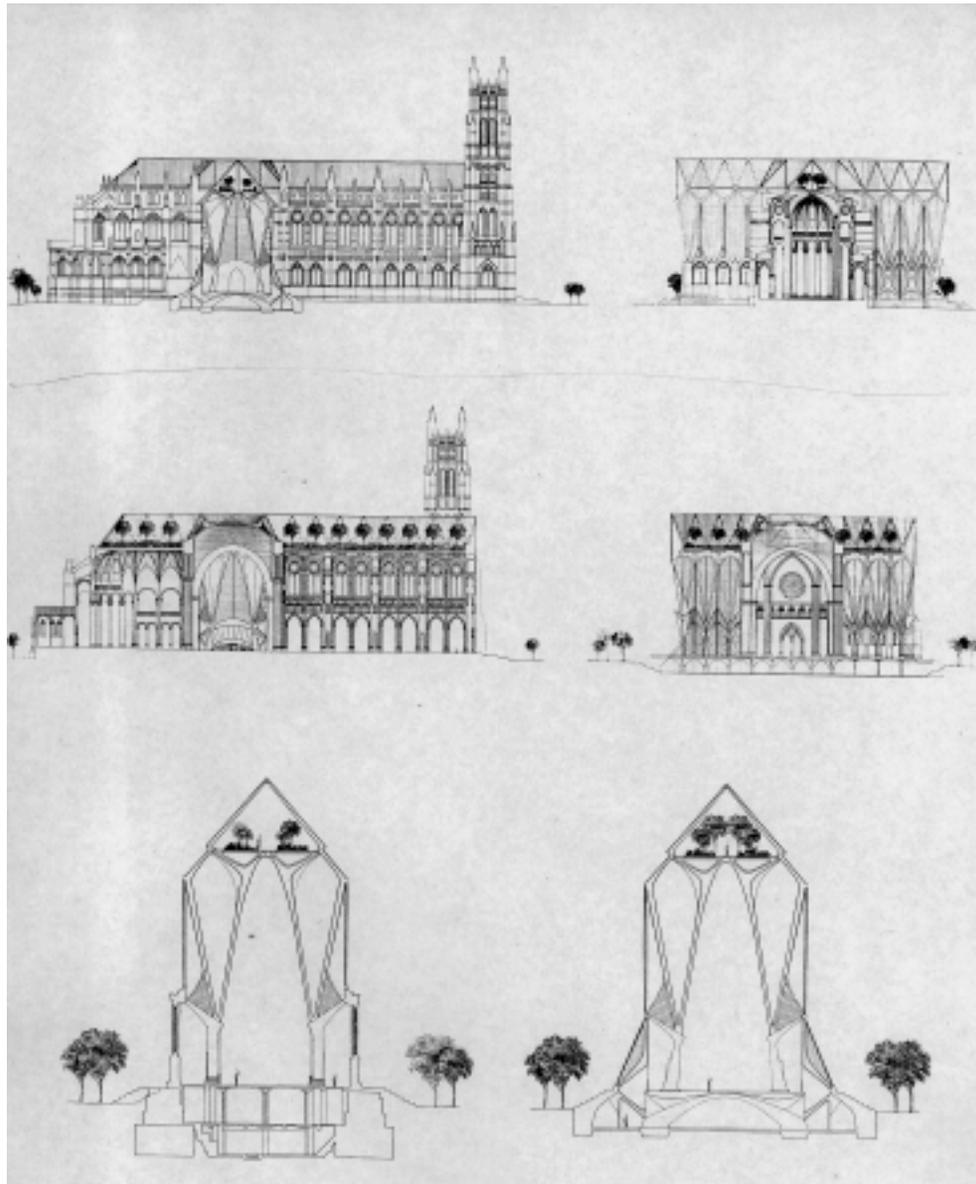
Designs for St. John the Divine Cathedral, 1991

Santiago Calatrava: Complete Works, Sergio Polano, p.226-228

13. POETRY AND ENGINEERING

We may have a sense of what Poetry is.

We have even said that to the extent that engineering

is concerned with making things, it is poetry.

Yet we have not really examined the *nature of engineering*.

Grammatically, the word *engineering* is a gerund, i.e.,

a verbal form used as a noun while conveying the meaning of verb –

as when we say "cooking is an art."

