glass

With this project, I would like to share my fascination for glass as a material and my attempt to discover beauty, distinction and harmony in glass work

PRODUCTS IN GLASS

nature of glass

transparent,
translucent, or opaque.
amazing play of light

reflective and refractive properties.
hard and resistant to surface scratches.
smooth, nonporous surface -easily cleaned.
resistant to chemical attack.

Various techniques are used to create glass products.

Most techniques demand skill
This makes making of many glass products more of an art.

t y p e s o f g l a s s

SODA-LIME GLASS

LEAD GLASS

BOROSILICATE GLASS

SPECIAL GLASS

This is the most common commercial glass.

properties
used as flat glass in windows.
easily cleanable.
resistant to chemical attack.

use
bottles,
jars,
everyday drinking glasses
window glass.

disadvantage
Its relatively high thermal expansion.
resistance to sudden temperature changes is poor.

applications

FLAT GLASS

- glazing
- window panes
- furniture (table tops,etc.)
- different types of mirrors

HOLLOW WARE

insulating vessels
- glass jewelry
- container glasses

o packaging glassware
o tableware
o hollow structural glass
glass blocks, Glass roofing tiles

SPECIAL GLASS

special purpose glasses
- laboratories, pharmaceuticals,
- electro technology , electronic gadgets
- optical and ophthalmic glass
- nuclear technology and radiation research

brief history

The First Period: 1700 BC through 100 AD
Primitive method of making glass using molds.


The Second Period: 100 AD through 400-500 AD
Glassblowing technique discovered, and glass manufacture becomes a more practical process.

The Third Period: 4-500 AD ~ 1200 AD
Extension of the Second Period spanning into and through the Middle Ages. It is characterized by Byzantine glass.

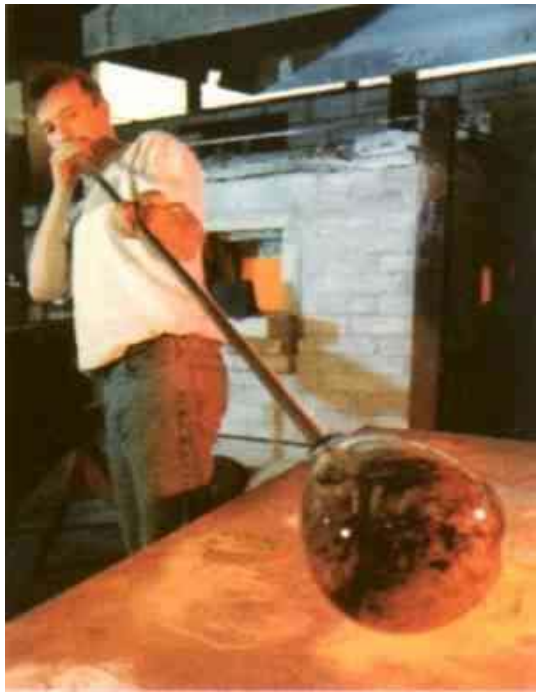

The Fourth Period: 1200 AD ~ 1900 AD
Venetian glass influence spreads throughout Europe, all the way to Asia. The foundation for modern glass making is set.




The Fifth Period: 1900 AD ~ present
Glass objects used as everyday goods. It is manufactured on a large scale. . It is widely used in varied areas-right from architecture, automobiles, lighting, hollow ware to special purpose applications in technical fields




various techniques



Glass objects can be produced by various techniques that have existed over centuries. (details in the report)

i n s i g h t s

most techniques require a very **high level of skill**

quality and expression of products made by these techniques cannot be predicted- more oriented towards experimental mode of work (mainly used by glass artists)

time consuming and demand lot energy and resources.

they cannot provide scope for and multiplicity of production

current scenario

glass industry in India

Ref: www.IndiaSocial.org (firozabadcluster.org)
Virtrum Glass (Empire Industries ltd.)

- **manufacturing set ups**
for e.g; Borosil Glass works
ORGANIZED SECTOR

- **small-scale glass industries**
Areas like Firozabad, Agra, Meerut
UNORGANIZED SECTOR

- **Fine artists** with independent setups

Borosil products
www.borosil.com

manufacturing set–up

standardization is very high.

less variety in designs.

Products of companies like Borosil, sell more because of the properties of the glass used (microwave resistant, dish washer proof, etc.) than the aesthetic qualities.

products made in
small scale industries
in Ferozabad
www.IndiaSocial.org

small scale industles

This set-up works with **low quality of material and infrastructure.**

This results in **cheap looking glass products**, which stand nowhere in comparison to products made from high quality European glass.

In jobs like glass blowing and handling molten glass, the level of **skill required is very high.**

products made in
European counties

Tacoma art museum
installation
Artist: Dale Chihuly
www.chihuly.com

glass artIsts

They are not interested in multiplicity

work is experimental and purely aesthetic

i n s i g h t s

products made in european countries

products made in ferozabad

The glass industry in India works with the following limitations

- **low quality of material**
- **low quality of infrastructure**
- **high cost of manufacture**

low quality of products

objectives

derived from insights

- Thousands of manufacturers and artisans earn their living from the small scale industries in Firozabad, Meerut, etc. making glass products that appeal to a variety of user groups.

- The design approach needs to look at a wide range of products that are now becoming a part of an average person's lifestyle.

How can they be given a better deal?

How to develop ideas to give a fresh expression to these products?

How can the available quality of material and infrastructure be utilized to develop new designs?

