CHARACTERISTICS OF DESIGN AND ITS IMPLICATIONS ON DESIGN EDUCATION

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Abstract

Higher design education has so far been linear extension of the undergraduate design education and has laid emphasis on visual design and visual harmony. Probably it was necessary when the foundation of such programs was laid. Now the situation has changed radically. There is a proliferation of new technologies. Millions of people throughout the world are fiddling with new machines and systems and loosing billions of hours trying to figure out how these can be put to use and used. This can easily be termed as design failure. With increasing number of these products and their increasing complexities, the problems of interaction are to grow many fold and with it the chances of design failure.

Majority of the design professionals, have been so far working in the areas where cost of error is low. Now the cost of error is increasing with the use of new expensive technologies at all levels. How should the education and training of designers be revamped so that they are ready and fit to work in these high-risk areas and how well they can cope with the problems of working as a part of a big design team?

The design spectrum is very wide ranging from the design of spectacle frames to space ship design on one hand and design of materials and design of mega-systems on the other. Should the higher design education be different for different specialties or should it be totally broad based and common, or how much specialized and how much broad based?

We have lately witnessed the marginalization of design profession, as the designers did not get involved in the latest technological developments. A rethinking needs to be done about the role of designer in this changing technological situation and the complex interactions that are likely to take place in future between human beings and their living and working environment. The use of the word 'hi-touch' are the hopeful signs that there is a growing realization that 'hi-tech' cannot go much forward without the design intervention that is needed for it to be accepted.

Is the current design education system seized of these problems? Is it preparing the future generation of designers to tackle successfully the growing complexity of relationships between man and man-made objects and systems? If not, how it should change itself and that is the challenge.

Key words: challenge, future, continuum, manufactured proliferation, design spectrum, envisaged and desired output, knowledge requirement, selective learning, professional respect, focused creativity, evolving systems

Main text:

When we talk about the challenge ahead, we are inevitably talking about future - uncertain and worrisome. Another reason to talk about future is that design is closely linked to it. What we design now will manifest only in future and it is only then that it can affect the society. Yesterday's designs are shaping our societies today. So in design we have to see one step ahead.

Third reason for discussing future in this paper is that education is also linked to the future. Its aim is to train people for the future whose decisions and actions will then change our society for the better. Design education is no exception. It has to look two steps ahead. Today's students of design education will be designers of tomorrow whose designs will have implications day after tomorrow and the day after....

And if we think of a new type of a design education now, we have to look 3 steps ahead. (fig1)

Figure 1
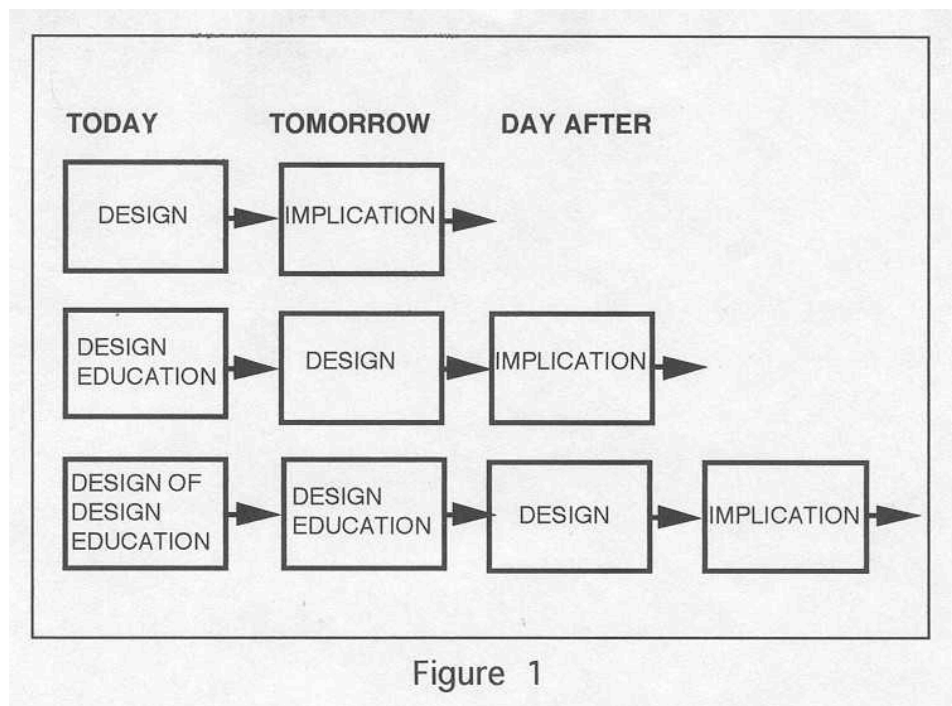
To fulfill the design requirements of our future society we must be able to foresee these requirements and tailor our education programs accordingly. We must also look at our past mistakes so that we can take corrective measures.