Engineering derives from the verb "to engineer";

to devise and design ways of doing things.

[O.F. *engeinier* (to make with skill) L. *ingeniare* (to contrive)

I.E. $\sqrt{\mathrm{GEN}}$ (give birth, beget) + in = inborn; L. *ingenium* (inborn quality)]

It is interesting that there is no exact equivalent in French

for the word engineering, though *ingéniérie, génie* are used with

restrictive meaning. The best translation remains:

"The art of the engineer."

The point is that Engineering is not applied science as is often thought.

It is much wider in scope. Technically, engineers are involved in the

three areas of Science, Engineering, and Technology.

Engineering is a social activity for social ends.

The business of Engineering is the development of technologies to process,

apportion, and give form to materials, energy and information which

constitute the substance of economic life.

Design is its backbone. Design specifies the way this can be done within the

scientific, technological, economic, ecological, political, sociological and cultural

context.

Engineering, science, technology are concurrent activities that feed upon one another through a complex of reciprocal interactions or feedback loops centered on the "hub" of desire or need and the "spokes" of *doing and making, using,* and *knowing*:
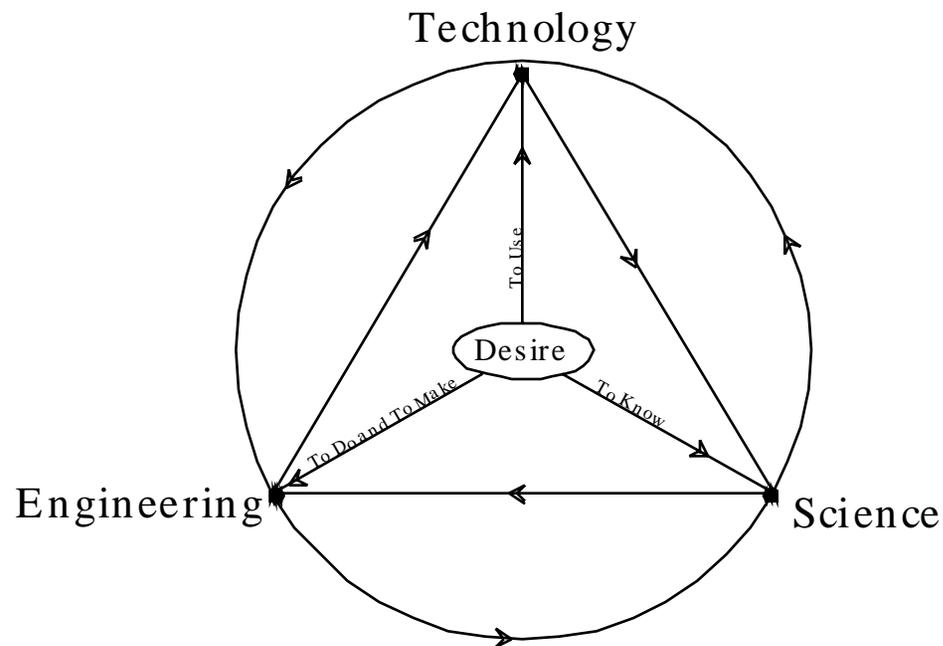
Having examined *Engineering* and its relation to Science and Technology,

let us consider its *relation to poetry*.

Eiffel tower under construction, 1889
Gustave Eiffel, Bertrand Lemoine, p.85

Engineering and Poetry in Action.

Engineering, through design, re-orders materials, energy, and information. It creates structures, machines and devices and puts them in functional relationships to achieve goals set by individuals, groups or communities, governments and agencies. Perhaps none strikes the imagination or elicits a poetic response more than certain structures: the Brooklyn Bridge in New York, the Eiffel Tower in Paris are such structures. Whatever pretext might have been used to gain support for their construction, they have become symbols not only of the very cities they were meant to serve, but of their age. "The utilitarian excuses," writes Roland Barthes of the Tower, "are nothing in comparison to the great imaginary function which enables men to be strictly human…"

Eiffel Tower completed, 1889

Gustave Eiffel, Bertrand Lemoine, p.85

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"Eiffel saw his Tower in the form of a serious object, rational, useful; men return it to him in the form of a great baroque dream which quite naturally touches on the borders of the irrational."