How can the unorganized sector be linked better with the lifestyle market?

project goal

project goal

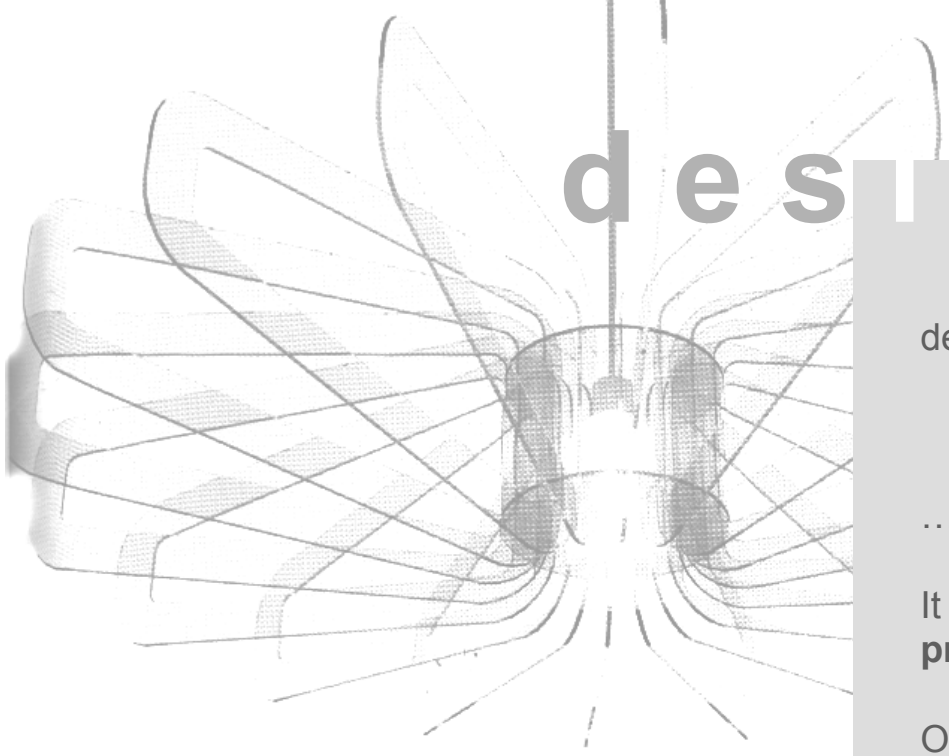
To explore **formal possibilities** in glass, within the **scope and limitations** of the material and infrastructure available locally,and to **develop the explored possibility in to products.**

scope

To explore various qualities like **transparency, translucency, play of light,colour, texture,** etc. to create a delightful experience.

limitations

- coping with the **low quality** of glass available locally
- working with the **certain techniques** that are suitable **for manufacture** of glass forms
- working within the limits of the infrastructure available.- **targeting the small scale setup**



designer's role

design is an expression of the designer…

…but,

It should have a well defined **methodology of production**

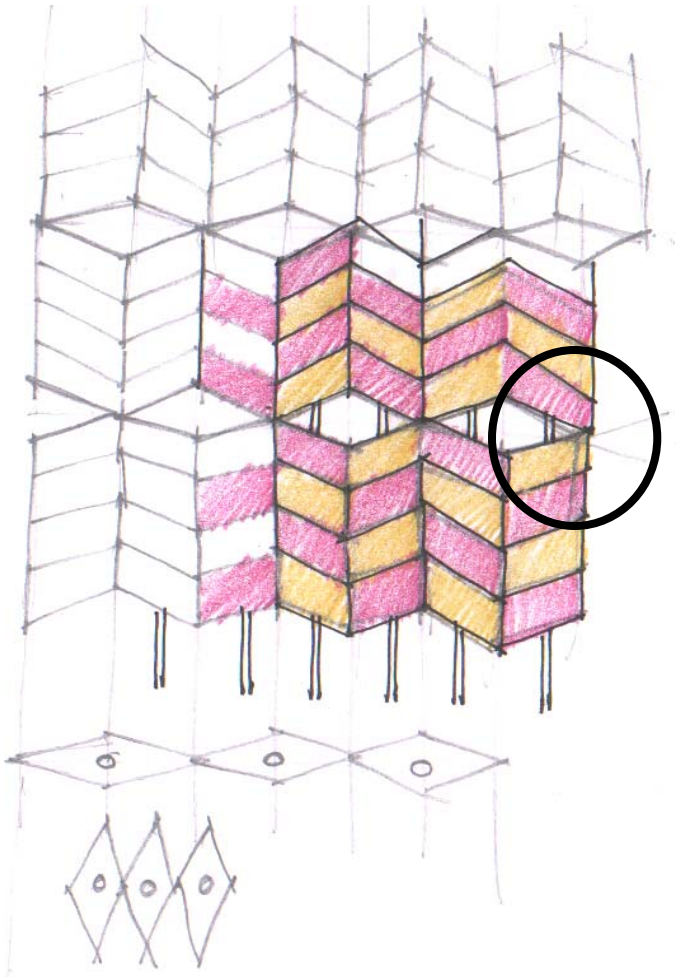
Once the design is stated its production should be possible **without the designer's involvement**.

It should be in tune with the available material, processes and other resources..

