

## *Design Narratives I*

*a g rao*

### **16 mm Projector**

This was my very first consultation project. It was also the first major design project from Industry for IDC. I must thank my colleague Uday Athavankar for his generosity. He first came across the client and handed over the job to me. The client was making the projector for many years under a collaborative agreement. The original design was from RCA(Radio Corporation of America), an American company. Photophone pvt ltd, the Indian company(our client) had bought the moulds to make the projector. 4 die-cast aluminum parts with several inserts formed the core of the 16mm film projector. At the production rate of the company based on the demand at that time, the moulds would last for another 20 years. RCA had already introduced the next version with a new design. But Photophone, had no access to it. The company management wanted a new design. But the brief was clear. No changes in the die cast aluminum parts to be made, but achieve a classic new look in the new design! Company was not interested in any user' study. They had no user complaints!

*I was at a loss, what to do?*

I requested the company to give a projector for study and a month time before we commit to undertake the project. The company agreed.

I tried to make some user investigations on my own but not much came out of it. I studied other projectors! There were very few anyway.

I found some functional problems which need to be addressed. Then

I made a systematic visual analysis of the projector.

- I found a basic short coming in the RCA model which the Company was making. It always needed a special stand. The front Arm of the projector was coming below the table level. So the projector could not be placed on any normal table! In other designs including RCA's new design, both the arms went up while projecting, which facilitated placing the projector on any table!
- Next was a production problem which led to poor quality. The covers for the projector and the sound box were of fabricated Aluminum sheet. A rexin cloth was glued on to the aluminum cover! The company had a problem to match the colours as the rexin cloth suppliers were not able to supply the same shade of colour. Each lot had a slight variation in the shade.
- This apart the projector had an old engineering 'look!' A typical product designed in 50s ! All the visual elements seen had an engineering, operational origin. There was no overall visual cohesion.
- A report based on the visual analysis was made. The visual inconsistency in the shape and operation of the knobs were pointed out. Round knobs were used for operations like on , off and bar knobs were used for indicating continuous quantities like volume.

The report concluded offering two options for taking up the design work:

1. Bringing in major change of taking both the arms up!  
This involved structural changes in the construction like modification of die-cast parts.
2. Keeping the arm positions as they are, making minor structural changes. Changes in shape of knobs and colours of the projector

as well as material and process of covers. Use of moulded plastic was suggested to overcome the problem of colour variation.

A fee for 'Redesign' with option 2 was quoted!

The company was impressed with the analysis. They wanted to give the project. But it started with a complaint, from the young owner that the fee was too much. We had to tell him that it was part of IIT system and we cannot change it. The young owner had an 'uncle' who was a member of 'governing board of IITB'. So they went and met the Deputy Director. DD promptly told them that the costs were worked out based on the work involved and no change was possible!. The company paid up the fees which was little less than twenty thousand rupees, but asked for the First option to be included. This involved lot more work! But I saw it as a wonderful opportunity! After all, this was my first professional project!

The time we had asked was 3 months after they paid the fee! This was a major project in industrial design considering the year 1971.

The 16 mm projector was about the size of a small brief case . There was a sound box which was of the same size! The covers for the projector and the sound box were sub-contracted by the company to a fabricator who made them in Aluminum sheet to keep them light in weight and stuck with rexin cloth. Here came the first opportunity for me. I started visualising these parts in 'Vacuum forming'! ABS could be the material. Coming from NID we, myself and Chatto(Maniram Chattopadyay), had a good grinding in plastics.

*A well known VJTI professor of Chemistry in Plastics Dr.Calthod was specially invited by NID to teach us, the first batch of industrial designers being trained in the Country!. His voice*

*still rings in my ears. How the cross links between Carbon and Hydrogen changes Thermo forming plastics into Thermo setting plastics, told emphatically by him could never be forgotten.*

Added to this I had worked on a project, 'travelling companion' framed by prof. kumar vyas. The project got shaped into be a brief case and I had made a full size model in F.R.P, after unsuccessful attempts to make it by vacuum forming. We, myself and my class-mate V.M.Parmar, who was also working on the same problem, were also responsible to start the huge vacuum forming Machine at NID . This is yet another story-