To foresee future is tricky, as you will all agree, nevertheless we must do it. If we look at present as a continuum of the past and future as the continuum of the present (fig 2) the task becomes easier. This means whatever has been thought and designed yesterday has its implications on today's society and whatever we think and design or decide today and if implemented will shape our tomorrow. So our future is with us right now.
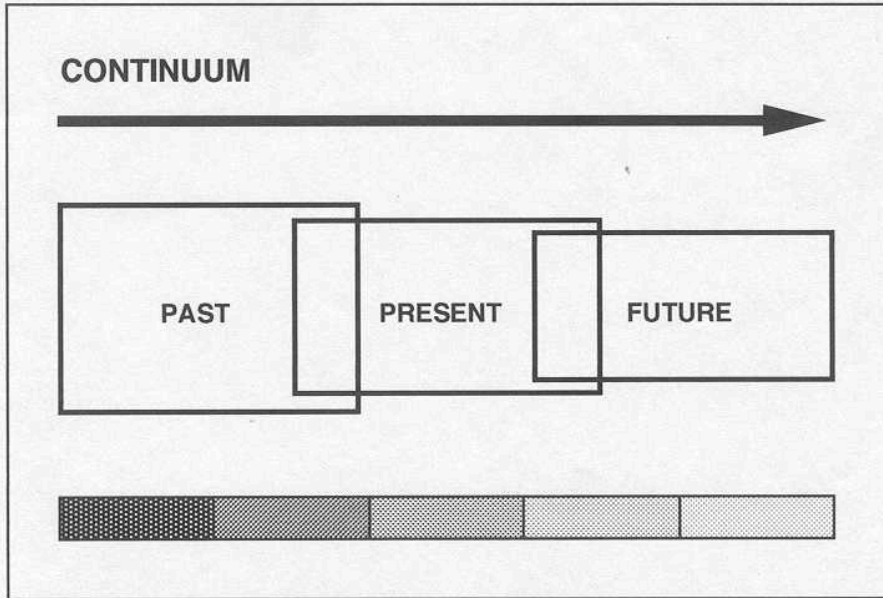
CONTINUUM

PAST   PRESENT   FUTURE

Figure 2

The other day we were discussing what are the latest gadgets IIT faculty is buying for their homes. Most of them we know had bought computers, laptops, and digital cameras. What will be the next gadget that will be bought for the home, I asked? Pat came the reply - robots. 'What after robots'? I couldn't get an answer. May be you can give me an answer. If you can't we have to be content with robots in our future homes. If you can, then we all know what the next gadget is going to be. So if we try to define, the future is really sum total of our present thoughts, concepts and aspirations multiplied by the efficiency of implementation (fig.3). There is therefore no mystery to it.

$$C_t \times T^E = P_t$$

C_t = Concepts & Ideas of Today

T = Function of Time

E = Efficiency of Implementation

P_t = Products of Tommorow

Figure 3

(If the efficiency of implementation (E) is zero, then Ct = Pt, then there will be no new products and we will have to be content with just the unimplemented concepts.)

Manufactured Proliferation

If we want to know our future we must therefore study our current thoughts and concepts and philosophies. We see all societies, all countries, all governments striving to give their people prosperity, economic uplift, increased GNP, high per capita income and increased buying power. Technology is a means to the same end. What does it all mean? We are in the thick of the materialistic world. Richest of the rich and poorest of the poor subscribe to the same philosophy. There is no denying this fact and there is no change sought in this, from any quarter. So our future is almost chalked out for us. We will have more goods and more goods. We will be surrounded by more manufactured things. If and when the density of these manufactured things increases considerably, then the things will become the interacting elements between man and man and man and nature. We will interact through things only and not personally (fig.4). We will be caged in our own things.

(Look at what cell phones, internet and I-Pads are doing to us – these have become the interacting elements)