It should justify the cost involved.

approach

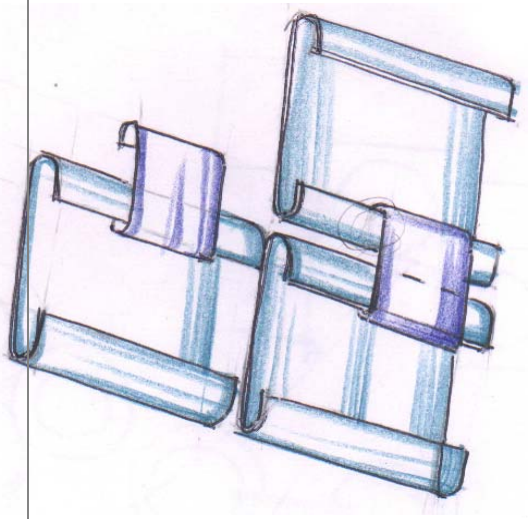
units or building blocks

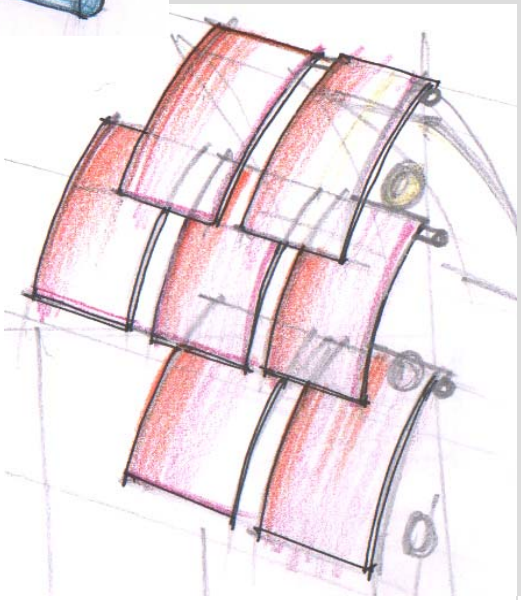


The exploration is directed to looking at formal possibilities in **repeatable forms (units) and patterns**
in glass

To create forms for multiplicity of production, every piece is similar yet different, thus **reducing complexities in production.**

To create forms that can act as units or building blocks to shape the product.



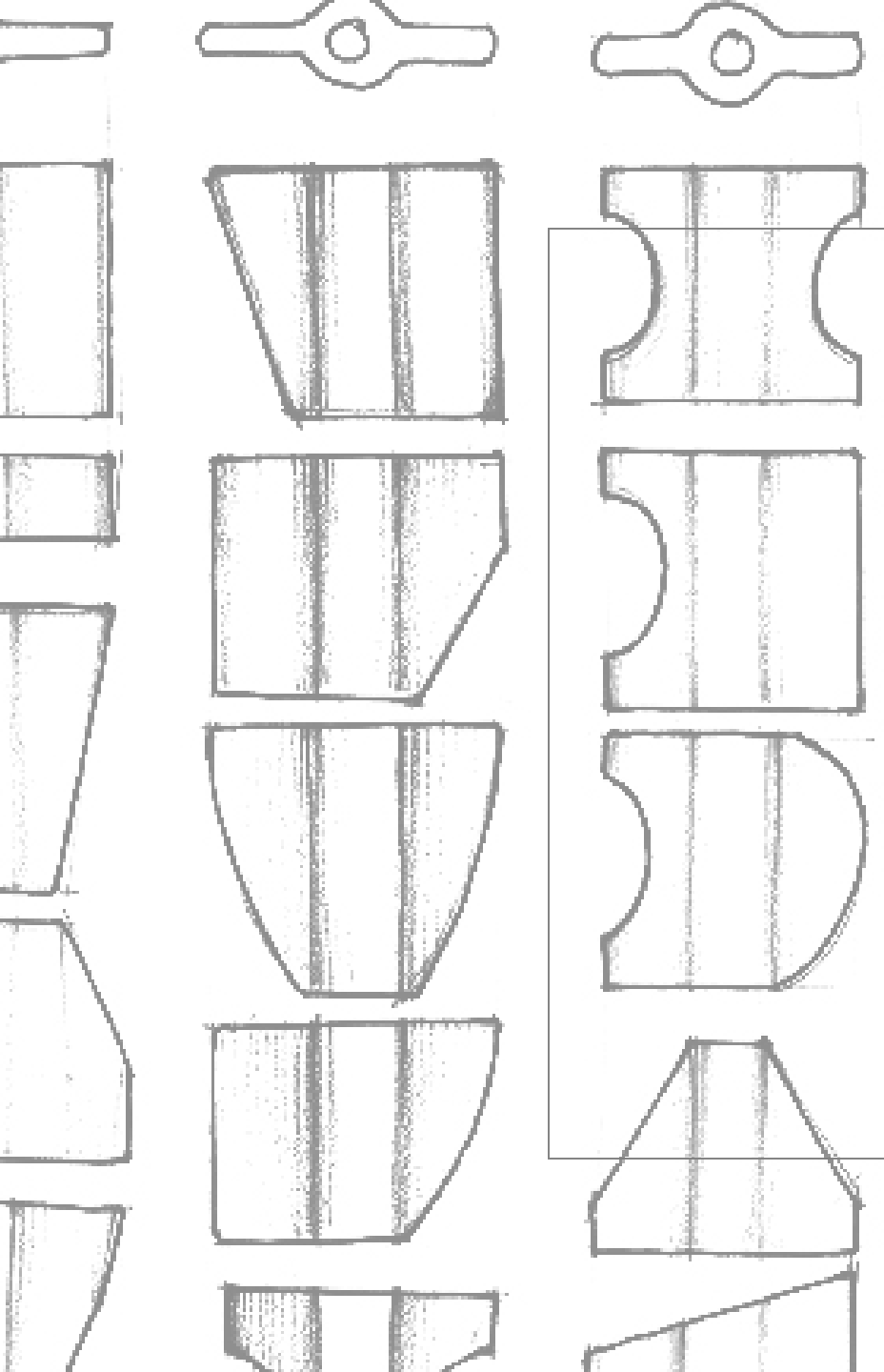


repetition and variation

assembly would be based on two principles :
repetition
Variation

The assembly of various units can be by:

- **Interlocking** two or more units
- Using **material/s other than glass** to create a linkage (metal. Wood, thread, etc)
- **Adhesives** (this may not have the advantage of reconfiguration)



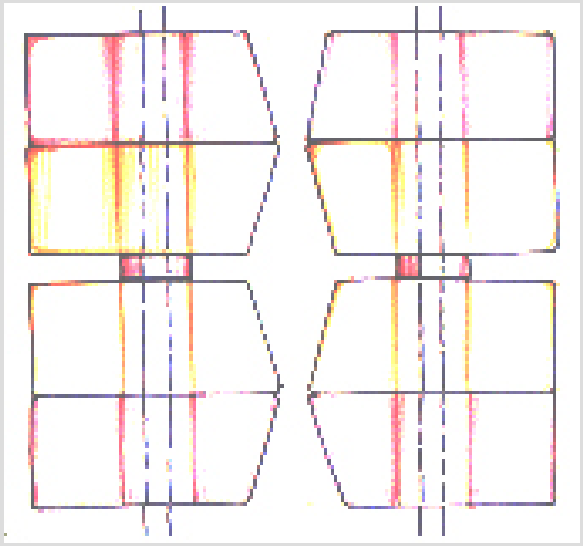
Repeatability and variation can be explored at different levels.

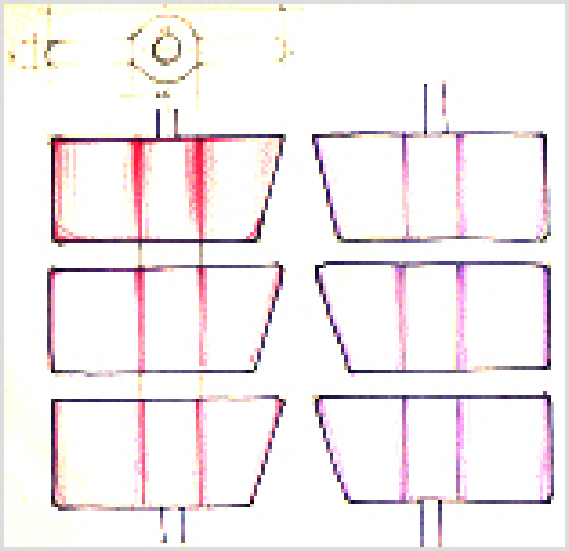
This can be done by way of
- **Design of the unit**
- **Design of the pattern/s in which the units can be assembled**

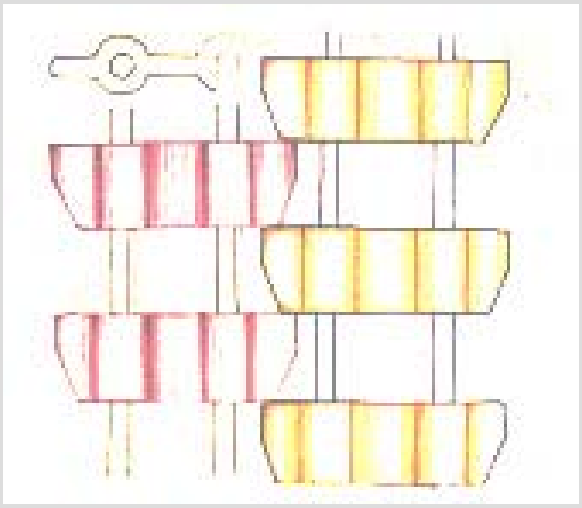
Design of each **unit** is based on

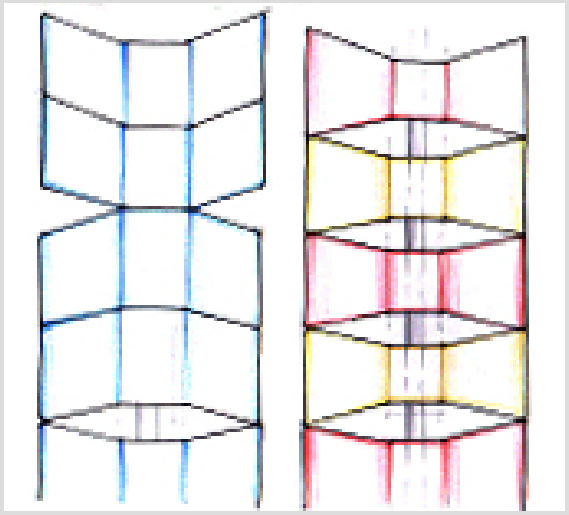
- Forms based on the thickness, radii, sizes that are permissible in glass

- Variations in a form resulting from the above considerations









assembly of units is based on

- Repetition of units
- Variation in units to be assembled-

focus on certain techniques

moulding

Mass manufacture of units

Targeting **small scale industry** for manufacture

- **Lower cost of manufacture**
- Variation in colour, etc is possible as units of the same colour can be produced in **small batches.**

fusing

Scope for multiplicity of production

In some cases, fusing can also be used to produce similar pieces in smaller quantity.