And he pursues:

"As a matter of fact the Tower is *nothing*, it achieves a kind of zero degree of the monument; it participates in no rite, in no cult, not even in Art; you cannot visit the Tower as a museum: there is nothing to see *inside* the Tower. This empty monument nevertheless receives each year twice as many visitors as the Louvre."

The Tower may be regarded as the first stabile, set in contrast against a whole city, providing a reference point in space and time for inhabitants of the city and a point of view for its visitors.

And he concludes:

"By affording its visitor a whole polyphony of pleasures, from technological wonder to haute cuisine, including the panorama, the Tower ultimately reunites with essential functions of all major human sites. Autarchy; the Tower can live on itself: one can dream there, eat there, observe there, understand there, marvel there, shop there…

One can feel oneself cut off from the world and yet, the owner of a world."

Yet when Barthes says the Tower is "nothing" he may go too far too quickly. It may be so to the casual tourist but, like the Brooklyn Bridge, the Chrysler Building, the Empire State or the Space Program, the Tower was erected against a specific social, economic and political landscape which, viewed through the lens of history, lends its own poetic framework to the informed observer.

"The image of the Eiffel Tower" writes the scholar Miriam Levin, "is commonly accepted to signify "modern style," the wedding of technology and art in a functional and economical form, which we have come to identify with values shaped in late 19th century France…In the Tower, Eiffel wedded skill and imagination in using new technologies, in developing new techniques, and in accepting functionalism and economy as both practical and aesthetic guidelines in the design of his structures."

Eiffel himself said his aim was "to raise to the glory of modern science, and to the greater honor of French industry, an arch of triumph as striking as those that preceding generations had raised to conquerors."

Jean Cocteau, poet, artist, and man of letters about town is said to have

remarked that the Tower was the Notre Dame of the Left Bank. There may be in

this more wisdom than was intended, for one can sense in the inspiration of its

designer the same striving that was animating the gothic designers: height,

lightness and airiness – the "more with less" philosophy that would later become

the leit-motif of Buckminster Fuller – in the service of an affirmation of the

Universality of Man (the Tower was erected to celebrate the hundredth

anniversary of the French Revolution) if not of the great medieval equation:

"God is Light."

14.   THE TASK

Now it is time to return home, to the House of Poetry

that we have in fact never left, for in that house there are many mansions.

The act of creation, the design process is metaphysically fundamentally

the same across the spectrum of the professions.

As the ancient traditions tell of God speaking things into existence, as the ancient

prophets and seers spoke the languages into existence, everything seems to

direct us toward the point where we too, people of the Art, will be able to speak

