Order & Chaos in Thinking

VCMSR – 5

Punyashlok Mishra

From VC Batra

ORDER AND CHAOS IN THINKING
Special Project

Submitted in partial fulfilment
of the requirements of the Master of Design
degree in Visual Communications

by
Punyashloke Mishra
886124
Guide
A.G.RAO

Industrial Design Centre
Indian Institute of Technology
Bombay - 400 076
March 1990

The Special Project entitled "Order and Chaos in Thinking" by Punyashloke Mishra (886124) is submitted in partial fulfilment of the requirements for the Master of Design degree in Visual Communication.

Signature of Guide

ACKNOWLEDGEMENTS

This is a project which I have been keen on doing for a very long time. My reading into which has been quite eclectic (and seemingly disjointed) has always seemed to be turning around a common centre. Be it the history of science the novels of Kafka, the poetry of Eliot or the mysteries of modern physics - all seem to be shadows of a few core themes - the themes of order and chaos and the theme of ambiguity (so closely related to the thin boderline between the above two).

This project would not have been possible unless it had been offered by Prof. A.G.Rao. I wanted a project which could focus my interests towards some coherent goal and result in some distinct output. This project offered me that opportunity - and for that I am grateful.

More than just offering this project I shall remember the long conversations that we had - not necessarily on the topic at hand. I may not have done exactly as he wanted me to but I hope it is forgiven.

Thanks are due to soem people who had to listen to me expound on all kinds of things. In fact the dangers of a project like this is that everything falls within its ken. For their patience I am thankful to my wingmates, my IDCmates and Smita.

O once again let us set out,
Our faith balanced by doubt,
Admitting every step we make
will certainly be a mistake,
But still believing we can climb
A little higher every time. . .

W.H.Auden

Order & Chaos in Thinking

The white rabbit put on his spectacles. "Where shall I begin, please your Majesty ?" he asked.
"Begin at the beginning," the King said gravely, "and go on till you come to the end. Then stop."
- Lewis Caroll

Order and chaos. Chaos and order. Black and white. Good and evil. Figure and ground. Irrevocable opposites - the absence of one defining the other.

Chaos was a bad word. The ancient Greeks used it to describe the state of the universe before creation. A kind of vague, disordered, gaseous state. Out of this chaos there emerged cosmos (a beautiful word) it implied the lovely ordered world we see around us, existing according to definite laws and rules. it was the entire universe with its beauty and grandeur and interconnectedness. Cosmos was order and sense. Chaos was disorder and nonsense.

Chaos was about as bad a word could go - and hence there was no way but up. Now Chaos is the name of the new science that has revolutionized the way we look at nature. Chaos is a science of everyday things - of art and economics, of biological rhythms and traffic jams. - giving new insights into the workings of nature. Not bad for a word with such lowly beginnings. On the other hand Cosmos had no way to go but down. It slowly took on restrictive meanings of beauty and (worse) superficial beauty and is now remains with us in the form of the word "cosmetic". So we see that, that which was nonsense becomes a science and that which was order and grandeur becomes superficial and silly. Somehow an apt description of the absurdity of the modern situation.

Notions of order

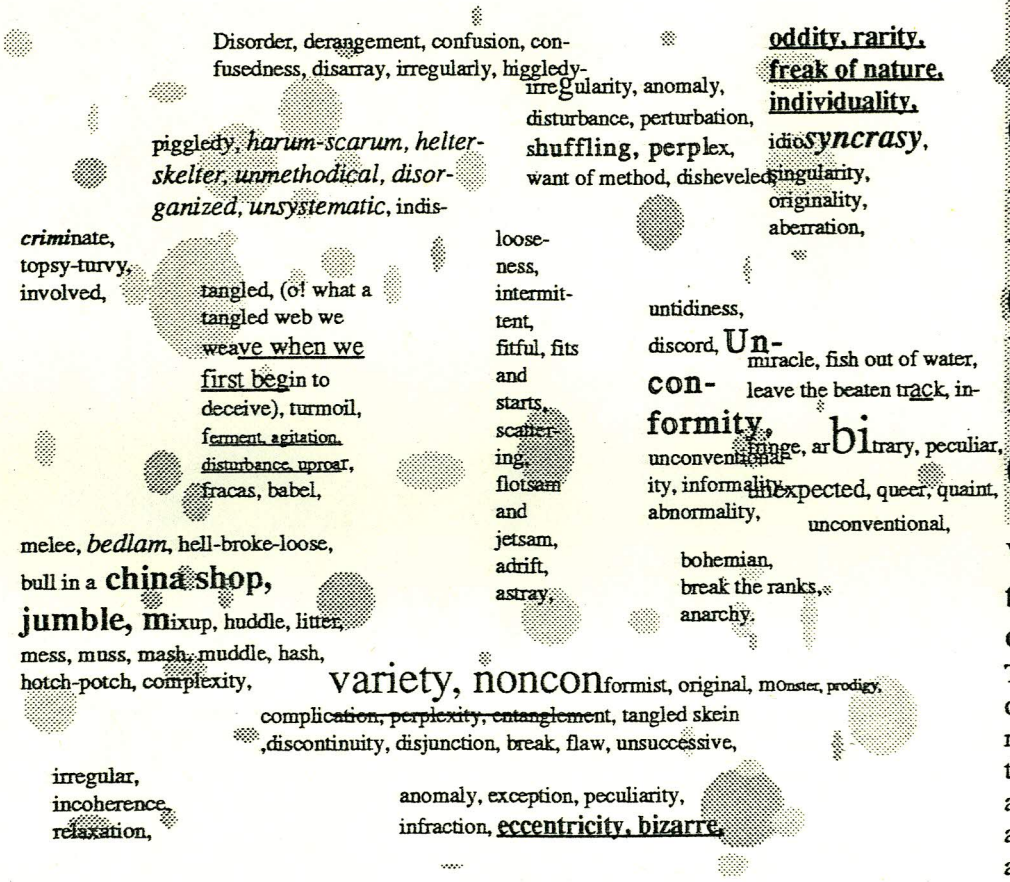
What is order ?

Order and chaos are essentially visual concepts. We see order in terms of symmetry and pattern, regularity and arrangement. Ask any one the meaning of disorder he will most probably say "er.. well.. . . when something .. er . . is not in the right place .. you know what I mean."
And strangely enough we do know what he means but flounder helplessly when it comes to defining them cogently and correctly.
Having defined them as undefinable we set out to tabulate the notions of order and disorder - always keeping in mind what Eliot had said in this context

. . . And so each venture
Is a new beginning, a raid
on the inarticulate
With shabby equipment
always deteriorating
In the general mess of
imprecision of feeling . . .
— T.S.Eliot in *The Four Quartets*

1) Continuity regularity, uniformity, pattern, continuity, succession, progression, series, train, chain, procession, arrangement, subordination, even tenor, method, routine, discipline, orderliness, rank, place, orderly, regular, in -order, trim, apple-pie order, according to cocker, its proper place, neat, tidy, well regulated, correct, methodical, uniform, ship-shape, business-like, systematic, habitual, unconfused, arrangeddiscipline,systematic,formua,system,principle, lawconformity,conventionality, rut, move in a groove, comply, adaptable, compliant, swim with the stream/ tide, rubber stamp, regimentation, **2) Hierarchy/ categorization** in terms of social order, natural order, gradation, levels, classifications, sorting, grouping, apportionment, taxis, taxonomy, graduation, organization, grading, re-organization, gradation, analysis, classification, division, systematism, sift, winnow, eliminate, narrow down, exclude, clear, purify, discipline, orderliness, rank, place, subordination, even tenor, method, routine in order, methodically, turn by turn, step by step, gradations, stages, intervals, systematically, by clockwork, at stated periods*Concepts of class (classification)* class, category, head, order, section, division, subdivision, department, province domain, sphere (how symmetric), kind, sort, genus, species, variety, branch, family race, tribe, caste, sect, clan, breed, clique, coterie, range, gender, manner, description, designation, character, predicament, conviction, file, similarity, classify, divide,string together, thread, register, record, list, catalogue, tabulate, index, alphabetize, codify, orchestrate, scoremethodize, regulate, systematize, standardize, **3) Predictability** continuation, Sequence,following, subordinacy,ensue, conformity,conventionality, rut, in a groove, comply, adaptable,compliant, swim with the stream, low information, specimen, sample, case in point, pattern, do at Rome as the Roman's do, orthodox, sound, invariable **4) Symmetry** can be quite complex. The concept of **geometric order, mathmatical order, statistical order5) Coherence** Harmony, simplicity, homogeneity harmony, music of the spheres, Simpleness,purity, homogeneity, Coherence, cosmos, organism

Notions of chaos



Verbal aspects of the notions of order and chaos

The words describing order seems so staid and run of the mill. In contrast the words close to chaos are so much more vibrant and lively, so much more active and dynamic.