furnace used for fusing

scale of exploration

Variability of scale

Similar units can be configured in different ways to create products of **varied scales.**

Scope for reconfiguration of units to create **variability in expression and function** of the product.

product range

Architectural elements
Door panels, window screens, curtains, partitions, installations, false ceilings, staircase elements like balusters, treads, risers, railing

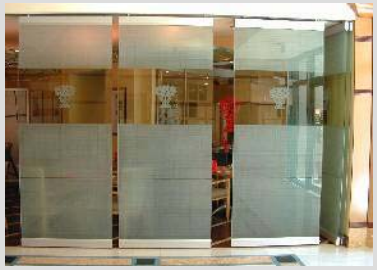
Table top items
paper weights, sculptural pieces, pen holders, mobile holders, card holders, candle holders, etc.

Containers
to hold stationery, fruits, etc

Luminaries

Furniture
centre tables, corner tables, stacking stools, etc.

creating imagery



partitions

tabletop

furniture

ceilings

doors/windows

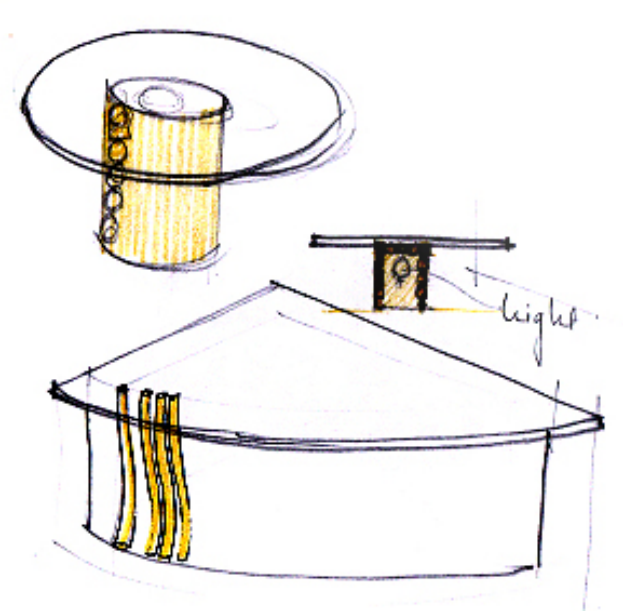
insights
from existing products

- In products like screens partitions, doors, mostly plate glass is used
- Texturing, etching, tinted glass are mostly used to give expression to plate glass
- Glass is always used mostly to reveal, hide or reflect something, more like a passive element
- Artists works does not have a possibility of multiplication of production
- Manufacturable forms have few formal possibilities explored

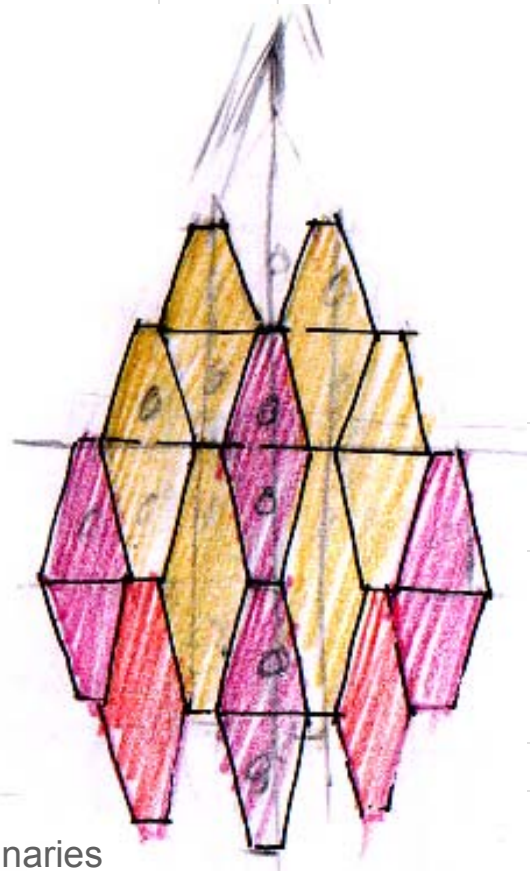
ideation

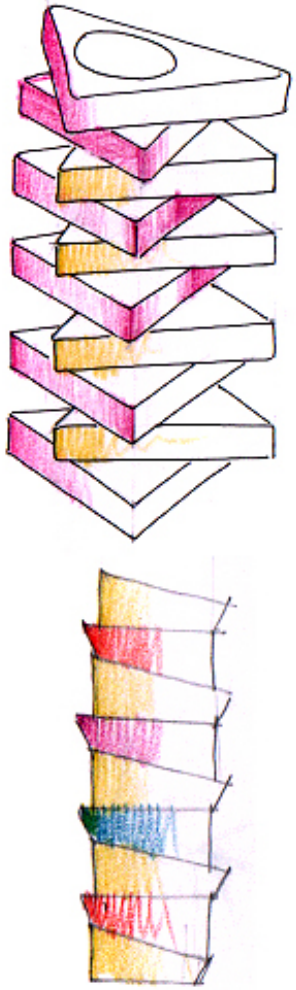
- identifying product areas or components where repetition of elements is possible

- creating patterns out of repeatable units.



