

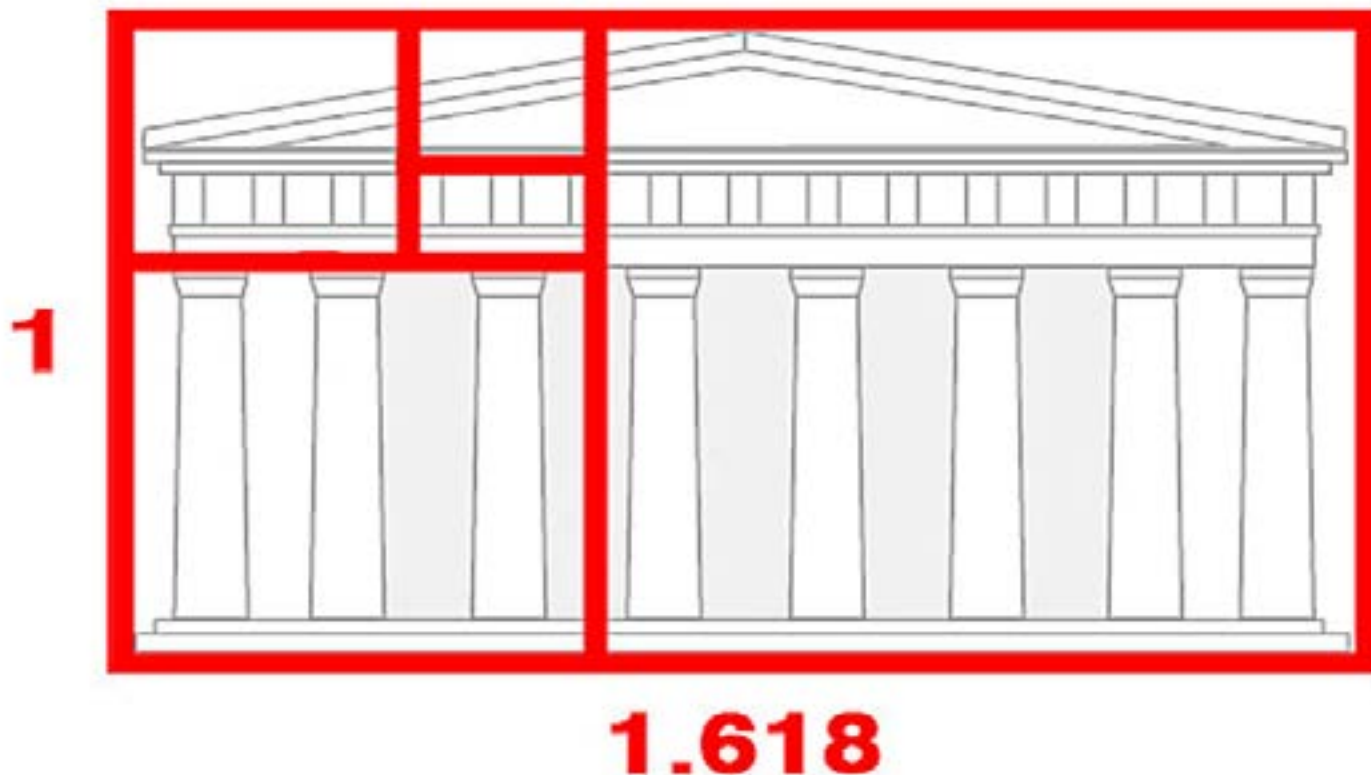
# Workshop on Art and Science of Golden proportion

a g rao

## Preamble

I thought many people might have heard of 'Golden Proportion'. To my surprise I found that few among engineers had heard of it. Many Architects and Artists had heard but didn't know that Golden proportion is 1:1.616. Why is it important or interesting to know ?

- \* It occurs in Nature.
- \* It is considered as a most beautiful proportion and had been used by Greeks in Parthenon temple structures!
- \* Leonardo Da Vinci had used it in a painting like 'Mona Lisa'



## Link with Fibonacci Series

Famous Mathematician Fibonacci (pronounced as fibonachi) discovered that golden proportion occurs between two consecutive numbers in a Mathematical Series named after him.