INTERACTION THROUGH THINGS ONLY
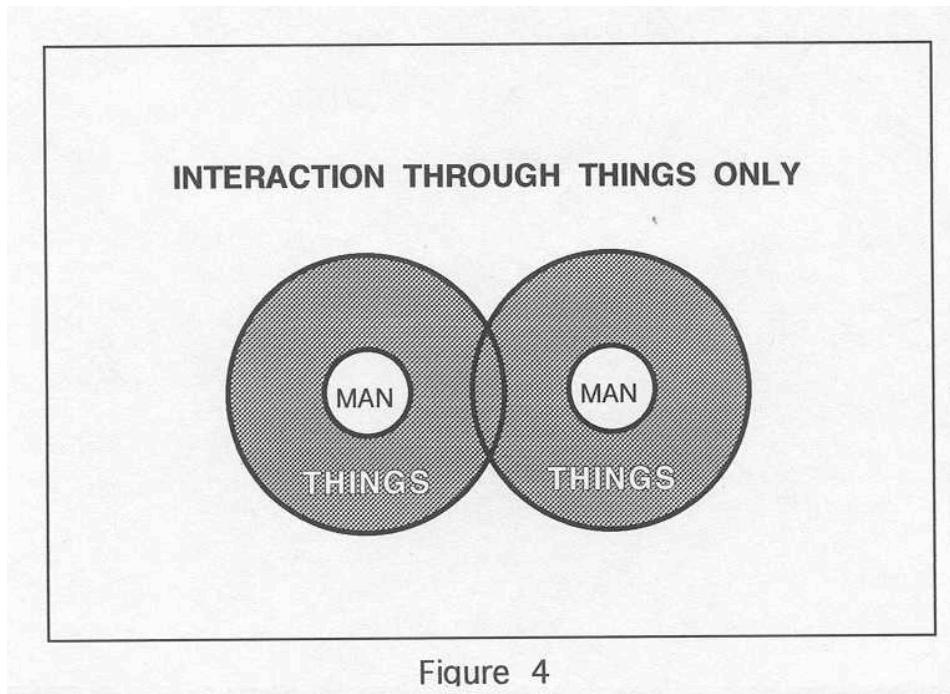
MAN
THINGS
MAN
THINGS

Figure 4

Since, politicians, economists, financial advisors, and not designers take all the above decisions, at least not yet, the designers have no choice but to accept the situation. There is though a silver lining. Designers will have details under their control. Powers that be, may decide that people should have more things, but it is for the designers to decide what 'form' of things. Powers may decide that people should be given more information, but

the designers will decide the 'form of information'. That means designers will have no control on the physical density - that is the number of things surrounding the man. They will however, have the option to make things opaque and shut him /her in, or transparent so that he /she has an option to see through and communicate (fig.5) with the outside world if they choose. This inevitable proliferation of goods, information and services in future can present itself as a great opportunity, but a serious responsibility also, and therefore a formidable challenge.


Figure 5
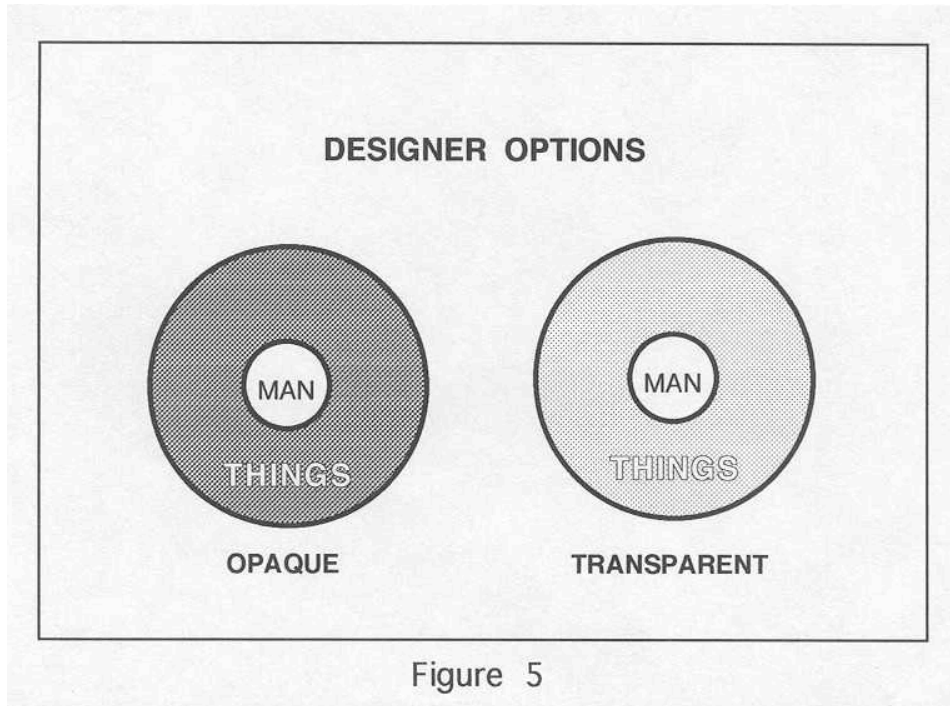
After seeing what kind of future we will have we must say 'what kind of design' we should have so that educational needs can be tailored to it.


Designed exploitation

Interesting thing about design is that it relates totally to the man-made. It is not an act of God. That is probably why it is some times used in a derogatory sense, like he had designs on her... and its connotations are exploitive. So when you design you have exploited something, be it materials, natural resources or the weakness of the people. Like by designing beautiful things the weakness of the people for beauty is exploited to lure them into buying more. This is a moral and an ethical issue and naturally should be intellectually discussed by future designers and an opportunity can be offered only in higher design education program.

If taken in the positive sense, design could be the exploitation of designer's own intelligence, creativity and talent for the benefit of the society, whereby he / she can add lot more value to small quantities of material (fig.6) through the utilization of his / her special mental skills. This can be well understood when we say that a ton of steel can be

exchanged for 10 Kg. of computer hardware or few grams of computer software. Should this be the philosophical basis of higher design education? I am inclined to say yes. Adding value to material through better utility and perfect usability should be aim of it. If design has to continue to be a meaningful activity, then it has to help conserve finite quantities of materials to produce more and more goods, which in fact is the future demand of any society.