Levels of order

It may be every ant we
trample in
is single before God,
who counts on it
for the unfolding of
the measured laws
which regulate the
curious universe.
The entire system, if it
was not so,
would be an error and
a weighty chaos.
— Jorge Luis Borges

Such a collection of words attempts to get at the core meaning of order/chaos but fails. Such a method, basically evades the main issue. **Beyond all these words is the concept.** Binding together scientists, artists, philosophers, mystics, doctors and cobblers - and it is this concept we have to try to grasp.

It is obvious that these concepts are not all at the same level - some are more general than the others. These words have been kept in some kind of sequence - from the specific to the general, from the clear to the diffuse, from close relationships to vague intuitive connections. One can easily see that the the more specific the word the less it communicates about the concept. So here we are stuck with a crazy paradox - the more specifically we try to define the word the more it slips from our grasp.

Moreover the definition of order and/or chaos depends very strongly on the person defining it. A scientist has a very different definition that an artist who differs greatly from a mathematician.

One can look at order at various levels.

1) The word "order" in english. Five alphabets "o" 'r" etc.
The word dog does not bite, similarly the word order is not symmetric.
2) In terms of meanings - that is tabulate/list/enumerate other words which can help us out. That has been done above.
3) Levels in terms of peoples perception of it as a personal creed or concept
4) Order as relationships

". . .there are times when I think life is vast, when I forget how ephemeral my life is in the total flow of time - a mere second. I forget that my existence is a pointless particle of dust. I start believing the nothing is more valuable than my life in this world".

Personal order is the manner in which we see the world around us - how it is related to us - how we are related to it.

This is a very important concept - the concept of personal order. Every person has his or her own concept of order. It may be quite vague and inexplicable but its existence cannot be doubted. It is the basis of the entire system of science, philosophy and world view that all of us share.

It manifests itself in simple mundane everyday activities - how we dress, how we keep our work place, how we think etc. etc.

Personal orders determine our behaviour to a great degree.

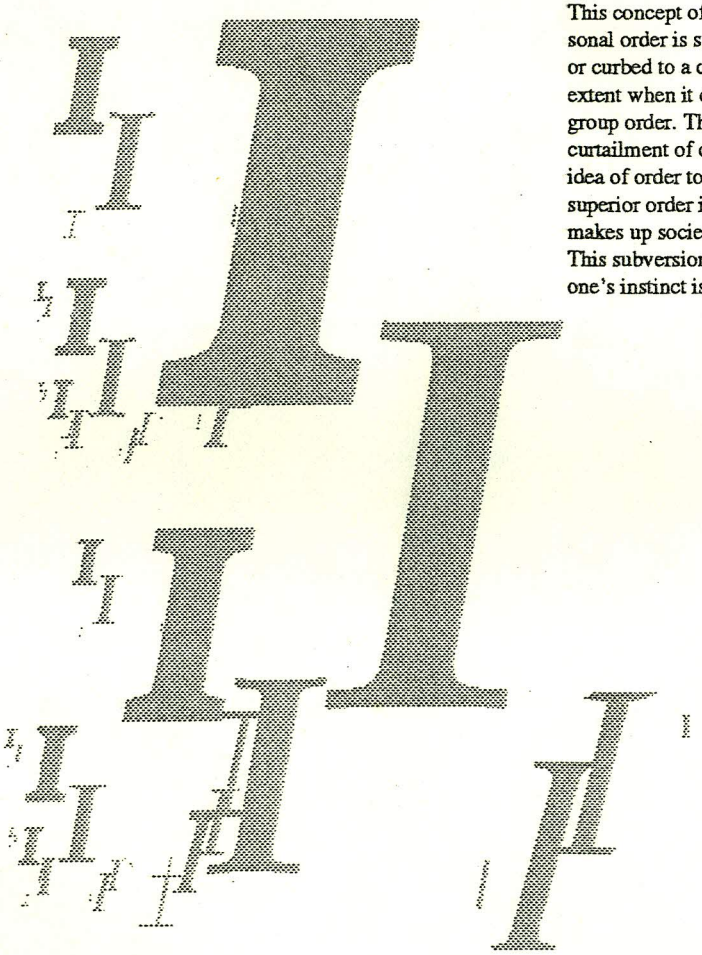
Personal order / chaos

Personal order when carried beyond certain limits can lead to the ignoring of the entire universe and the elevation of the self. "Only I exist", the solipsist declares, "Everything else is a creation of my fecund imagination". The solipsists vision of the universe as expressed by Borges in his poem "The Suicide"

Not a single star will be left in the night
The night will not be left.
I will die and , with me,
The weight of the intolerable universe.
I shall erase the pyramids, the medallions,
The continents, the faces,
I shall erase the accumulated past.
I shall make dust of history, dust of dust.
Now I'm looking in the final sunset.
I am hearing the last bird
I bequeath nothingness to no one.

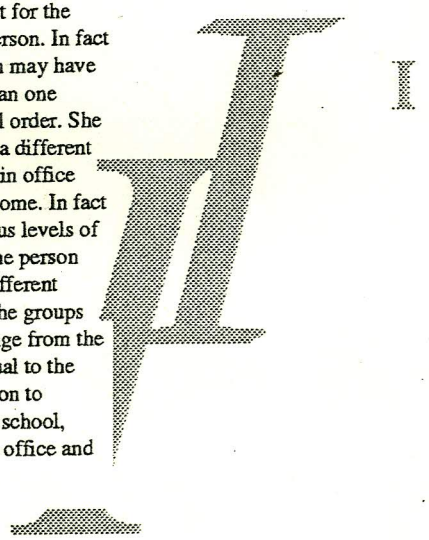
Group Order

There is safety in numbers
— Anon



This concept of personal order is subverted or curbed to a certain extent when it comes to group order. This curtailment of one's idea of order to a superior order is what makes up society. This subversion of one's instinct is mainly for a sense of belonging, conformity, security and continuity. It is in sharp contrast to the freedom one enjoys while existing in one's personal order.

Things are not that simple. Personal orders can be different for the same person. In fact a person may have more than one personal order. She may be a different woman in office and at home. In fact at various levels of group the person plays different rules. The groups may range from the individual to the family on to friends, school, college, office and society.

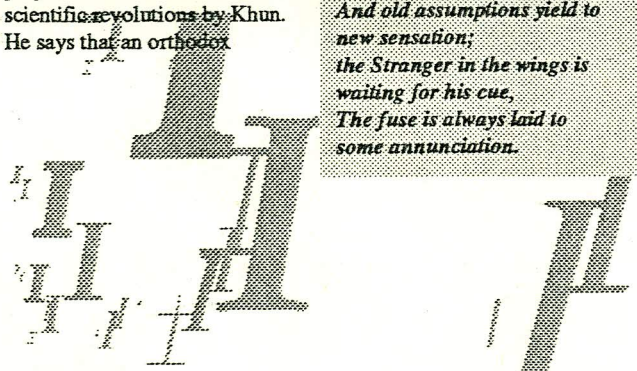


There can in fact be clashes and conflicts between these orders. **Out of this conflict is dissidence born, and dissidence begets chaos.** This can in turn lead to an upheaval aiming to change the existing order and replace it with a new one. This intermediating phase may be marked by disorder and chaos. One can easily understand most social movements in this light. Communism and capitalism and most other isms are nothing but differing kinds of group order vying for survival in the social arena.