Fibonacci series

1,1,2,3, 5,8,13,21.....

1,1+0, 1+1, 2+1, 3+2, 5+3, 8+5, 13+8.....

By adding each previous number in natural number sequence you get Fibonacci series. In Fibonacci series proportion of consecutive numbers after 8, remains always same and is equal to Golden Proportion.

A Spiral generated out of Golden proportion by dropping the diagonal from mid- point to corner of a square gives a golden spiral.

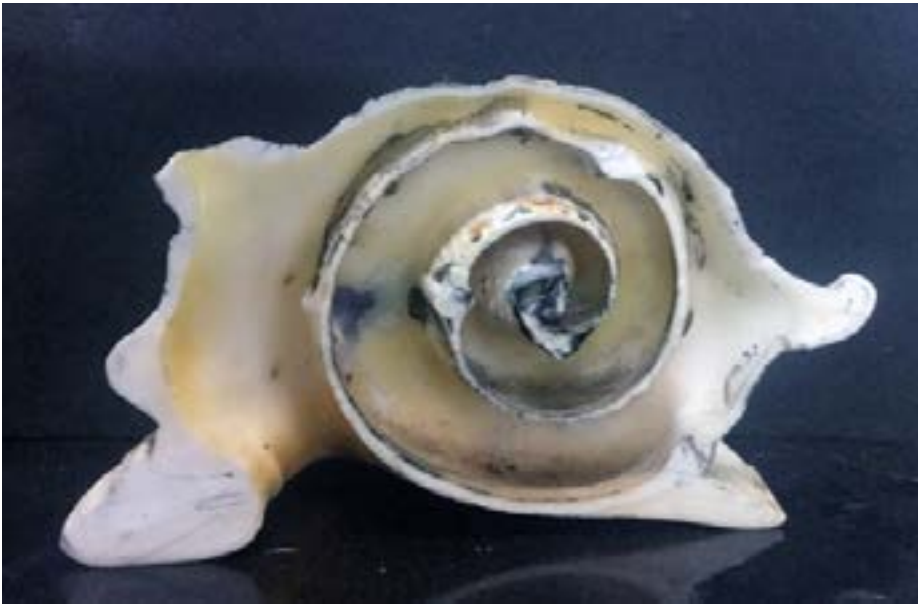
Golden proportion and spiral can be observed in Sea Shells, Sunflower, Pineapple, Ram-horns,etc.

So we took this as a theme for a Pomegranate workshop for children.

## On Methodology

We have developed a method of introducing a subject to children, what I have called TLP. Teaching Learning Platform. TLP can become a general methodology for effective learning.

TLP involves working out a 'mode' of engaging children through Narratives, video's, PPTs, specially designed tasks,games,..etc. in which they go through experiential learning sessions of drawing, making, enacting, writing stories or poems, singing, tasting and playing, etc.. In these sessions even as children learn about the specific topic, they also develop their creative traits by getting rid of social inhibitions and mental blocks in addition to discovering their own limitations of thinking skills. Research is done on the history of the 'content' to start with, in this case 'Golden Proportion', and how it has evolved. Literature search of experimental learning methods and support materials which have been already used, is carried out. Gaps in them are identified. New learning material is designed to complete a module or session. Design and Development of new kits, 2D,3D models thus get a focus.



## Preparation of Back-Ground Material

I had been fascinated with Golden Proportion for long. A M.Des project and a Special Project were done under my guidance. In the Special Project taken by Anthony Ben, we had successfully cut couple of large shells to see the golden spiral in cross section.

General information and images were collected, mostly from the net and books like 'On form and Growth' by D'Archy Thompson.

One can use a 'Mind map' effectively at this stage as general method for TLPs. I personally use a Mind map if I am stuck. Otherwise I get into a flow with the theme and it keeps working in my mind!

A ppt was prepared explaining fibonacci numbers and how Golden proportion occurs in Nature. It is generally mentioned in Art and Design books that Golden proportion occurs in pineapple, sunflower, ram horns, etc.,. But how it occurs is seldom discussed. Study revealed interesting information.