Figure 6
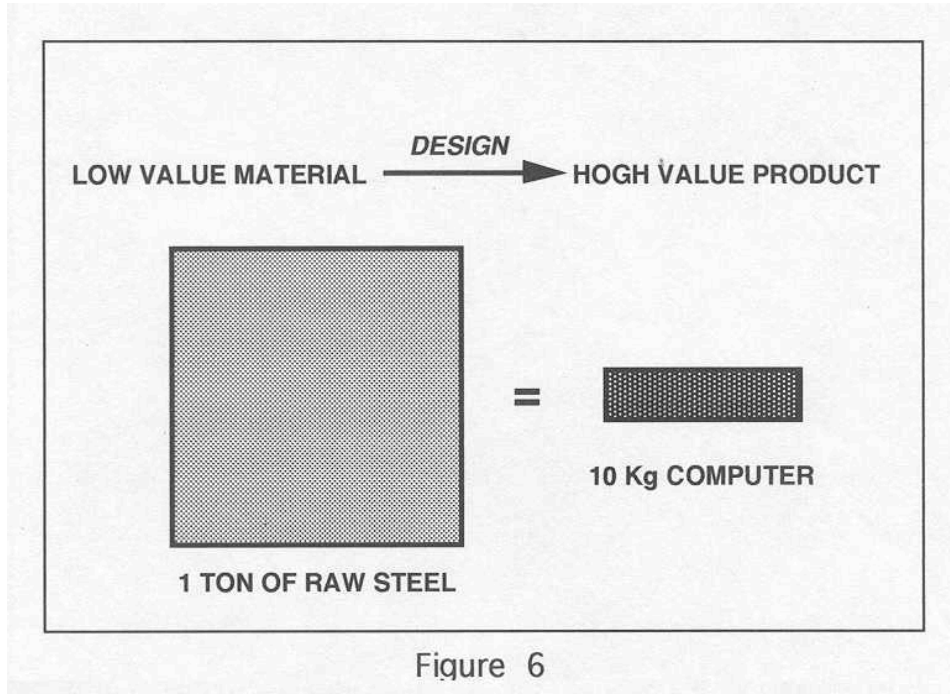
Another interesting aspect of design is that the design has a very wide spectrum (fig.7).

Figure 7
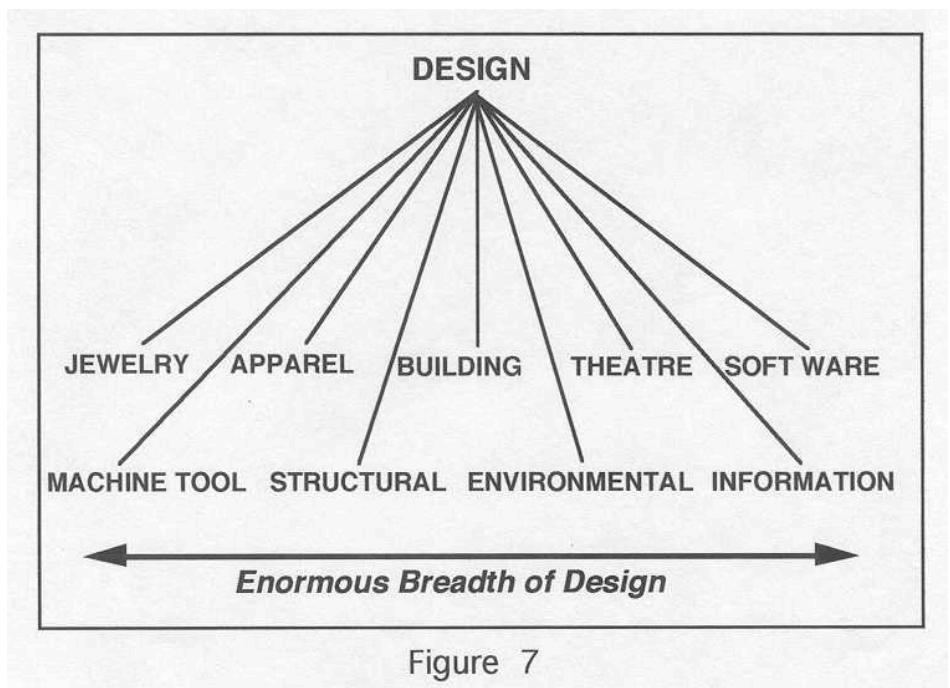
It is an enveloping term for many design disciplines like jewelry, apparel, product, machine tool, electronic equipment, optical, furniture, structural, building, interior, environmental, theatre, graphic, information design and so on. It seems to cover every thing from spectacle to ship design. This shows the enormous breadth of design. If we look at the other axis we find design operates at many levels ranging from micro-micro to macro-macro (fig.8). By the manipulation and restructuring of atoms and molecules we can design new materials like new plastics, new ceramic materials, super conductors etc. By shaping materials like plastics or metals we can create components or single component products. From components we can design subassemblies, from sub-assemblies complex products. From products we can design systems like a seminar room where various products like chairs, tables, screen, projector, microphones are laid out in certain configuration for the purpose of conducting a seminar. Bigger systems are designed by the assembly of smaller systems and products, like transportation system of a city consisting of network of roads, buses, bus stops, maintenance depots etc. Similarly even bigger or mega systems can be designed - new urban centers, national health care system, political and judicial system etc. In fact our political system is a designed system and its design document or manual is the constitution of India.
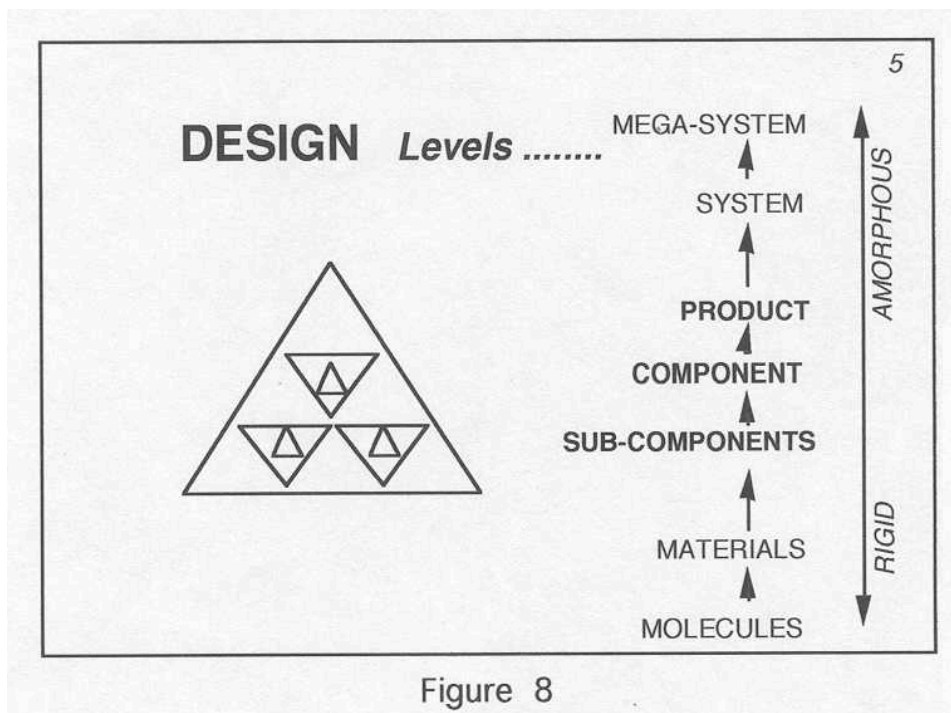