Such a model has been proposed for the structure of scientific revolutions by Khun. He says that an orthodox science generates for itself a certain kind of order (which he calls a *paradigm*). With time and newer and better experiments this sense of order begins to crumble and a period of chaos ensues. This is followed by the rise of a new order or paradigm.
Even though personal orders differ from person to person - it may be shared within a culture, to a certain extent. One of the greatest perils of the modern communications era - is the imposition of a certain culture's biases and views on other less vocal cultures.
This subservience of one for the good of the many can have many nasty consequences. The more obvious ones are the dictatorships and totalitarian regimes where personal freedoms are non existent. The minor irritations can be shifting out of a house since it is being demolished to make a highway or the cleaning up of the hostel-room since somebody's parents are coming on a visit.
The existance of personal orders has many consequences for designers. While designing for a group one tends to forget the individual. One considers and is swayed by the group order - whose concerns may be sometimes in conflict with those of the individuals. It is very important that one does keep a slight free way for the individual - who by his very nature is disordered - at least with respect to the group or institution.

Louis MacNeice on Paradigm shift in his poem "Mutations"

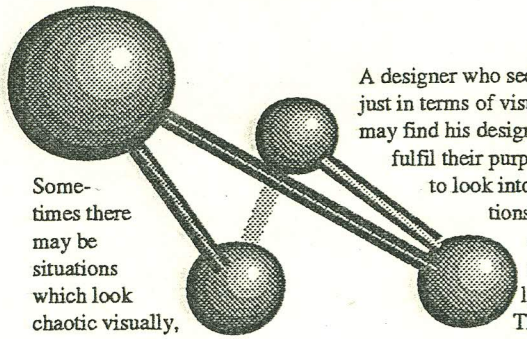
For every static world that you and I impose
Upon the real one must crack at times and new
Patterns form old disorders open like a rose
And old assumptions yield to new sensation;
the Stranger in the wings is waiting for his cue,
The fuse is always laid to some annunciation.



The implication of considering the existence of personal order is that no single conception of order is absolute and accurate. Each and every person is entitled to his or her views as long as it does not impose it on others.

Order as relationships

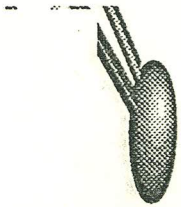
"What escapes the sight of the eyes can be seized by the sight of the mind"



Sometimes there may be situations which look chaotic visually, but if we penetrate beyond the superficiality of the visual sense we may discover a deeper order.

A good example of the underlying relationships is the distribution of people on a beach. People do not follow any visual order such as a system of modules or a grid but instead interact in a dynamic manner with their environment and each other. **The complex web of relationships thus set up has to be understood for us to see the order inherent in the system.** Such a sense of order is more dynamic and fluid - but also more true to the world.

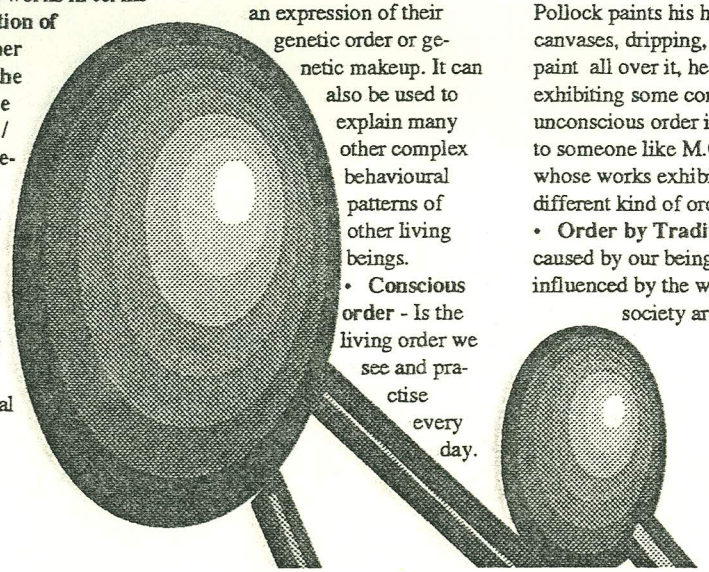
A designer who sees things in just in terms of visual order may find his designs failing to fulfil their purpose. He has to look into the relationships and discover the underlying order. This will ensure that his designs are more successful and useful. The sad fact is that most design education restricts itself to visual concepts such as symmetry, balance etc. **Most design, works in terms of an imposition of modules rather than fitting the module to the existing web / network of relationships..** These though looking ordered may clash very strongly with the personal / group orders of the potential users.

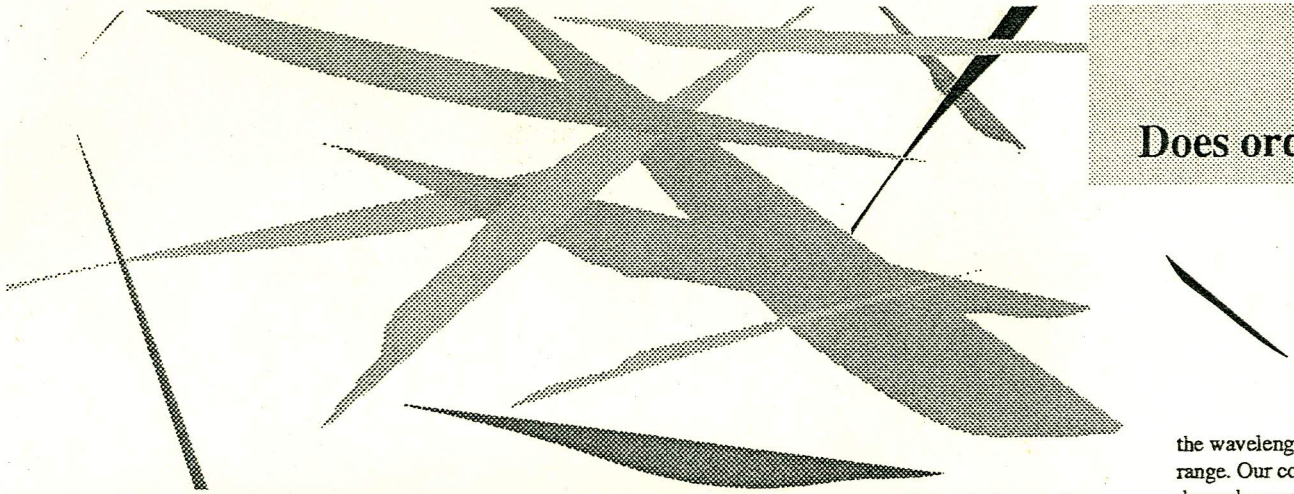


Order seen in terms of relationships may clash with the common notions of order as we know but such a concept enriches the meaning of order and makes it more useful.

This approach also brings many other orders within its ken.

- **Genetic order** - something like the complex but behaviour of ant colonies becomes an expression of their genetic order or genetic makeup. It can also be used to explain many other complex behavioural patterns of other living beings.
- **Conscious order** - Is the living order we see and practise every day.
- **Unconscious orders** - These can be used to explain the differing views of artists and other creative persons. When a person like Jackson Pollock paints his huge canvases, dripping, splashing paint all over it, he is actually exhibiting some complex unconscious order in contrast to someone like M.C.Escher whose works exhibit a very different kind of order.
- **Order by Tradition** - is caused by our being influenced by the world/ society around us.





Does order exist ?

Does order exist or is "The cosmos, at best, like a rubbish heap scattered at random." (Heraclitus) But the universe cannot be chaos through and through.