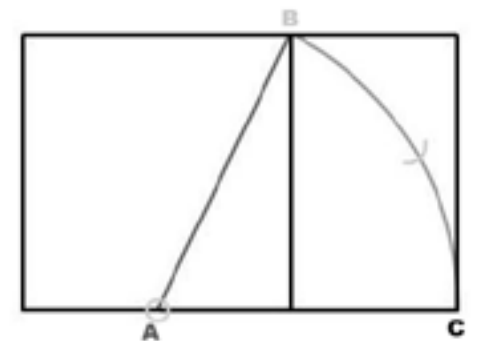
In sunflower we see spiral lines and the number of lines are Fibonacci numbers.

Spirals on pineapple also match with a Fibonacci number.

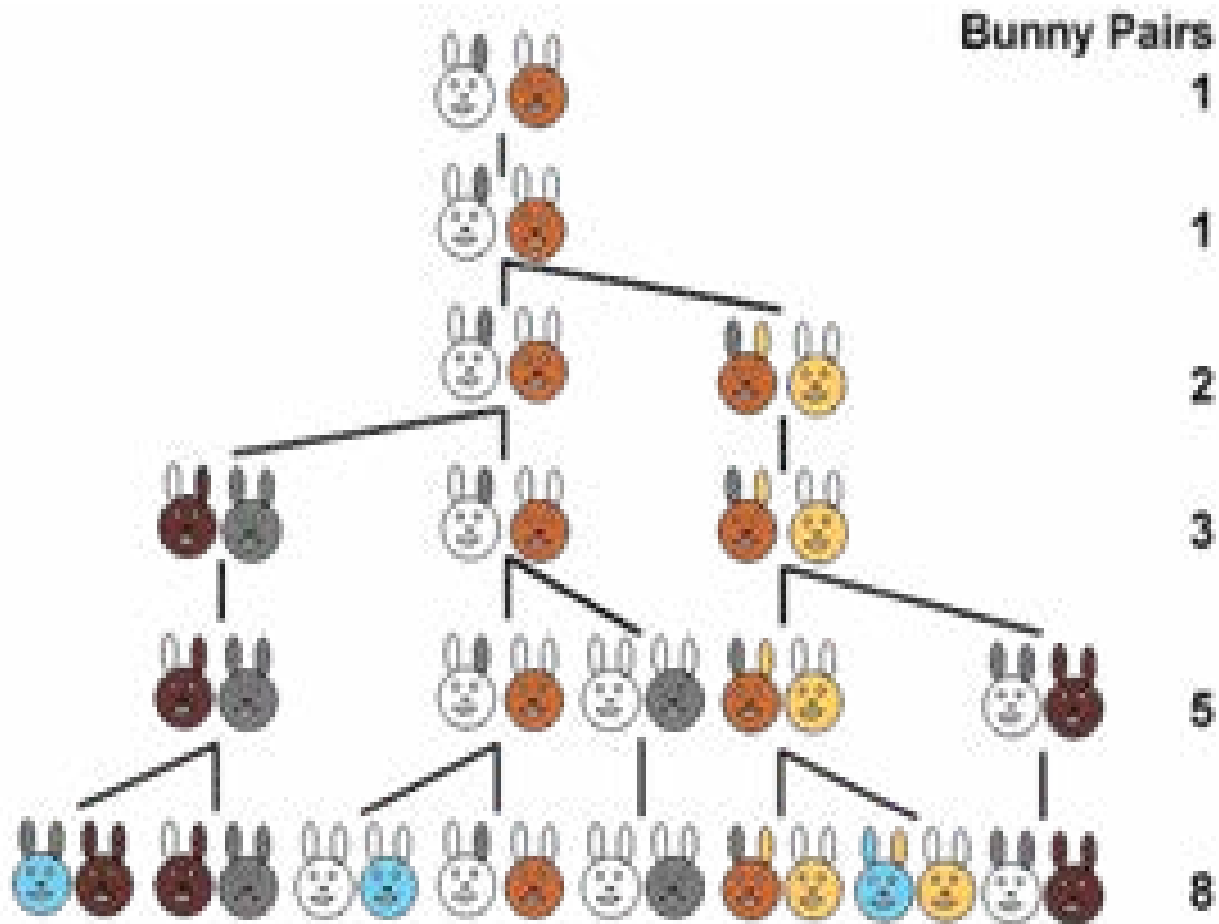
Ram horn has a golden spiral.