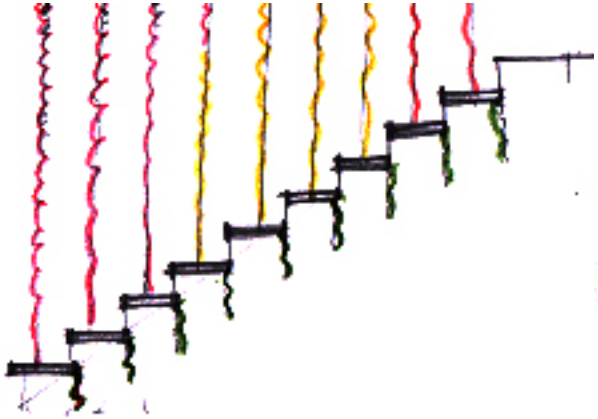
furniture

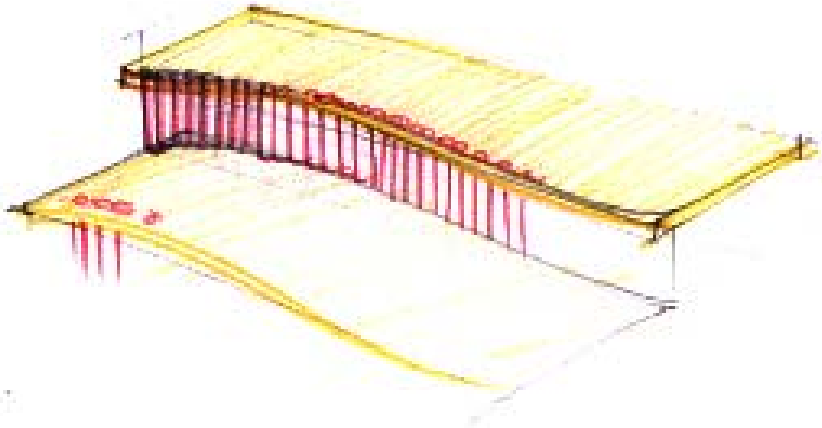


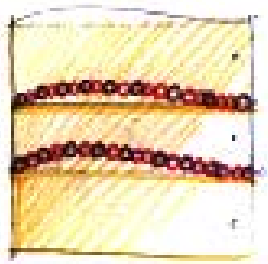


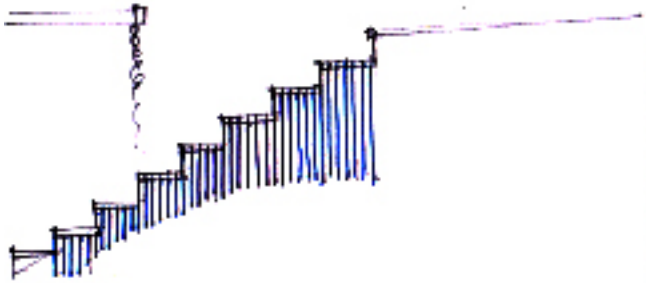
luminaries

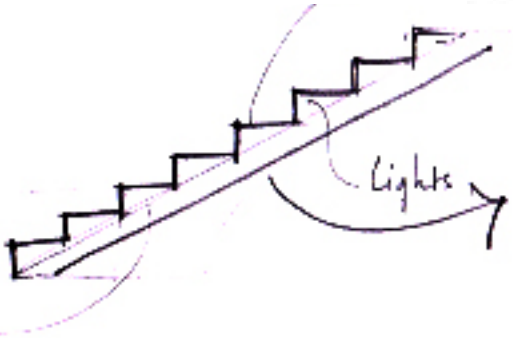
staircase elements

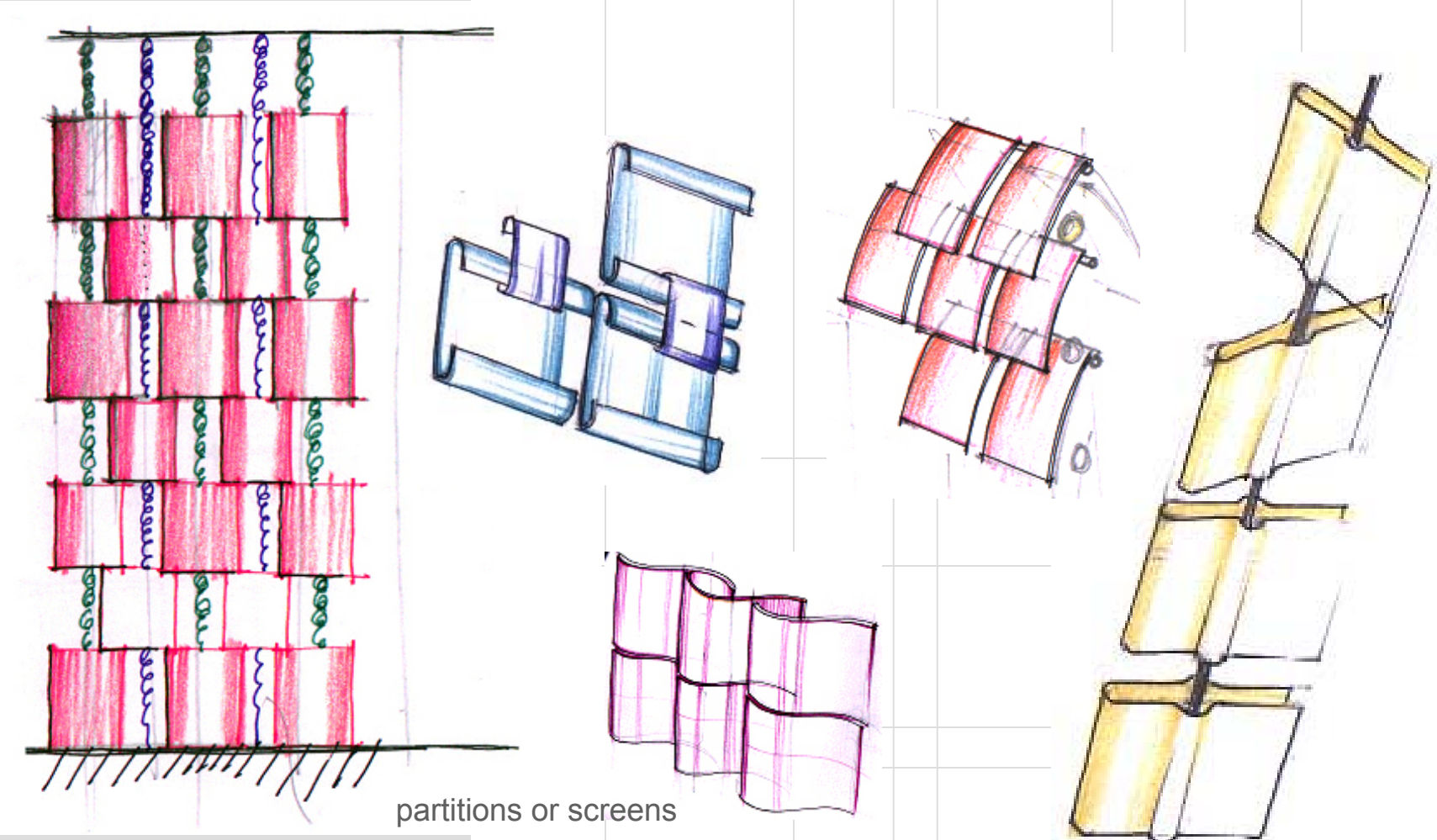










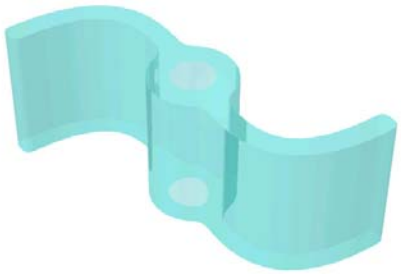


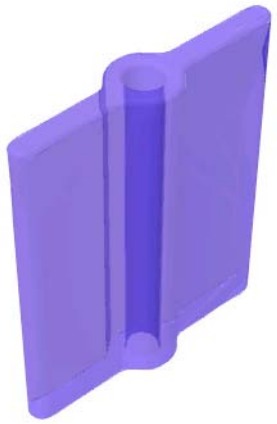
partitions or screens