"A universe of pure chance is, in the strict sense of the word, unthinkable, by which we mean, not simply distasteful or dissatisfying but something on which the mind cannot take hold at all. A world of pure chance is simply chaos, or absolute disorder has no positive intelligible content." W.R. Thompson

Chaos as defined by information theory

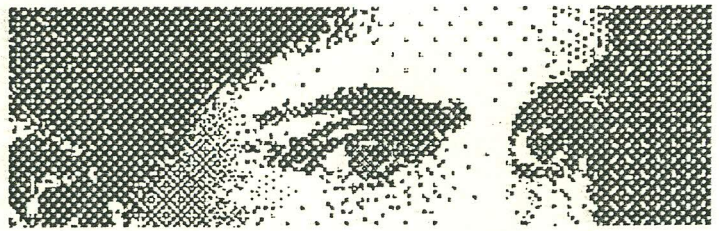
According to information theory chaos or randomness is defined as **the amount of information required to describe the system.** In this sense of the word, order requires the least amount of information. Something like 111111111 or 010101010 needs very few bits for encoding. A sequence like 101001000 10000100000 needs more bits. A random sequence can never be encoded by any simple rule since one cannot predict the next digit in the sequence.

Our mind cannot grasp chaos.One chaos is indistinguishable from another that is why the word chaos is always singular. There is no way of distinguishing one chaos from another while there can be various approaches to order.

But to a certain extent the world around us is chaos. Man is inundated with information every moment of the day and night. The sensory system catches a negligible percentage of the impulses impinging on it - what Kenneth Clark *"habitual flux of information"*. In the visual system man can perceive just a fraction of the wavelengths - the visible range. Our concept of the world depends very strongly on this fact. From the infinitesimal we try to understand the infinite.

"You can't embrace the boundless." said Kuzma Pruktov a fictitious philosopher (?) created by the poets Count Alexei Tolstoy and Gemchushnikov.

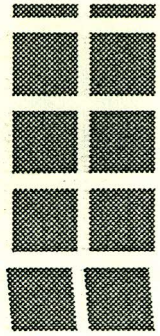
This is not all . . .



In man, in the visual system alone, there are more than a million channels. If every group of ten of these channels is assumed to be independent of every other group, then with a maximum of firing rate of the neurons of 100 pulses or "spikes" per second, the neural channels could be handling up to 10^6.(10^2/10) = 10^7 pulses per second. If each pulse provides one "bit" of information about the input, then the brain could be bombarded by 10^7 bits of of information per second. This figure far exceeds our capacity to deal with information, which is limited to about 25 bits per second.

The cocktail party effect is the whimsical scientific name given to this phenomenon of selective concentration - called so because in the general hubhub of a cocktail party our mind can actually catch only that conversation that we want to hear and blank out the rest. Moreover we can shift our attention to any other voice any moment we desire.

"All the time we are aware of millions of things around us - but not really conscious of them unless there is something unusual or unless they reflect something we are predisposed to see. We could not possibly be conscious of these things and remember all of them because our minds would be so full of useless details we would be unable to think. From all this awareness we must select, and what we select and call consciousness is never the same as the awareness because the process of selection mutates it. We take a handful of sand from the endless landscape of awareness around us and call that handful of sand the world". — Zen and the Art of Motorcycle Maintenance



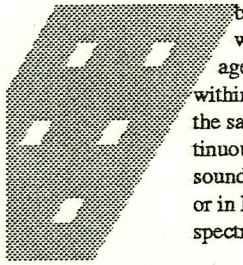
Why do we see patterns ?

Order is Heavens first law;

— Alexander Pope

Do patterns really exist or do we impose them ?

Human memory depends on patterns and simplicity to remember things. According to George A. Miller we can not grasp more than 7 (+ or - 2) things at a time. Our mind balks at numbers bigger than that. When ever the objects become more than this range we chunk them up into manageable groups so that they lie within this magic range. We do the same even if the data is continuous such as in the case of sounds (the Seven notes in music) or in light (the seven colours in the spectrum).

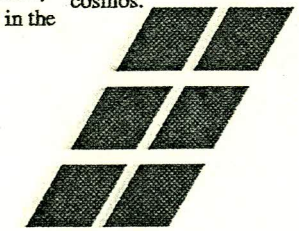


How far is the order we think we see around us due to the innate inability of our brain to grasp the diversity and multiplicity of the universe ?

How far can concepts of universal order, mystical, holistic experiences be regarded as valid experiences as to the nature of the cosmos ?

Every society has its own reference points and own myths and values which force it to see the universe in a certain way. How is one to determine which views are correct or valid ? Is there any way to determine this ?

Even within science there are different views views of order. Though the quantum theory is held true by most scientists, opposing theories such as David Bhom's theory of Implicate order do exist. This theory contends that the entire universe is "bound together" by an underlying symmetry and the chaos we see in the macro-cosmos is just a manifestation of deeper inherent orders in the micro-cosmos.



Patterns of the Unconscious

"As long as the brain is a mystery the universe will also be a mystery"—Ramon y Cajal

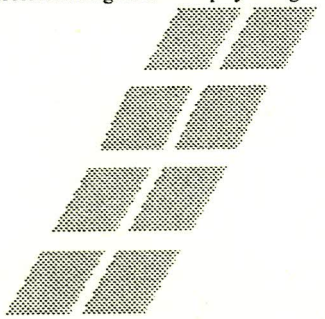
"In the human head there are forces within forces within forces, as in no other half-foot of the universe that we know." —Roger Sperry

How far our mind is responsible for the sense of order we have can be determined by studying folk myths and stories. R.D.Laing compares the birth of a child and the subconscious trauma associated with it (even for the newly born) with some of the commonalities found among various myths. It seems that the myth of the newly born baby being rejected by the mother and left floating in a basket to be found by someone else is one such myth. Of course,on the other hand, Oscar Wilde (in The Importance of Being Earnest) and hundreds of hindi films parody this concept. Similarly Carl Sagan tries to connect up the various after-life feelings that people get with the trauma of Birth. Moreover there are hundreds of theories of birth and regeneration specific for every culture and tribe. Most of them have some major similarities - often quite puzzling.

Do these similarities have something to do with the patterns in our minds ?

The Brain - where "enchanted loom of millions of flashing shuttles weave a dissolving pattern, always a meaningful pattern, though never an abiding one.

— Sir Charles Serrington Neurophysiologist.



THE SCIENTIFIC METHOD
With a slight digression on the value of mathematics and the meaning of simplicity.

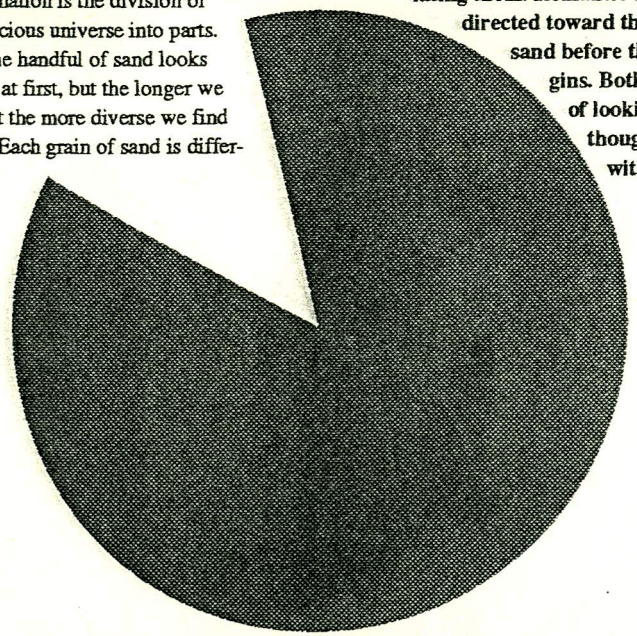
. . . But what we must aim at is not so much as to ascertain resemblances and difference, as to discover similarities hidden under apparent discrepancies. — **Henri Poincare**

Having satisfied ourselves that order does exist in this universe and that we as humans are condemned to seek patterns we wonder what are the methods we use to seek patterns - to see the inherent order of the cosmos.