Golden spiral can also be seen in the cross section of Sea shells when we cut them. It is related to the growth of snail in the shell.

Golden proportion can be derived geometrically by dropping a radial arc from the mid-point of square



Constructing and drawing a golden spiral itself is an engaging task to children or adults. Seeing actual spirals and counting in a beautiful Sunflower is not an easy task. It can become a good exercise in scientific observation.



How Fibonacci explained his series with multiplication of rabbits was another interesting graphic image.

How to convert golden spiral into a play mode was one more concern.

I thought of a laser cut templates of small and bigger sizes. And then came the idea of making a rubber stamp.

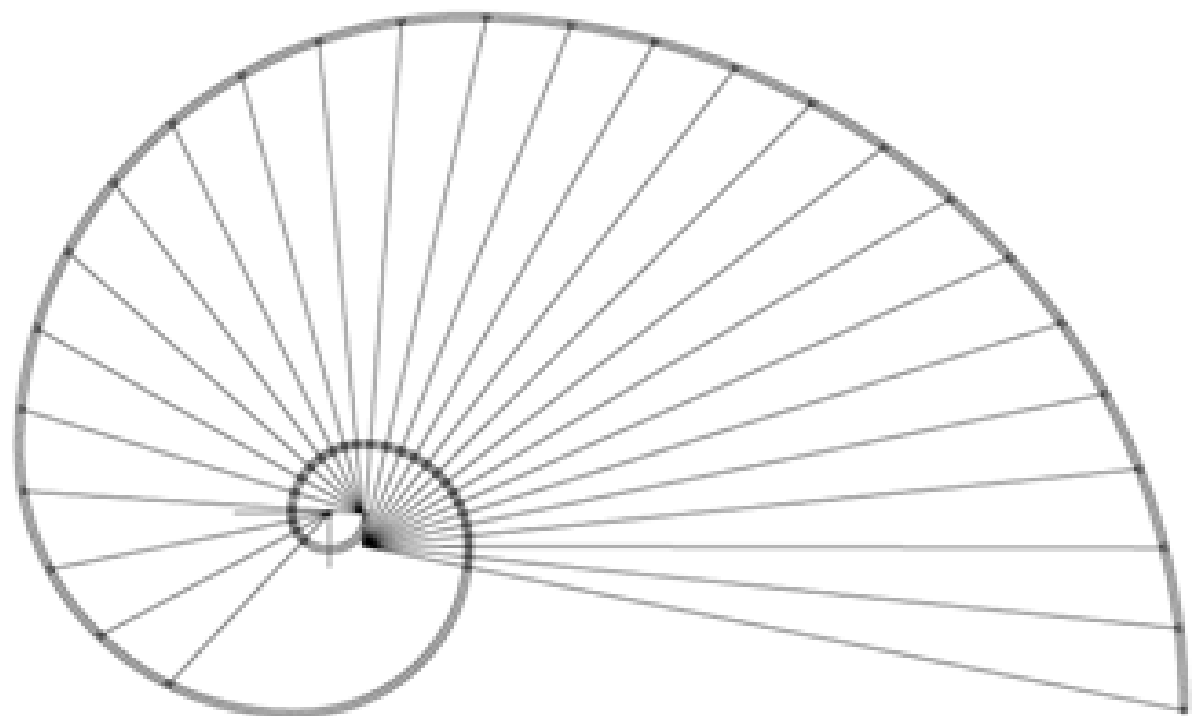
Girish was working as a design associate at that time. He found somebody in Dadar, who was ready to give a laser cut rubber stamp.

Soon, ideas were floating around. They started getting linked. We had four sessions, two week end half days.