our design into existence, where design can be rendered as natural as speaking

and writing.
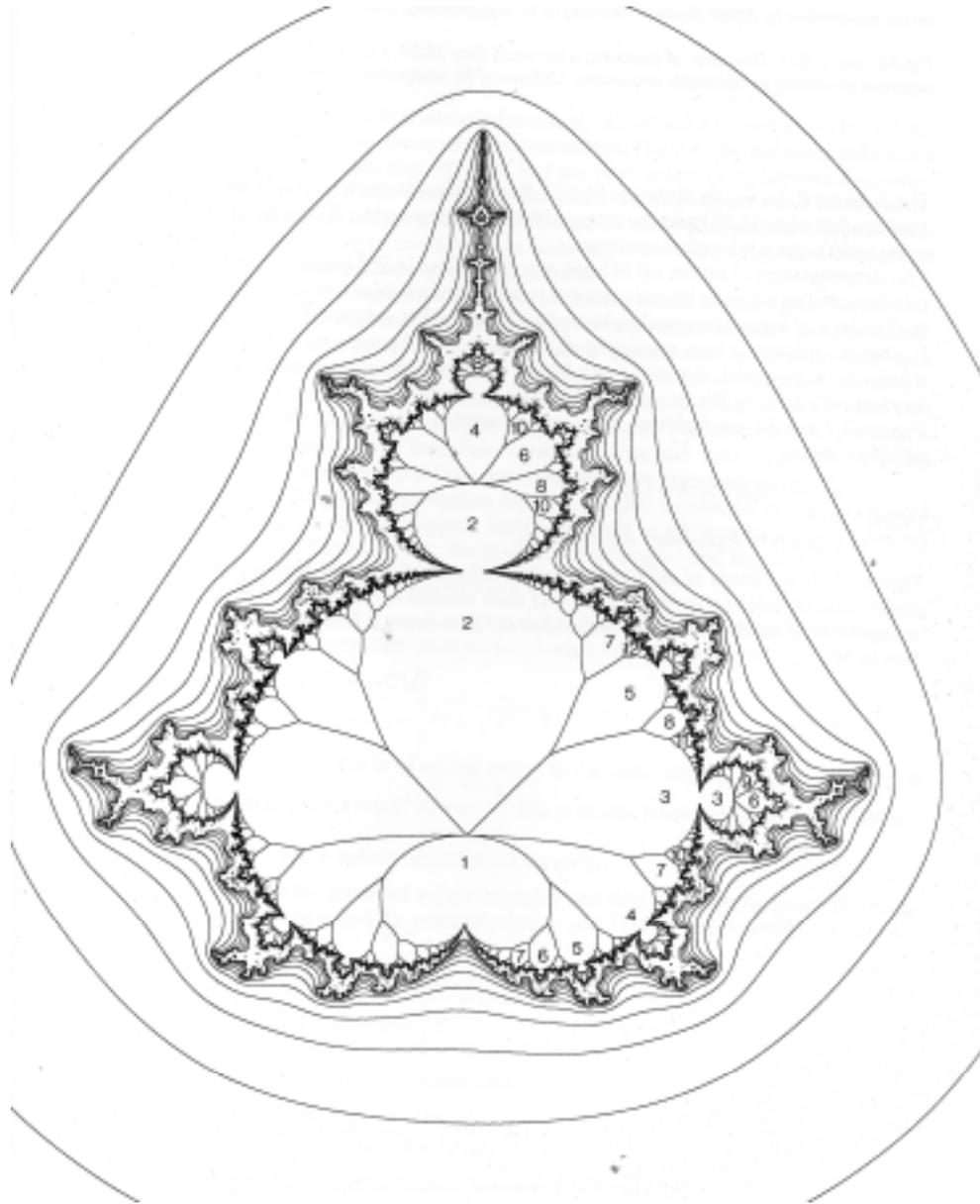
Fractal Pattern

The Beauty of Fractals, H.O. Peitgen and P.H. Richter, p.61

For a long time engineers have been deprived of the joy of making things with their hands. More often than not, most of them have been deprived of making things at all – their contribution reduced to analysis, calculation, a rough sketch or a succession of meetings where design decisions are made by others.

Few are the Ammans or Eiffels, the Roeblings or the Calatravas, the Bugattis or Fords, who can leave their name on a bridge, a tower, an airport, or a car. Architects at best have often to content themselves with drawings and balsawood models, poor substitutes for the real thing. Artists are more lucky in this.