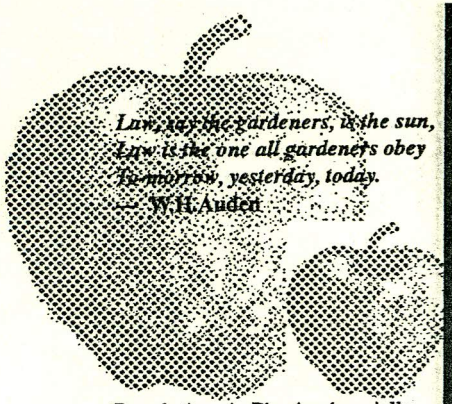
There are two ways of looking at the world around us - the holistic and the reductionist. The holistic sees the world as it is - completely and fully grasping the entirety. The reductionist on the other hand breaks up the world into parts trying to understand the whole as the sum of its parts. This is the method of science. These contrasting approaches have been beautifully described in Robert M.Prisig's masterpiece, *"Zen and the Art of Motorcycle Maintenance"* .

"We take a handful of sand from the endless landscape of awareness around us and call that handful of sand the world. Once we have the handful of sand, the world of which we are conscious, a process of discrimination goes to work on it. This is the knife. we divide the sand into parts. *This and that. Here and there. Black and white. Now and then.* The discrimination is the division of the conscious universe into parts.

The handful of sand looks uniform at first, but the longer we look at it the more diverse we find it to be. Each grain of sand is different. No two are alike. Some are similar in one way, some are similar in another way, and we can form the sand into separate piles on the basis of this similarity and dissimilarity. Shades of colour in different piles - sizes in different piles - grain shapes in different piles - subtypes of grain shapes in different piles - grades of opacity in different piles - and so on, and on, and on. You'd think the process of subdivision and classification would come to an end somewhere, but it doesn't. It just goes on and on. **Classical understanding is concerned with the piles and the basis of sorting and interrelating them. Romantic understanding is directed toward the handful of sand before the sorting begins. Both are valid ways of looking at the world though irreconcilable with each other.**



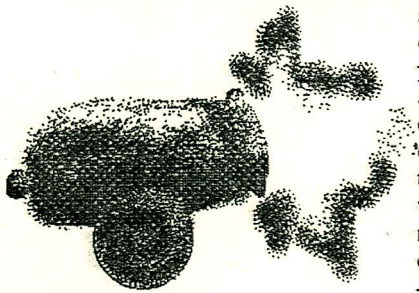
The laws of physics



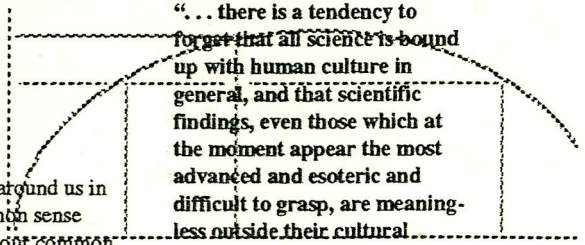
Law, say the gardeners, is the sun,
Law is the one all gardeners obey
To-morrow, yesterday, today.
— W.H.Auden

Revolutions in Physics (specially those in the 20th century) have led us to ask some very fundamental questions about the very nature of the scientific method. How real are the laws of physics? How far do they correspond to somereality ? Are they justt mental constructs? Delusions of our mind? Ghosts ?

"Ghosts are un-scien-ti-fic. They contain no matter and have no energy and therefore, according to the laws of science, do not exist except in people's minds. Of course the laws of science contain no matter and have no energy either and therefore do not exist except in people's minds. it's the best thing to be completely scientific about the whole thing and refuse to believe in either ghosts or the laws of science. That way you're safe. That doesn't leave you very much to believe in, but that's scientific too."
— Robert M. Prisig

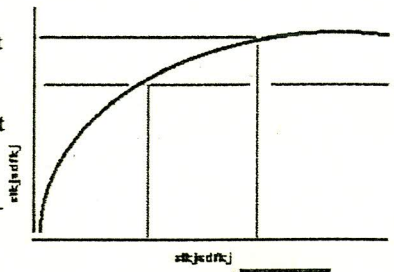


"Man tries to make for himself in the fashion that suits him best simplified and intelligent picture of the world. He then tries to some extent to substitute this cosmos of his for the world of experience, and thus to overcome it. **. .He makes this cosmos and its construction the pivot of his emotional life in order to find in this way the peace and serenity which he cannot find in the narrow whirlpool of personal experience".**
— Einstein



". . . there is a tendency to forget that all science is bound up with human culture in general, and that scientific findings, even those which at the moment appear the most advanced and esoteric and difficult to grasp, are meaningless outside their cultural context.
— Erwin Schrodinger

We see the world around us in terms of our common sense assumptions. But our common sense assumptions can be very wrong at times - as modern physics has so often and so convincingly proved. *Apriori* assumptions depend a lot on cultural bias. The open or closed nature of society, the social structure all have a bearing on these default assumptions. Somehow science seems above such petty things, and seems to converse skillfully about reality, but is it ?
The kind of order we impose on the world is very dependent on our default assumptions. The western view is totally incompatible with the mystical approach - another approach to order.



Science creates disorder...

The Validity of the Scientific Method ?
or Where does Asking Questions lead us ?

The game of twenty questions can be taken as a good model of the scientific method. By just binary answers (1 or 0), yes or no we can specify any object from a million other objects. This game visualizes **a scientist as just an unprejudiced observer** asking questions and inferring the structure of the universe.

In a new version of twenty questions no word had been decided upon. (We quote physicist John Wheeler). Each one questioned would answer as he pleased - with one requirement that he would have a word in mind compatible with his own response and all that had gone before. This version of the gam was therefore as difficult for my colleagues as it was for me."
"What is the symbolism of the story? The world, we once believed, exists 'out there' independent of any act of observation. . . I thought the room contained a definite word. In actuality the word was developed step by step through the questions I raised . . . Had I asked different questions or the same questions in a different order I would have ended up with a different word
. . . However, the power I had in bringing the particular word . . . into being was partial only. A major part of the selection lay in the 'yes' and 'no' replies of the colleagues around the room.
. . .In the game no word is a word until that word is promoted to reality by the choice of questions asked and answers given. **In the real world of quantum physics, no elementary phenomenon is a phenomenon until it is a recorded phenomenon.**

"What is an elementary particle? The answer depends on what you mean by the question."
Victor Weisskopf

Murray Gell Mann
"Another possibility is that we are just not asking our questions in exactly the right way. Perhaps some now unknown brilliant young scientist will find a new set of questions to ask, the answers to which will clarify today's problems."

It's a wonder that scientists still do manage to do any science.

Science creates disorder ?

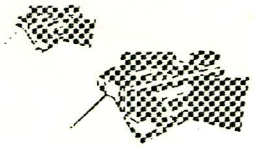
. . . Scientific truth was not dogma, good for eternity, but a temporal quantitative entity that could be studied like anything else.
. . . The purpose of scientific method is to select a single truth from among many hypothetical truths. That, more than anything else, is what science is all about. But historically science has done exactly the opposite. Through multiplication upon multiplication of facts, information, theories and hypotheses, it is science itself that is leading mankind from single absolute truths to multiple, indeterminate, relative ones. *The major producer of social chaos, the indeterminacy of thought and values that rational knowledge is supposed to eliminate, is none other than science itself. . . Scientifically produced anti-science — chaos.*

"Do bats eat cats ?", and sometimes "Do cats eat bats?" . . . for, you see, as she couldn't answer either question, it didn't much matter which way she put it.
-- Lewis Caroll

The Limitations of Science

The nice thing about experimental physics is that ultimately nature has the last word. — Physicist William Fairbank.

The more the universe seems comprehensible, the more it also seems pointless. . . . But if there is no solace in the fruits of our research, there is at least some consolation in the research itself. . . The effort to understand the universe is one of the very few things that lifts human life a little above the level of farce, and gives it if the grace of tragedy. **— Steven Weinberg**



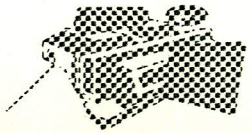
The success . . .

All criticism apart one cannot deny the power and accuracy of modern science. If not anything else the sheer success of the scientific method validates it.While criticising modern science one tends to forget or ignore depth to which man has understood nature. This success is primarily due to its attempts at being totally objective i.e its self correcting nature, its refusal to stick to any kind of dogma and most important to let observations and experimentations be the ultimate test of any theory.