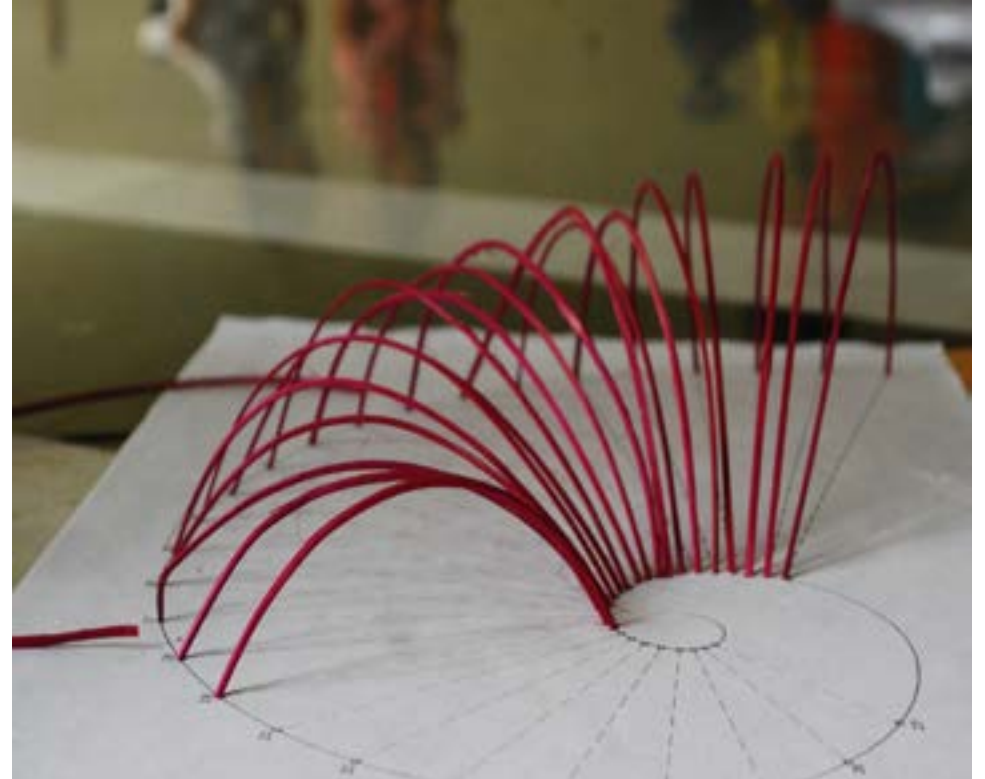


I wanted some thing in 3D. Ram horn was there.  
Sea shell was there.  
Daksha, a design student from Shrishti who  
came to work on a bamboo project was also  
helping us.



We deconstructed the  
Horn into a 2D image  
with the golden spiral  
drawn.

The 3D shape could be built on this spiral. Corrugated pp board has been one of our favourite materials and readily available in Bambu studio. We got a big print out of the spiral above, stuck it on PP board, punched holes at the ends of straight line. Connecting holes by inserting bent wires or sticks can give us an Arch. If we choose spacing between such arches we could get a 3D volume with golden spiral base. We thought of bamboo. Use of bamboo is an untold constraint in our mind. Machine made sticks were available readily. But they broke when we tried to bend. I suggested bamboo sticks made by hand. These worked and when we put these in different lengths, it started taking the shape of a cut shell. In the picture we can see how it manifested..



At this stage Girish came out with an interesting idea of a mask. Viola! I jumped at it as I have seen in earlier workshop at Tawalai, children love 'Masks'. Ram mask started taking shape in our minds.



Several Ram faces were drawn, and the one was chosen for making it in numbers.

The workshops were held in the city. We got benefited by the expert skills of Priya Srinivasan, founder of Pomegranate workshop. She took care of announcing the workshop in right forums, sending through their mail list, etc. It is a huge time consuming task and not easy either. We were particular that children and their parents understood the theme and efforts we put in before hand!

## Sequence of workshop

### Day 1

- Introductions.
- I give a brief of the theme.
- We show samples of cut shells, pineapple.
- We explain how to draw golden spiral on a board and a PPT if projector gets ready.
- Talk on proportion in general and Golden proportion
- Children construct a Golden spiral in A4 sheet and fill up with colours.
- Children get sunflower prints with a tracing sheet to trace spiral lines and count their number.