c o n c e p t g e n e r a t i o n - s t a g e

developing units in glass-
designing forms for variability and pattern creation

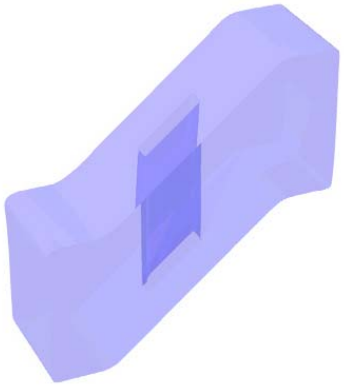
concept1

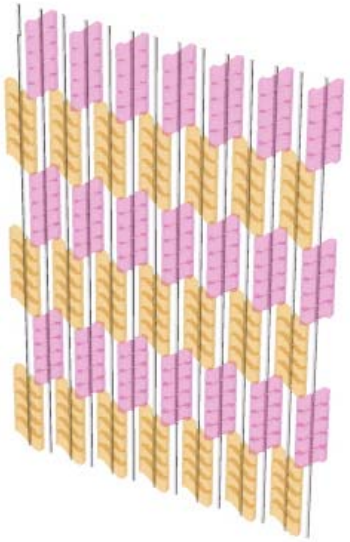


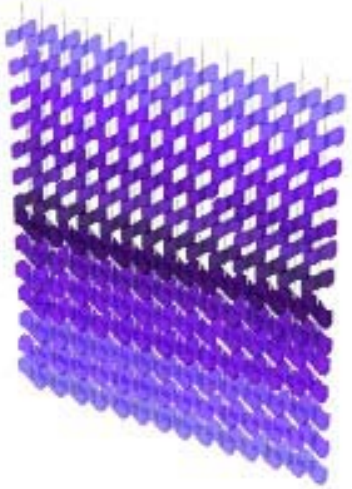


Unit pivoted around a cylindrical rod.
Similar units oriented differently to create screens with different configurations which can be used as
partitions, trellises, door panels, etc