But as science develops there seems to be no coherent base to fall back upon. One just pushes the limits of ignorance further and further remaining as far from the truth as we were when we began.

. . . the Failures

Where was I born?
Where did I come from?
Where am I going?
What am I?



These ancient Hopi questions still remain unanswered. As science progresses man becomes more and more insignificant, a lonely speck in a violent and uncaring universe. As the Rubaiyat puts it

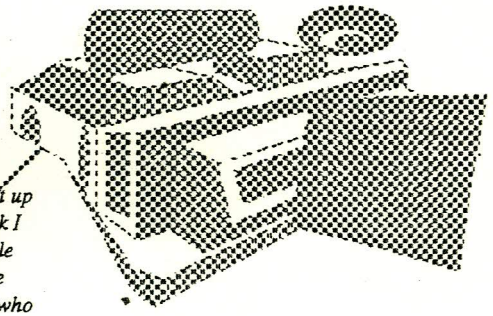
"Into this universe-
and why not knowing,
Nor whence like water
wlly-nilly flowing"

How does it feel
To be on your own?
With no direction home
Like a complete unknown
Like a rolling stone.

Who am I?

...was I the same when I got up this morning? i almost think I can remember feeling a little different. But if I am not the same, the next question is, who in the world am I? Ah! that's the greatest puzzle. – Alice in Wonderland

Who am I? The simplest of questions, yet so difficult to answer. The mystics give their own explanations - science rejects them but gives no solutions either.



I am Me !!

Said man to the Universe "I exist"
"However", said the Universe "that creates in me no sense of obligation".
— Anon.

Mathematics

Euclid alone has looked upon beauty bare.

Much to the disgust of thousands of school-children mathematics is a compulsory course. Scientists of course swear by it. Mathematics they say is the language of nature. If tomorrow we have to converse with Extra-terrestrials the only language common will be that of mathematics.
But why should it be so ? Is it imposed or is it a part of nature ? Does it by some freak co-incidence just work now (for the time being) and might suddenly (just as freakily) give up tomorrow ?

Differential equations, Fourier transforms, tensor calculus, probability theory etc. etc. etc. strange and esoteric names but these words speak the truth of nature.

I can't help it, gas escapes my fundamentals on the least pretext, it's hard not to mention it now and the, however great my distaste. One day I counted them. Three hundred and fifteen farts in 19 hours, or on an average of 16 farts an hour. After all it is not excessive. Four farts every fifteen minutes. It's nothing. Not even one fart every four minutes. It's unbelievable. Damn it, I hardly fart at all, I should never have mentioned it. Extraordinary how mathematics helps you know yourself.
— Samuel Beckett in "Molloy".

$$e^{\pi i} + 1 = 0 .$$

The magic formula combining some of the most simple yet fundamental constants of mathematics. Why should this be so ? One maybe can never answer. But this "shuddering before the beautiful" (as described by Subramanyam Chandrashekar) is realization of cosmic order of a very high nature - and the closest one can get to the ultimate reality.

The only insight available is now is through mathematics: that's the only place people allow themselves any freedom. They can play around with mathematics as much as they like without experiments. . . So nobody minds, as long as it is mathematics. People believe that mathematics is truth, but anything else is not.
- Bavid Bhom

Orders may be simple or complex. So even if our universe is ordered one wonders

is the Cosmos Simple ?

Steven Weinberg says, "This may not be true, but it seems wise to assume so. . ."
But what exactly is simple ? We tend to use the word as Lewis Caroll did to describe something he thought simple ". . *Its chief merit is its Simplicity - a Simplicity so pure, so profound, in a word; so simple, that no other word will fitly describe it."*

The fact that we don't exactly know what concepts we are talking about has never deterred us from using them. Even the sciences who pride themselves on precesion . . .
Nevertheless, at each step along the road simplicity seems to enter into a scientists work in some mysterious way that makes the simplest workable hypothesis the best bet. "Simplest" is used here in a strictly objective sense, independent of human observation, even though no one knows how to define it.
Martin Gardner

That what is simple today may not be so tomorrow.

The concept of simplicity varies from culture to culture. Even today something which the mathematicians feel is simple is not necessarily so even for an high-flying executive (a person supposedly one with the times).

The concept of a flat earth is a simple one and was believed to be true for thousands of years. Today it seems simpler to believe in the infinity of space and time.

Times change and with it our assumptions and ways of looking at the world around us. Different world views will have differing notions of what is simple.

Simplicity vs Simplicity

be another man's complexity.

The relative nature and dharacter of this simple (?) concept can be easily seen from these comments by some physicists on a controversial new idea in astrophysics - the many worlds interpretation of quantum physics. The same word simplicity is used by both sides of the argument.

Against
Rudolf Peierls
"That's making things unnecessarily complicated. Since we have no means of seeing or ever communicating with the other universes, why invent them?"

For
David Deutsch
"It is by far the simplest (interpretation) in that it involves the fewest additional assumptions beyond those which correctly predict the results of experiments."

Against
John Taylor
"I'm afraid I don't see it as satisfactory. I really must confess that I find the many-universes interpretation as bizarre. No, I'm sorry, I'm a hard nosed physicist. Since one has no idea of what goes on in the other universes, they shouldn't be brought in."

The rage for order & the need for chaos

Within each of us is "a rage for order". We take the natural world and in which we live and continually reorder it to suit out predilections toward order. We divide our nations into city and country. We divide our cities into streets and blocks and neighbourhoods. We divide our blocks and neighbourhoods into lots and houses, and we divide our houses into rooms. We put our clothes into drawers and we put our papers into files. We place our books in ranks on shelves and we put our dishes and eating utensils into cupboards. We drive on the left hand side of the road and we mark intersections so that the automobiles moving in one direction stop while those moving in the other direction pass by. We define working areas for ourselves, in our rooms and in our basements and at our places of business. Every aspect of our lives is pervaded by our desire for order. Most of this order serves very useful purposes; it makes our life easier by making things easy to find and by giving us an orderly means of making decisions (for example when we approach an intersection in our automobile). But not all the order that we impose on ourselves in purely utilitarian. We order our entertainments as much as we order our more pragmatic activities. We play our games according to rules . . . we watch movies with well ordered plots in which lives must be lived out within a specified time.

But at the same time we like to create an illusion of spontaneity. We like to pretend that we impose less order than we do in the world. We are constantly striving to make arrangements of our lives that appear to be random, that have the same illusion of randomness that we see in nature.

Such art has nature in her kind
A taste more finical and nice
Would comb out kink and curl alike.
But O ye barbers at your trade,
What more beguiles us? Your coiffures?
Or gold come waterfalling down?
— Donald Justice

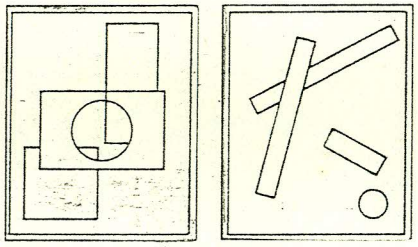
A sweet disorder in the dress
Kindles in clothes a wantonness:
. . .
A careless shoe-string, in whose tie
I see a wild civility:
Do more bewitch me than when art
Is too precise in every part.
— Robert Herrick "Delight in Disorder"

Artists / Designers and the concepts of order and chaos

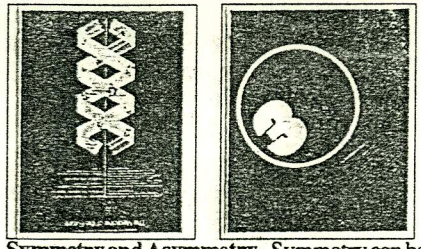
Sometimes artists use various terms that seem very undefinable and vague - and some artists even do it deliberately. Anyway, with some idea of order and chaos (specially according to information theory) we can get an idea about the logicbehind the language used by artists and designers.