Figure 8

We see that along with so much breadth, design operates at so many levels, and it will be no exaggeration if this age of ours is labeled as the 'age of design'.

Although all the above-mentioned disciplines are so diverse in their output and the knowledge base required, yet they are all 'designs'. So there must be something in common - a binding thread that runs through all of these.

If we try to sum up the above and see if we can formulate a common generalised definition of design.

Design is a conscious and a deliberate attempt to juxtapose various necessary elements or components including human components and making them interact with each other in such a way that they function in a coordinated manner to produce an envisaged and desired output or effect (fig.9).

Figure 9
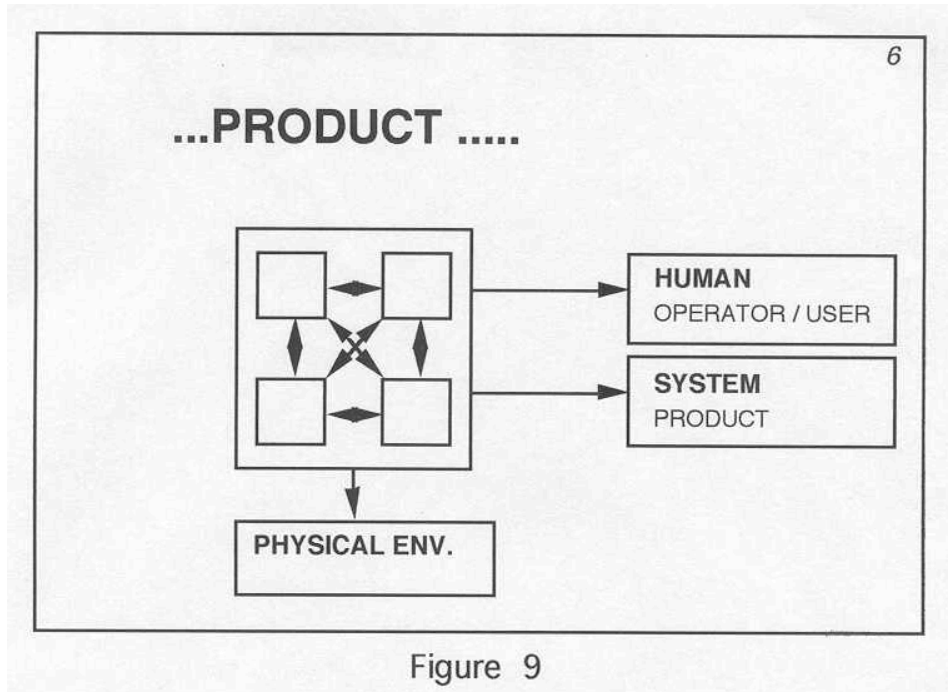
In this definition envisaged and desired are used together and cannot be separated as 'desired' results can also come about by an accident. In that case it is not design. The 'envisaged' output on the other hand is always obtained by design.