### Day 2

- Symmetry with Golden Spiral.
- A theatre workshop to enact symmetry.
- Form smaller groups and Create symmetry panels on imperial size drawing sheets using Golden Spiral rubber stamps or templates!
- Children display panels.

Planning for the 3rd and 4th day was done in detail only after the two sessions. We were ready with the 'Mask idea'. Making mask would take one session. We got corrugated board and pasted printout for Ram face and spirals. Bamboo sticks were made and dyed with natural colours by Rudrapaul, our bamboo craftsman.

A graph sheet was prepared with exact lengths, for children to make and cut the bamboo sticks. I made up the story to be told on 2nd or 3rd day. Extension for the story to be done on 4th day. Large sheets were collected. A beam compass was made to draw bigger radii for large spiral.

As we were working on these, I thought that it would be a good strategy to give a small Brochure on Golden Proportion to children when they came to the workshop. Many parents are not familiar with golden proportion and they can get exposed through this. Sachin Datt, a phd scholar who was assisting me as a TA helped in designing the brochure.

In the content I added some material on ratio and proportion as we were not sure children would have been exposed to them. Rest was on golden proportion. I created a puzzle inspired by 'word-puzzles' of Lewis Carroll. A collection of Math puzzles will be a good back up for Designing TLPs. During this process I also dug up interesting property relating to Centre of mass, CG and Golden Proportion.

Maximum size of a square you can cut at the corner of a bigger square to retain its CG, had golden proportion.

We had some props for workshop ready.

1. Cut shells to show the golden spiral in Nature.
2. Laser cut templates of golden spiral - about 10x8cm
3. Rubber stamp of golden spiral of same size
4. Ppt on golden spiral
5. Pineapple
6. Picture of Sun flower
7. Booklet on Art and Science of Golden proportion
8. A Ram Mask
9. A4 format to construct and colour Golden spiral

I thought that a story needs to be created with the theme . We saw the power of a story with children in an earlier workshop . It becomes real to them as they participate. Activities of the workshop and timing of story has to be matched.

Slowly 'Plan' for first two days got fixed. Normally I keep changing the plan as new ideas come. These are filtered to fit into a basic structure.

After first 2day session there would be gap and 5 days time. We would know the children by that time and adopt our plan for the last two days.



# DAY-1



## 4 Day Workshop

On the first day we started with a discussion on 'What is proportion and How a linear proportion will give a diagonal straight line', if quantities vary in direct proportion. I took an example of cooking rice for 3 people. It needs 3 small cups of rice, for 5 people 5 cups, 8 people 8 cups, and so on.. If we draw a graph we will get a (diagonal) straight line.

After this I took the example of a baby of one year old, assumed height to be 1foot(ft).

If we take linear proportion the baby's height would be 2 ft after 2 years, 3 ft after 3 years and so on.... 10 ft after 10 years. In this case it cannot be 1:1, direct proportion.

10 ft tall kid at 10 years old was quite amusing to children.

So proportions are not always 1 to1.

Then I took the example of rabbit multiplication every year and its relation to Fibonacci series.

1, 1, 2, 3, 5, 8, 13, ... and so on.