Terms usually used by artists and designers

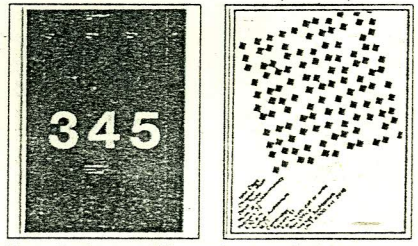
Thesevisuals have been taken from "A primer of Visual Literacy", by Donis A. Dondis MIT Press. As she herself says that "it would be impossible to name all the visual techniques available, or in naming them, succeed in giving them hard definitions. . . (personal interpretation apart) each technique and its opposite can be defined as a polarity". It was felt that it could be interesting to study these examples in terms of the concepts of order and chaos. The various examples are given below along with some critical comments.



Balance and Instability - Balance would correspond to order being described as "being the existance of a centre of suspension between two points". On the other hand instability is chaos - "highly upsetting visual information."

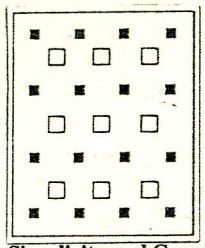


Symmetry and Asymmetry - Symmetry can be called axial balance- but it can be"static and even boring". In asymmetry the "design is complicated. . . but is interesting and rich in variety." Too much of it and it can degenerate into chaos.

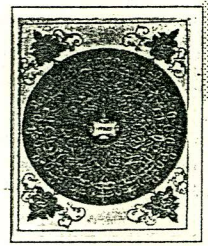


Regularity and Irregularity - is the development of an order based on some principle. Irregularity emphasises the unexpected the unusual - in other words it is disorder.

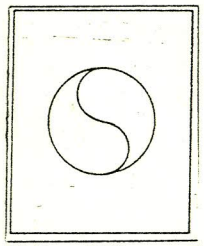
Artists / Designers and the concepts of or..... (contd.)

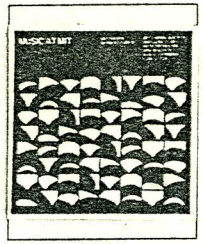


Simplicity and Complexity - Simplicity is a visual technique "free from complications and elaboration". In complexity on the other hand is difficult to grasp the pattern (if any).

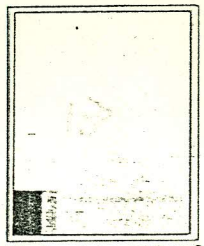


Economy and Intricacy - Economy is the "presence of the minimum number of visual units. It is frugal and judicious". Intricacy makes beautiful by "softening and ornamentation." Economy can be called order but intricacy is very perfectly controlled order. One cannot call it disorder.

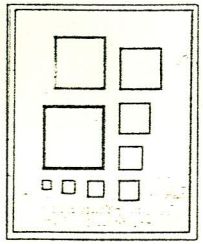


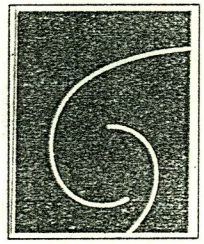


Unity and Fragmentation - Unity implys the "convergence of "diverse items into one totality. Fragmentation in contrast is the breaking up of the elements into individual pieces.

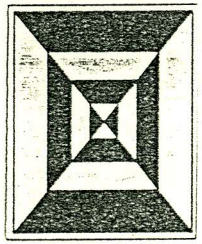


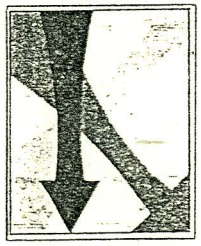
Understatement and Exaggeration - These are intellectual counterparts of economy-intricacy and are difficult to classify under order and chaos. But taken as a relationship between the design and the viewer - understatement is more ordered than exaggeration.





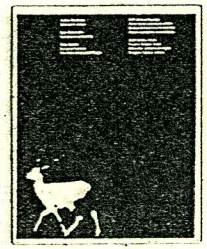
Predictability and Spontaneity - implys "some order or plan that is highly conventional, Spontaneity on the other hand is characterized by lack of plan. This is the conventional definition of order and chaos as given by Information theory.



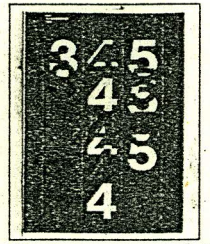


Passiveness and Activeness - Passiveness is repose. It is static as opposed to activeness which signifies motion. One cannot draw a clear line but passiveness signifies order more than activeness - which tends towards disorder.

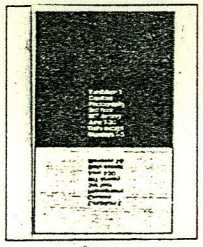
Artists / Designers and the concepts of cha.....(still contd.)

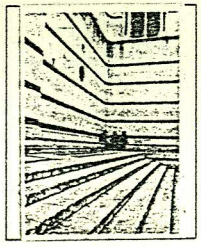


Boldness and Subtlety - Boldness "is and obvious visual technique" hence one can say that it is a certain kind of order (since it has less ambiguity) in contrast to which subtlety is more ambiguous "shunning any obviousness" hence more in the domain of chaos.

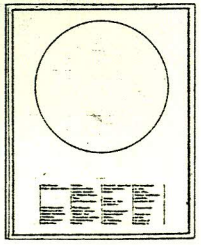


Transparency and Opacity - Transparency means "visual detail that can be seen through" while opacity means "the blocking out, concealing what it visually supercedes". These two concepts are difficult to co-relate with the concepts of order and chaos but one may say that opacity by increasing ambiguity (by actually hiding information) is more chaotic in nature.

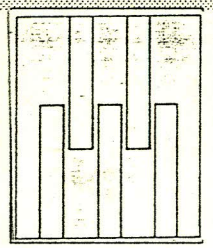




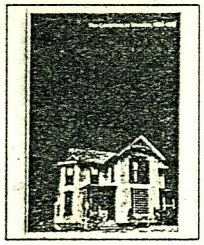
Flatness and Depth - Both these effects are ruled by the use or non-use ofperspective - to suggest or erase the appearance of dimension. It is difficult to classify thse effects under order or chaos though flatness does look more ordered.



Neutrality and Accent - A neutral look to a design is a"least provoking approach to design". In this it is predictable and hence "ordered" while accent disturbs the atmosphere of neutrality. This feeling os spontanaety sets it apart and brings in some disorder.

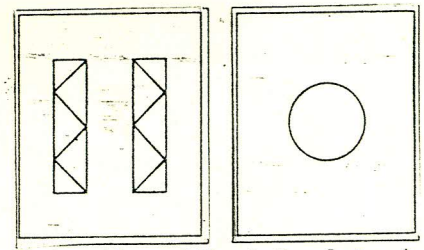


Consistency and Variation - Consistency is "developing a composition dominated byone thematic approach" - quite cloe to predcictability and order. Variation in turn "offers diversity and assortment". This is the hallmark of disorder.

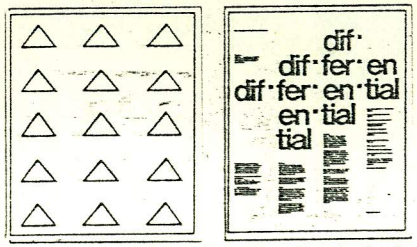


Realism and Distortion - Realism attempts to replicate the same visual clues that the eye sends to the brain. Distortion tampers with reality seeking control through deviation. By bringing some degree of disorder into reality.

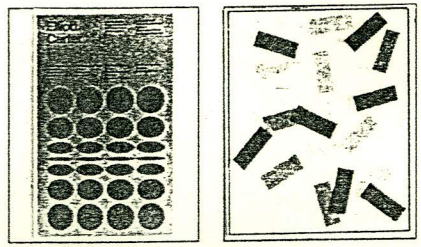
Artists / Designers and the concepts of cha....(The last at last.)



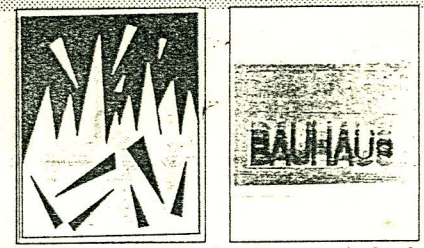
Juxtaposition and Singularity - Juxtaposition places atleat two cues side by side, activating comparision of relationships (which imposes a kind of order or meaning). Singularity is the focus of the composition - in that it implys a break from the norm to draw attention to a certain aspect. This is disorder.