So what kind of education is needed to create people who should know about the desired output and also put this whole act together? What should be their special qualities and attributes? This will then lead us to what kind of education should a designer be offered so that he imbibes these special qualities and attributes. In the following discussion we will try to find answers to these questions.

First of all we must sort out if there should be one kind of education program for all design disciplines. The answer is yes as they all come under one umbrella of design and no because they are all different kinds of design. May be a new classification of the design will help us to get a definite answer. We will try to classify it according to its operating levels.

1. Micro level designing - all those levels, which come below product level like design of sub-assemblies, components, materials etc. Here the relationships are physically rigid between interacting components. Laws of physical sciences generally govern these relationships. For example if the composition of carbon and iron in steel changes even by a very small percentage, we will get a different grade of steel with entirely different properties. At this level of design, human being is not a component. At micro level designing narrow but deep specialized knowledge is required (fig.10).
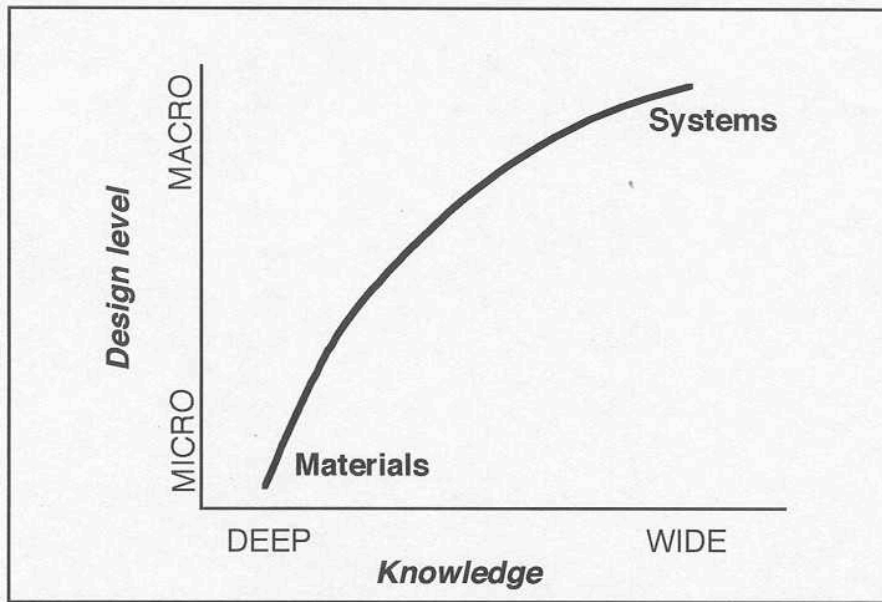
Figure 10

At this level evaluation techniques are precise, success or failure of design can be known early. Testing can be carried on to destructive levels if necessary, and cost of failure is low.

2. Macro level designing - all those design levels which come above product level like the design of sub-systems, systems, mega systems etc. can be put in this category. Here the relationships between various components are loose and amorphous. Number of interacting elements is large and diverse. Human being is generally a component. Besides physical laws, biological as well as social/cultural laws govern these relationships. Designing at this level therefore needs broad knowledge base.

Evaluation at macro level of designing is difficult and not as precise. At this level design can be put to real time test only, with delayed success or failure detection. Cost of failure is high. So the strategies adopted for designing at micro level will not work satisfactorily here.

Product design falls somewhere in between these two classifications. The product as a whole is a component of a macro design system, but it itself is made up of micro designed components.

Knowledge requirements

Since the design occurs at the interface of levels like material to component level or component to product level, the designer at any level therefore should be well versed with one level below and one level above his level of operation. That is, a component designer should know about the materials from which the component is made of as well

as the product in which it goes. This can set the limits of knowledge requirements at various levels of design. Sometimes this knowledge requirement increases horizontally or vertically or both (fig.11) depending on the design problem being tackled. This can happen when the design problem is complex or when one is working at higher levels of responsibility and tackling many diverse design problems. Imparting very deep as well as very broad knowledge is time consuming and expensive, it is not practical. In that case designer should be equipped with techniques of acquiring knowledge on his own and quickly enough to be useful. This is a decentralized form of learning as against structured formal imparting of information. This way of acquiring knowledge is selective and therefore meaningful to the requirements of design; and is much less expensive.