*When we started designing the brief case prof.Nadkarni, who had just come to NID after studying at the famous school of Ulm, prompted us to make(karo yar!) in vacuum forming. he said it was so easy and in Ulm they used it often. What he didn't tell us was it was a small 12"x12" machine. The huge Vacuum forming machine at NID was silently staring at us every day! We fell for it. Let us start the machine, we decided. Mr.D., senior engineer, in charge of the workshops of NID was very co-operative. We made a negative mould in plaster of Paris using a readily available injection moulded tray. At that time only plastic material available for vacuum forming was PVC (vacuum forming grade). The frame to fix the plastic sheet was very heavy. Three workers helping the task, we fixed the sheet. The machine had heaters in the top and bottom of the sheet. But alas! the very first trial was a disaster. The mould crumpled like a 'pappad' with the vacuum pressure. The up-coming mould table hit the knob at the end of a projecting handle with big noise! We all got scared at the disaster! I could see 'panic' in the face Mr D., who had taken charge of the operation. But he came out of it with his ever green smile! He stopped the machine, and said we will need a 'positive mould'!*

*So we started making a positive mould in full size. It was not easy. But we were trained by a very special teacher, Mr.Hancock, who had come from England to set up the wood workshop at NID. He was involved in building all the airplanes in wood for a famous*

*film 'Those Magnificent men in their Flying machines'.*

*All those planes flew!*

*We had to build the moulds by gluing 2"x3"x2.5' wood battens, sanding them to give the crowning at the top and radii at the edges. We had huge belt sanders in NID at that time. As we made the moulds I was bugged by the projecting handle and the broken knob in the vacuum forming machine. I looked at the German catalogue of the machine again and again. Suddenly I had an insight! Oh! the top frame to hold the sheet was (ultra)-'upside down'. Once the idea came to the mind, small 'not so clear pictures' started making sense! . It was not very difficult to convince my friend Parmar! We both went to Mr.D.. and told him that the frame need to be reversed! He was not convinced! But we argued and asked him to allot few workers so that we can try out! We assured him we will not start the machine without his presence. He agreed and allowed us to try! The huge, heavy frame at the top of machine was lifted and reversed.*

*It needed 5 people as we didn't have a Crane!*

*'It was Magic!'*

*The frame started to lift up like a feather! It was designed for easy lifting. It had a heavy counter weight! Only it was reversed for ease of packing! It became obvious why it was so heavy to lift! The counter weight was acting against lifting operation!. The handle bar with broken knob came to the top. It was meant for holding and lifting the frame!*

*So we proceeded and vacuum formed with 2mm pvc semi transparent sheet. Everything went well. We removed the piece from the mould. It looked sturdy. We thought , 'It is done'. We started cutting off the piece from the sheet. That is when we discovered another 'disaster'! The walls were floppy, they had no strength! The sheet connection which acted as rib was no more there. We were depressed, did not know what to do! No help could come as nobody knew about vacuum forming more than us at NID. That is when I learnt the importance of the rim around, in 'Vacuum forming!'*

*Well! After a day's sleep we bounced back! I got another idea! Why not use FRP? Only problem was to get the finish outside! So we needed a negative mould! Our weak, flexible PVC piece became a negative mould! So we started again.FRP(Fiber-glass reinforced plastic)material had just arrived and nobody in NID knew how to use it. There was one demo by an outside*

*manufacturer. He had shown how to make a tray! so we went through all the initial troubles to find the right proportions of accelerator and catalyst which never correlated with what was mentioned in the catalogue!  
Finally we did make our suit case/travelling companion in FRP!*

Thus I understood designing for vacuum forming. A lip around a box shape was so important. Unlike F.R.P, vacuum formed parts of similar size would have no structural strength without this lip. Since the shape is drawn from a flat sheet, the top portion becomes thin and the flange is the one which gives strength to the part. So I developed the shape of the covers for the projector based on these structural fundamentals!

*Form follows the Process* –became my dictum.