But, through the labors of the engineer, a new day may be dawning. Already some techniques of rapid prototyping allow the engineer to produce objects in three dimensions, directly from a CAD file.
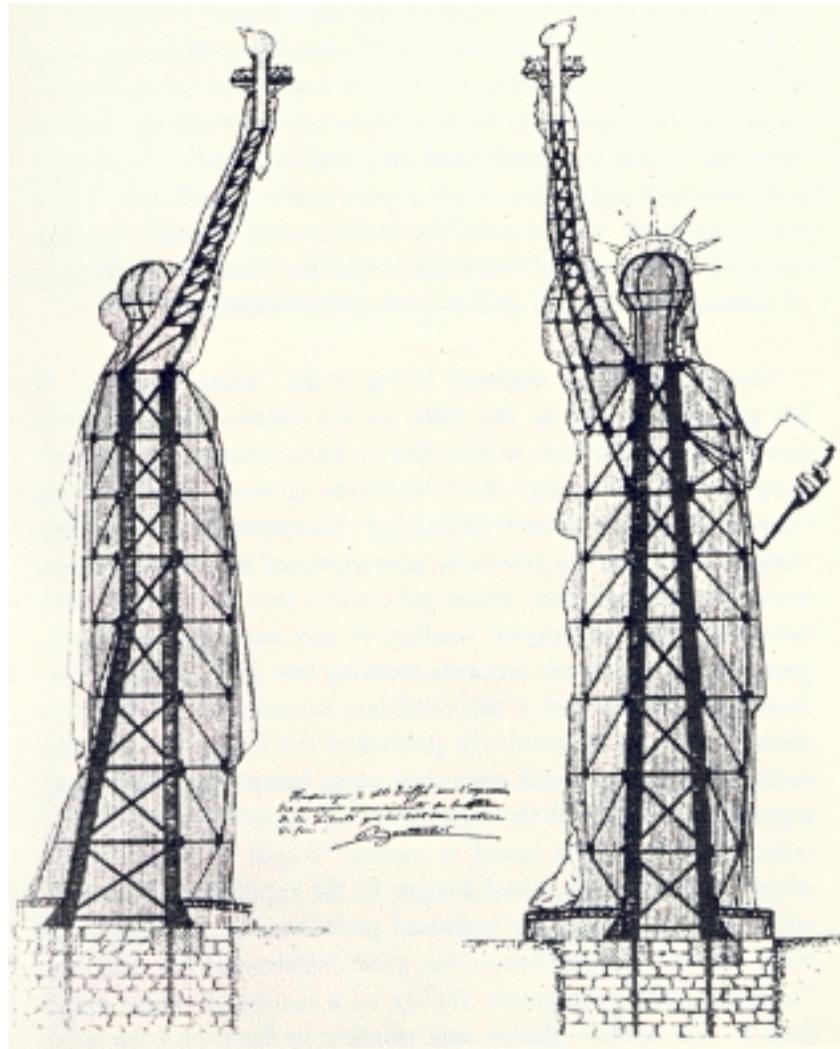
Interior bracing of the Statue of Liberty, 1881

The Tallest Tower, Joseph Hariss, p.51

As the composer of electronic music can bypass scribes and publishers,

orchestras, maestros and even concert halls and produce his music exactly as

he wants it, we are approaching the day when the engineers, like the artisans of

old, will be able to produce their devices and machines directly also –

craftsmanship by computer.

Already, new sculpting machines allow three dimensional cyberforms to be downloaded in rapid prototypers. May the next stage be for voice operated computers to obey oral commands and produce forms directly so that "the word" becomes "the thing" while bioengineers spell out new codes for living cells giving rise to a whole Bestiary more fantastic than anything thought up by the wildest imaginations of the medievals?

Is this the return of the Prodigal son….to the House of Poetry?

Or is this the point where the House of Poetry turns into the House of Horrors?

Crucial tension, crucial moment

between viewpoint and standpoint

between the possible and what ought to be done

or not done.

Who will decide?

Perhaps Jose Ortega Y Gasset [11] gives us a clue here when he writes:

"It is not enough to be an engineer. We are not allowed to confine ourselves within our own professions, but must live in full view of the entire scene of Life, which is always total. The supreme art of living is a consummation gained by no single calling and no single science; it is the yield of all occupations and all science and many things besides."

And Heidegger[12] widens our perspective as he reminds us that:

"Everything depends on our manipulating technology in the proper manner as a means. We will, as we say, "get" technology "spiritually in hand." We will master it. The will to mastery becomes all the more urgent the more technology threatens to slip from our control…. There was a time when it was not technology alone that bore the name techne. Once that revealing which brings forth truth into the splendour of radiant appearance was also called techne."

[1] The Economist, November 2, 1996, p. 32, in New poetry from America – Mouth to ear resuscitation

[2] F. Hallyn The Poetic Structure of the World, note 54 p. 71

[3] U. Eco: L'oeuvre ouverte. Ed. Du Seuil. Paris 1968 p. 11

[4] P.D Oupensky: In search of The Miraculous. Harcourt, Brace & World, Inc. New York. 1949.

[5] ibid

[6] "La machine n'est qu'un agencement de moyens entre deux termes qu'elle présume"
Paul Claudel – Art Poétique. Du Temps I.p.134 Pléiade, Gallimard, Paris, 1967.

[7] Paul Claudel, op. cit. p. 136

[8] Fernand Hallyn: "The Poetic Structure of the World" p. 191, Zone Books, New York, 1990

[9] F. Hallyn op. cit. p 171

[10] F. Hallyn op. cit. p. 173

[11] Jose Ortega y Gasset in "Man the Technician"

[12] Heidegger: Essay "The Questions Concerning Technology"