Knowledge
WIDE

Knowledge
requirment
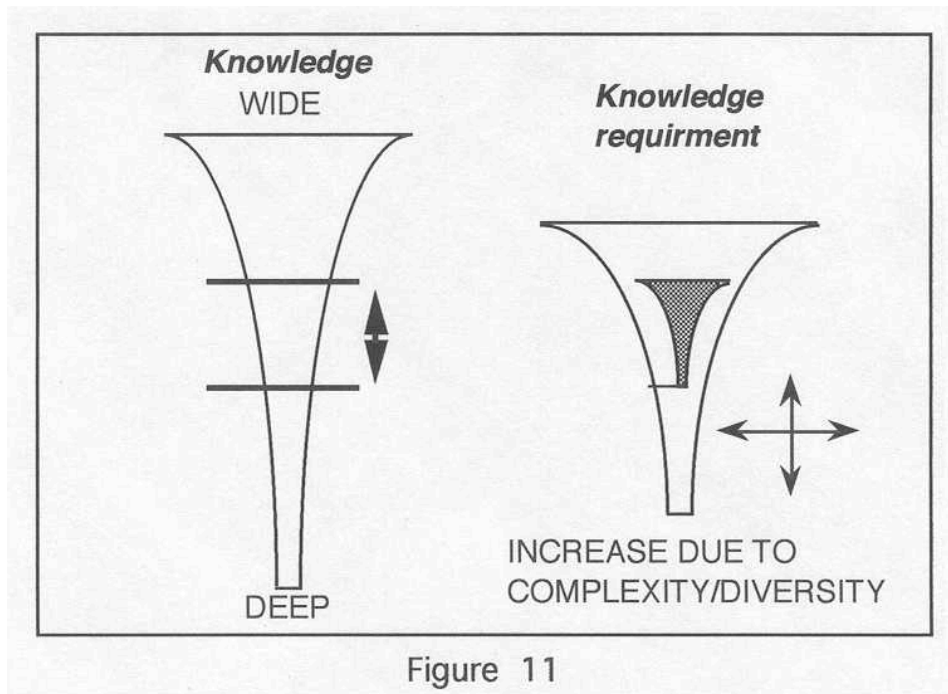
DEEP

INCREASE DUE TO
COMPLEXITY/DIVERSITY

Figure 11

So the designer should develop quick learning capability, if he has to tackle complex problems and diverse problems. This is not a new statement. It has already been said. Then, why is it not part of design curriculum at higher level? Probably because higher design education has so far been, a linear extension of the undergraduate education and has laid emphasis on visual design and visual harmony. May be it was necessary when the foundation of such programs was laid. Now the situation has changed radically. There is and there is going to be proliferation of new technologies and hence newer products. With increasing number of products and their increasing complexities, the problems of interaction are to grow many-fold. Designers will have to deal with these larger issues than mere aesthetics.

Pedagogic experiments

I am trying an experiment with my students. I give them a problem of making a perspective drawing of a cube with rounded edges and spherical corners. It is a two-line

problem and appears deceptively straightforward. Most of them often get stuck after an initial start and wait for some revelation to come by. They are then advised to go to the library and learn the method of drawing perspective within a limited time span. The emphasis shifts from mechanical drawing to learning on their own. *After that* They draw with greater zeal. They also get to know if the method is not followed, what a mess it can be.

I gave one of my students a problem of designing a battery powered aircraft tow tractor. At first, he was rather taken aback as any one would be, when confronted with an unfamiliar problem and a open brief. He was reluctant to take it and said, "I don't know anything about it". "So what do you want to know? I asked. This triggered a volley of questions, which he thought could enable him to understand the problem. These questions were listed and their possible & likely answers discussed to ascertain their validity and value for the design. The questionnaire was edited accordingly. This helped him in asking pointed and relevant questions. The answers to these questions were sought from various sources of information. While defending his project thesis he could talk to the examiner, who was from Air-India, in his own jargon. What is important here is development of attitude of quick learning by finding answers to relevant and not redundant questions. That means not only one should be armed with the methods of quick learning but also selective learning. He/she should also be imbibed so that when confronted with such a situation of unfamiliarity or partial familiarity he should take recourse to this method.
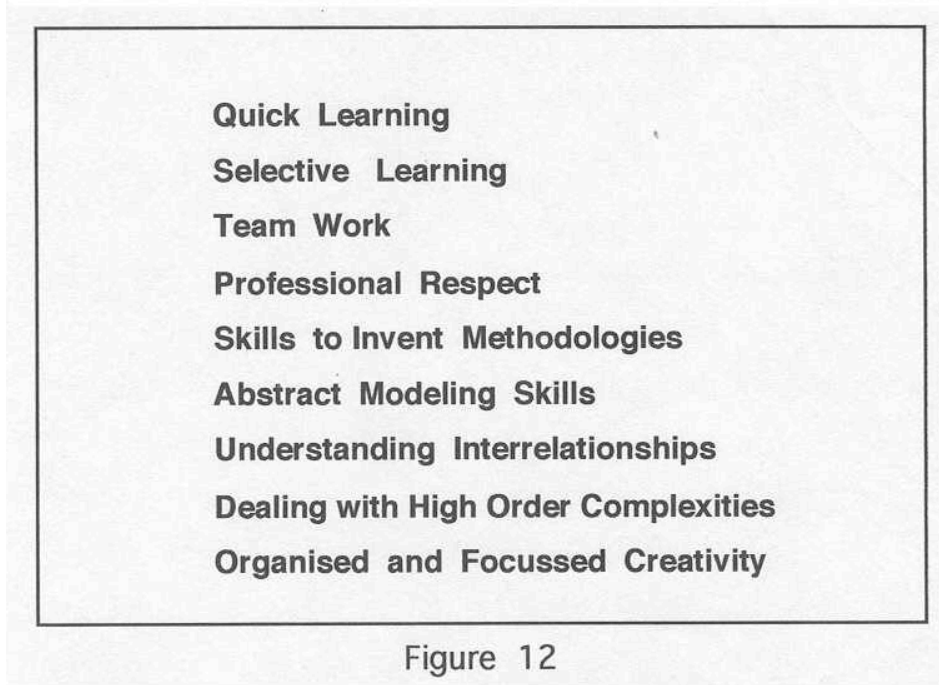
(In Norway at AHO – Oslo School of Architecture & Design, I floated a course " Design for the Other Worlds". Students were asked to select problems from totally unfamiliar situations and contexts. Before designing they had to learn to' familiarize' themselves with the 'unfamiliar' situation and they had to do it very quickly. The students were quite excited about it and in the process they invented their own methodologies for working.)