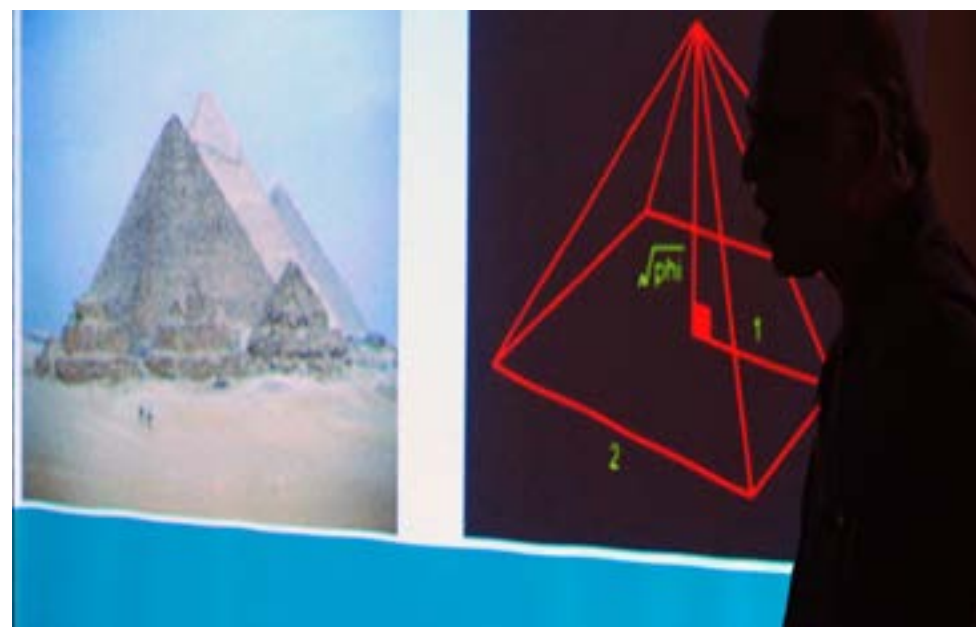
An explanation on the board got reinforced with a power point presentation.

How the golden spiral was constructed was told. Occurance of Golden spiral in Nature, and its use in Greek and Egyptian Architecture was shown through pictures.

A stage was set to see the golden spiral physically.



DAY-1



Girish watching me counting the spiral lines in a pineapple, with Sanjay Nair and Sachin behind.



Feeling the pineapple and even eating at the end of session makes the experience memorable.



Seeing the golden spiral in a cut shell is a rare experience for school children



DAY-1

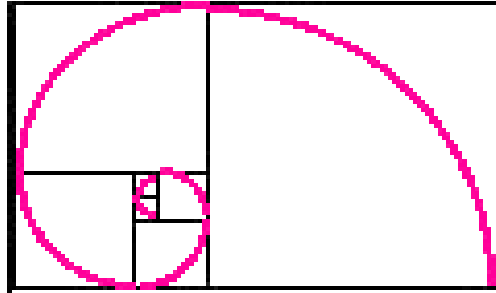
# DAY-1



Observing and drawing the spiral lines is a scientific process. In Nature exact geometry will not be seen. Sometimes, an order has to be extracted based on the probability.



# DAY-1



Constructing Golden spiral became an enjoyable task in Geometry.

We found children struggling with their compass.

The inexpensive school compasses available in the market are of poor quality. I feel a good quality compass is an essential investment, parents need to make.

Filling up with colours transformed the task into an 'art activity' which children invariably enjoyed!

## Enacting Mirror Symmetry

# DAY 2

We started the second day with the theme of Mirror Symmetry and children were to **enact** it. I have been using theatric participation as means to loosen up. We asked one kid to become mirror image and the person opposite to be the subject. Mirror image has to imitate whatever the subject does. After some time the roles were reversed. Children soon got into a mood of mimicking and it became a fun session. Some rules of mirror symmetry like 'Image has to move left hand in response to subject's right hand', were pointed out as they enacted.





Stories can grip children and adults alike.  
I made up a story  
**'Number Monster in Fibonacci Caves'**  
for the workshop.  
As in the story, Children made symmetry  
panels on the second day and Ram Masks  
the third day!



DAY 2



After 'theatrical participation' in Symmetry, they sat down to work on the sheets. I explained. Sachin, demonstrated how they can use templates effectively. Children got engaged with drawing activity. They came out with varying designs of panels, sticking to the rules of Symmetry. All the sheets were displayed. Priya came out with an idea that they can talk about what they have done. This was a new input I had not thought of. Children had their own stories to tell why they had done in that manner! Group participation and verbal expression often consolidate right brain learnings. It forms an important mode of **studio learning** which needs to make an entry into School Education!



DAY 2





Our Team on day2  
Right to Left  
Priya Shrinivasan  
Akshad  
Sachin Datt  
A.G.Rao  
Volunteer  
Sarang

DAY 2

End of Part 1  
Wait for Part 2

Read the story  
**Number Monster in Fibonacci Caves (part1)**