Photophone (R & D) had a chief Mr. N.. who was a very senior engineer. He didn't know about plastics that much. But he declared in the very first meeting, "the knobs have to be in Bakelite and the colors have to be red or black," when I asked him whether the projector gets heated up. I was careful not to get into any argument with him. His son used to study B.tech at IITB. I just used to enquire how his son was doing whenever I met him! Initially he was opposed to any major change in the existing design! But once the Management decided he fully co-operated. Mr. N said, 'Don't change the main die castings. You can add new ones or even machine the die-castings! So it became a major detailing work to add a new arm in place of old one! Both arms were made foldable. They got internally locked when they went up! I developed a system of 'knobs' with colour coding.

*I had specialized in radius as a student. Prof.Kumar Vyas was very sensitive to radius and this had a great effect on me! I once asked him, 'why are we doing the radii manipulation exercise?. What is the use of it?' But he simply said 'Why are you so skeptic?' Now I realize how important it is to learn some times without questioning its use! It is not*

*easy to articulate many things in design! You will find the use much later, when you are mature enough!*

For the shape of knobs, a bar attached to a circle with a gentle flow, of radii at the joints became a main feature!

A month of intense designing and drawing to accommodate technical details started showing results. I could create a visual binding around, with the addition of castings which were required for lifting the arms. Distinct blue colour created the framework for the rest of projector. Control knobs for speaker operation and projector operation were colour coded. This also brought life into product. It looked more ordered. Two distinct levels, reinforced with colour combination could be seen. Visual organisation of knobs brought focus to them. A visual flow, which was missing before could be seen. Each visual element supported the flow. This was a problem in the earlier design. Each element was fighting with other for importance.

We started planning for a full scale model. A big team was working for me in IDC. The company started asking when the designs would be ready. Three months were coming to an end. I put down the deadlines. We started with the full scale wooden model. Moulds were made for vacuum forming covers. I standardized the sizes, so that same part could be used for both projector and sound box!. A cut out incorporated speaker front in the front cover of sound box. Production economy was so important for the companies. Every part reduced eliminates separate inventory. Vacuum formed parts were looking good.

While making full scale model I had a serious of problems. Suddenly prof.Nadkarni had to make another presentation and the expert carpenter who was working on the projector was taken for that work! Wooden moulds take time to make! Myself and Rajan explored alternatives. We thought of reducing the scale of model. But it was more complex as all

knobs had to be made for that scale! Finally I bargained with the company for two more weeks! Once the dead line got extended we were working every night up to 'one o' clock in the night, then starting early morning next day. The last two days became critical. One of the mechanics who was doing spray painting work stopped coming. We had no way to contact him as he was staying in Ulhasnagar and no body knew his house! He had no telephone! We had not even heard of Mobile phone! No body else could spray paint in the workshop so I took it up myself ! NID training with 'hours and hours of spray painting' had left its mark, '*an expertise in spray painting!*'.

It is difficult to believe that the last two days before presentation I was working whole night sleeping at 4 am or 5 am in the morning. Whole workshop was working in the nights for a week ! There were many parts to be made in wood, putty to be applied, and prepared before painting. Govinda Rajan was in full charge of the workshop. There was little time for taking photographs! Atto took up the charge of studio photography! He worked whole night finishing the B & W photographs of the final model. Colour slides were taken in the morning before going to the company. I was busy making a report to be presented. I still remember the very morning Prof. Nankarni was binding the report for me. Chatto took the colour pictures. I can not imagine this happening again! Whole IDC was behind me. It was like a 'War scene' and I was fortunate to be the general! The presentation was around one 'o' clock! Photo phone company was in Sakinaka. Both myself and Rajan had not slept at all in the night.

The presentation was memorable. Whole family of the owners were present. It was an emotional situation for them. The product was like their 'baby' and they could see a new 'form', new life in the product.

They were almost in tears! It was a touching moment. They thanked me! When the owner enquired whether it can be made, R & D chief Mr. N...replied "there is no problem sir, Mr. Rao has discussed every detail with me!" It was a great moment in my life! Myself and Rajan left the model in the company and reached staff Hostel where I was staying at '3' O clock. We were hungry, dead tired. Mina(Mrs.Chatto) made cheese omelets and toast for us to eat! We thanked her .Then we slept to wake up around '9' o clock for dinner!.This exciting experience of design stays with me till today!

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