Some more designers' attributes...

To compensate for the lack of deeper and specialized knowledge a designer will have to take help from a specialist. For example while designing slide projector he has to take help of an optical designer (micro level designer). He should have the skills of inter-professional communication and be able to work with other specialist professionals as a team member. Teamwork becomes easy if the designer has inculcated professional respect (fig.12). Should the inculcation of this quality be one of the mandates for design education?

Besides the above problems, there are many other problems the designer has to cope with - a designer does not find answers to all his questions at the outset, he is faced with inadequate information and yet he has to design. At other times he is faced with too much information. He has to sift and weed out trash. He needs to verify the quality of information. How does he do it? He needs different strategies to deal with different situations. He has to develop skills to invent methodologies or choose appropriate ones from the existing stock and skills to modify these methodologies to suit the design situation.

So a place for higher design learning should not only equip the student but also conduct research to invent new methodologies. Shouldn't we also look over the fence to pick methodologies from other disciplines and induct them into design like investigative methodologies used by physical scientists or abstract methodologies used by mathematicians.

Quick Learning

Selective Learning

Team Work

Professional Respect

Skills to Invent Methodologies

Abstract Modeling Skills

Understanding Interrelationships

Dealing with High Order Complexities

Organised and Focussed Creativity

Figure 12

Designed system vs. evolved system

Designed systems or man-made systems come about through the understanding of interrelationship of various components, including the human component of the system, and then affecting that relationship. The evolved systems like natural systems on the other hand come about through many random couplings and disengagement of its constituent components till the system stabilizes. The evolved system, though sound and durable, takes a long time to reach its maturity. An old city grows through decades, whereas new cities are developed in a few years from inception to completion. The designed system takes much less time, because of the structured trial and error, as opposed to random trial and error that happens in an evolved system. In our keenness to increase the rate of economic development or GNP, all systems in future will therefore be designed systems. And all efforts will be made to reduce the trial and error time further by taking recourse to various techniques including mathematical modeling. So naturally these techniques should form the part of design education curriculum.

As we see future with more goods, more information and more services, the future systems are certainly going to be more complex. These systems will necessarily be complex. For example, the modern aircraft, the most efficient means of personnel transport over long distances, is a highly complex machine. It cannot be otherwise, if it has to function. To conserve our energy and material resources we will be striving to develop more complex and highly efficient systems.

(We have seen developments like fly by wire aircrafts, which are more complex and more efficient, regenerative engines, which are more complex and more efficient. ....)

Majority of industrial design professionals have so far been working in the areas of low complexity where the cost of error is low. With the increasing use of new expensive technologies and the increasing complexity of numerous and often conflicting design factors, intuitive problem solving approach will not suffice. More rigorous and disciplined approach and fresh methodologies to deal with high order of complexities are needed. This is possibly the biggest challenge that design education has to face.

Creativity

Creative ability is the acknowledged corner stone of design activity. Its enhancement both in quantity and quality should of course be one of the foci of higher education of design. Creativity in general is good for all walks of life but design requirement is organized and focused creativity. This also means when to turn your creative mind on and when to turn it off. Who should install this switch?

Openness and insight are some of the attributes listed by experts for innovation. How do we inculcate openness or develop insight. I do not have the answer. One of our alumni, who teaches in University at Mysore has conducted some experiments by introducing meditative and yogic practices to the participants of entrepreneur development program, and he has reported encouraging results. Results of researches like this should be incorporated in the design education program. This of course will be a major departure from the current practices of design education, but the introduction of these practices will be a live endorsement of the attitude of openness. Workshops on experimental theatre at IDC, is seen as something, which helps in creating openness, reduce inhibitions and fear of failure.

Results of the research in the area of thinking and artificial intelligence could possible be incorporated in the program of higher learning in design, if it helps to develop the range and depth of mental skills so vital for designers. Learning practices adopted by the classical musicians are worth considering if one has to take the design act to perfection.

In conclusion…

The above examples are only a pointer to what design education at higher level should be, keeping in view the demands that are to be made from now on. The design education, we are talking about, may not be strictly necessary for all kinds of design, but if imparted, it will definitely make better designers including those who design political, economic and social systems, as this system of education is involved with developing mental skills needed for 'design'.