Continuity and Episodicity - Continuity is the uninterrupted visual connections - it is the cohesive force that holds the composition together. Episodic techniques indicate disconnection, reinforce individuality and has its roots in chaos.



Seqnentiality and Randomness - A sequential arrangement follows some "logical order" as opposed to randomness which suggests disorganization or chaos.



Sharpness and Diffusion - Sharpness is closely related to clarity of physical state and expression and easy to interpret. This negates ambiguity and hence can be considered as order. Diffusion opts for less precision but more atmospher, more feeling and warmth. The less precision shows the presence of chaos.

Seeing these visual techniques in terms of the concepts of order and chaos shows us the universal validity of these concepts and how they can be used to understand various aspects of art and design. A few conclusions that can be drawn from this is that both order and chaos are very important aspects of design and they have very different and contrasting effects. Order symbolizes stability and coherence while chaos stands for individuality and uniqueness. All good art is a balancing act between these two concepts - order and chaos. Too much order leads to stagnation and predictability while too much chaos is impossible to grasp. It is this balancing act which characterizes the creative impulse.

Order /Chaos and the creative impulse

The creative impulse is born of theclash between differing kinds of order - established and personal, group and individual, rigid vs free wheeling. The creative impulse is unpredictable and quirky, both signs of a chaotic nature. Order can produce mere conventionality - it needs a bit of randomness to set it free.

The role of the artist is to filter out order out of chaos. So it is that all works of art are the result of a structuring, and important part of which is the selection of details. The selection of details reveals the characteristics of the speaker, and is responsible for the effect of the work of art. But although works of art have to be carefully structured and organized, we also expect them to appear unplanned and natural, to give and illusion of the random.

Our lives seem to be as chaotic as leaves being continuously blown around by winds and good art attempts to portray that. All writing has a theme - but if we feel that life has no theme ? Then if art is to reflect life then is it necessary that there should not be a theme. It is this fine balance that all art has to strike.

The goal of modern art is "the expression that there is nothing to express, nothing with which to express, no power to express, no desire to express, together with the obligation to express."
— Samuel Beckett

Somewhere beyond the scorched gable-end and the
burnt out houses
There is a poet indulging
his wretched rage for order -
or not as the care maybe; for his
is a dying art,
an eddy of semantic scruples
in an unstructurable sea.
-Derek Mahon "Rage for Order"

oRdeR AND CHAOS

Dada/Avant Garde and the concepts of order and chaos

The seeing of art as a new ordering of the old may seem antagonistic to avant garde art or the dada. In such cases it seems that art produces more chaos than order. But to deny that some order has been produced is to reject a basic fact. The order is a kind of "meta-order". Though on the surface it may look chaotic but at another level it forms a higher kind of order because it reaffirms the chaotic nature of life. But stressing the chaotic it becomes order.

What then is the mechanism of collage? I think I would say that it amounts to the exploitation of the chance meeting on a non-suitable plane of two mutually distant realities.
—Max Ernst

To understand the complex patterns of music of Bhimsen Joshi or Bach is not as culture dependent astrying to grasp the avant garde music of John Cage for which one must know the entire history of western music and the revolt against it. So though superficially Cage's music may look disordered, it is not so - in fact it is ar a higher level of abstraction - a higher kind of order.

Chaos ambiguity & art.

The ambiguity of art

Life. So many loves. So many parts and bits and parcels and pieces and molecules and atoms and they mix and mingle and move and turn and go round and round and round till they become a giant ferris wheel. And I have to write about them. I have to put it into language the drama of these atoms going round and round. But language is senile and words are battered and maimed . . . I am divided, I am broken into pieces into atoms. I'm a symphony composed of atoms.

— Badal Sircar in "Evam Indrajit"

Willow's leaves quiver
In April breeze
As a butterfly's wings.

White chrysanthemums
In haze
Like snow flakes

Two haikus. One composed by a computer and the other by a Boseau one of the greatest exponents of this form of poetry.

Order is meaning . . .

Ambiguity and futility seem to be hallmarks of our time. But what is ambiguity if not thinly disguised chaos. Some of the best poetry and prose of our times is chaos, or at the best it is highly ambiguous. The information is at one level above that of the story or picture. It is usually in the form or structure itself. It is an attempt to understand the world - sometimes a reaction to it.

In such a situation how is one to rate computer poetry or prose? The only thing that seems to give poetry by Cage, cummings and a host of avant-garde artists any significance is reading them in context of 20th century literature i.e.

. . . & chaos is lack of it.

looking beyond the apparent surface of their work into the thoughts of the creators. But what if the poem looks good and seems deeply ambiguous and loaded with meaning, but has been written by a computer ? How are we to read meaning into it since these poems are just random collections of words "full of sound and fury signifying nothing."

Poem No. 929 by RCA-301 computer. The "poets" blank verse is composed of a vocabulary of 130 words. The metrics are strictly specified.

Some computer poetry. . .

While dreams soar aimlessly
aloft the shattered
hopes,
And space is bled
of broken love in pain,
The light of your's
has slowly gone from the
reticent,
And skies are on the alert.

Poetry by computers proves to be particularly erudite when theit must obey strict rules, as in the Japanese haiku (see above).This once again proves **the subtle demarcation between order and chaos, ambiguity and certainty.** If the rules are too lose the poetry becomes a jumble and meaningless. If the rules are too rigid it becomes too mechanical and the very nature of poetry is lost.

The uses of disorder

In his book "The Uses of Disorder" Richard Sennett wrote that the chaotic urban situation is a healthy one for human growth: a complex and challenging social matrix in which people can learn the value of change, whence they might develop a humanistic ethic for dealing with and unproductive world.

In the natural environment one can never achieve a zero error rate. So nature in her delicate brilliance, finds a way to make

errors work. It's sort of like this : outrageous errors are deadly, but slight errors keep things loose enough for the new to appear.

. . . Introducing small bits of something that doesn't belong there can dramatically change the structure of a large scale array. . . Evolution works due to small scale errors causing variety to emerge. Similarly an artist or scientist gets ideas inspiration from the chaotic world around and within him. Michelangelo, standing before the marble that was to become David, had in his mind the image of a young man, but also allowed himself to be invaded by the block of marble, the whole universe itself.

Murray Gell Mann on the creative act. "Any art that's worth the name has some kind of discipline associated with it. . . and the object is to get

across what you're trying to get across, while sticking to the rules." He describes both art and science as a problem solving activity. The first thing is to "work very hard . . . trying to *fill yourself full* of the problem, just to know

what barriers you are trying to crack. After that, further voluntary effort . . . is not so productive. After that time the pre-conscious seems to be more important. Processes that are just outside of awareness go on, which thrust up bubbles

of ideas from time to time. And that can happen when you're driving, or shaving, or walking - anything."

We go back around a hundred years to Poincare who continues the story of the act of creation by considering thoughts to be like so many atoms in our mind. When we

think we "mobilize certain of these atoms ... and put them to swing. . . and after this shaking up imposed upon them by our will, these atoms do not return to their primitive rest. They freely continue their dance. . . Then the mobilized atoms undergo impacts which make them enter into combinations. . ." and of this interplay of chance and order a new thought, a new order is born.

This interplay between order and chaos, the random and the planned is the crux of the matter. It ensures that a mechanistic, reductionist view of the world may not be absolutely accurate. There may not be any single solution to problems that beset us today.

There may not be an unique explanation for the world we see around us. There is a degree of chaos in everything around us. Chaos implies ambiguity and ambiguity negates certainties and absolutes.

THE WORLD AS A WORK OF ART AS OPPOSED TO THE USUAL SCIENTIFIC IDEA OF THE WORLD AS AN AUTOMATON .A WORK OF ART IS A CREATIVE ORDER. IN THIS WAY, THE UNIVERSE IS AS FREE FROM ULTIMATE INTERPRETATION AS A BACH CANTATA OR A POEM BY BLAKE.