concept2

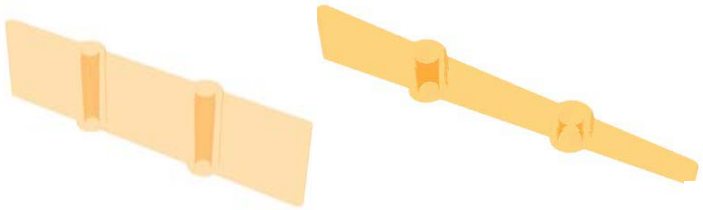


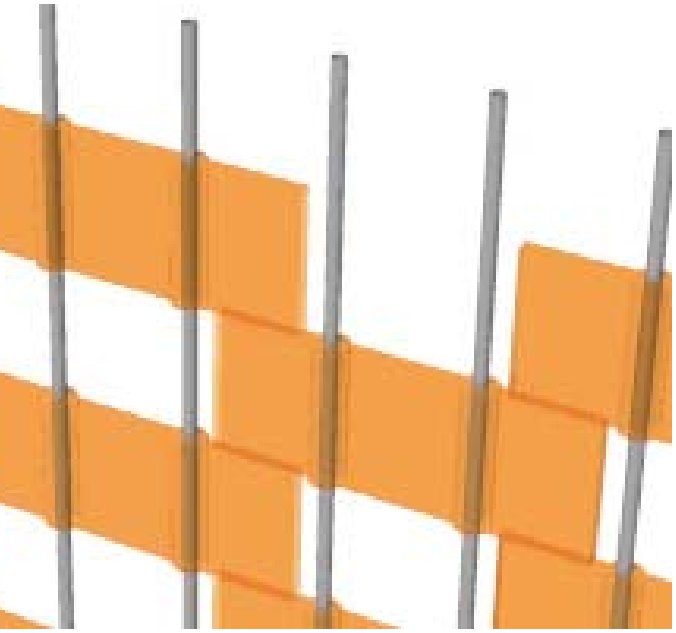




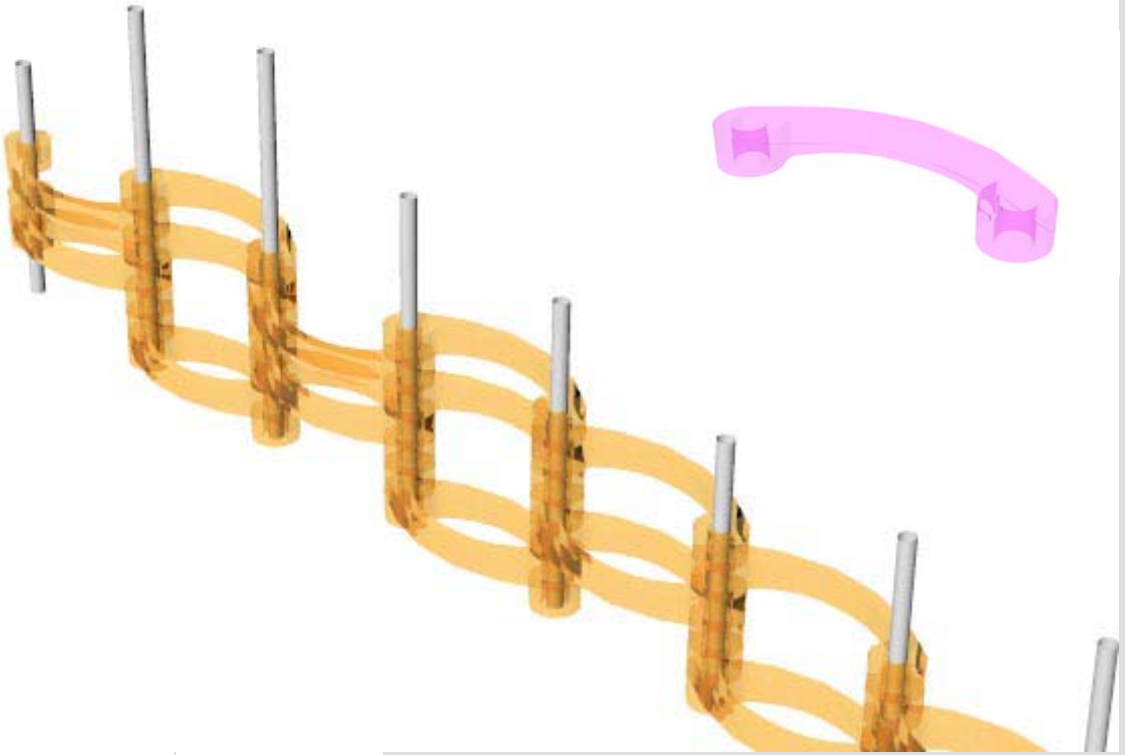
Unit is a solid block held by rods of square cros section. Similar units in different colours are configured different ways to create screens which can be transformed into partitions, trellises, door panels, etc

concept3

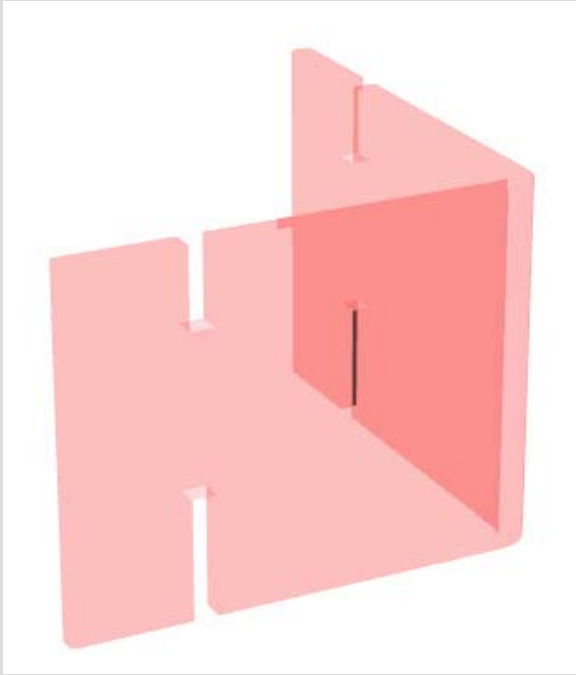




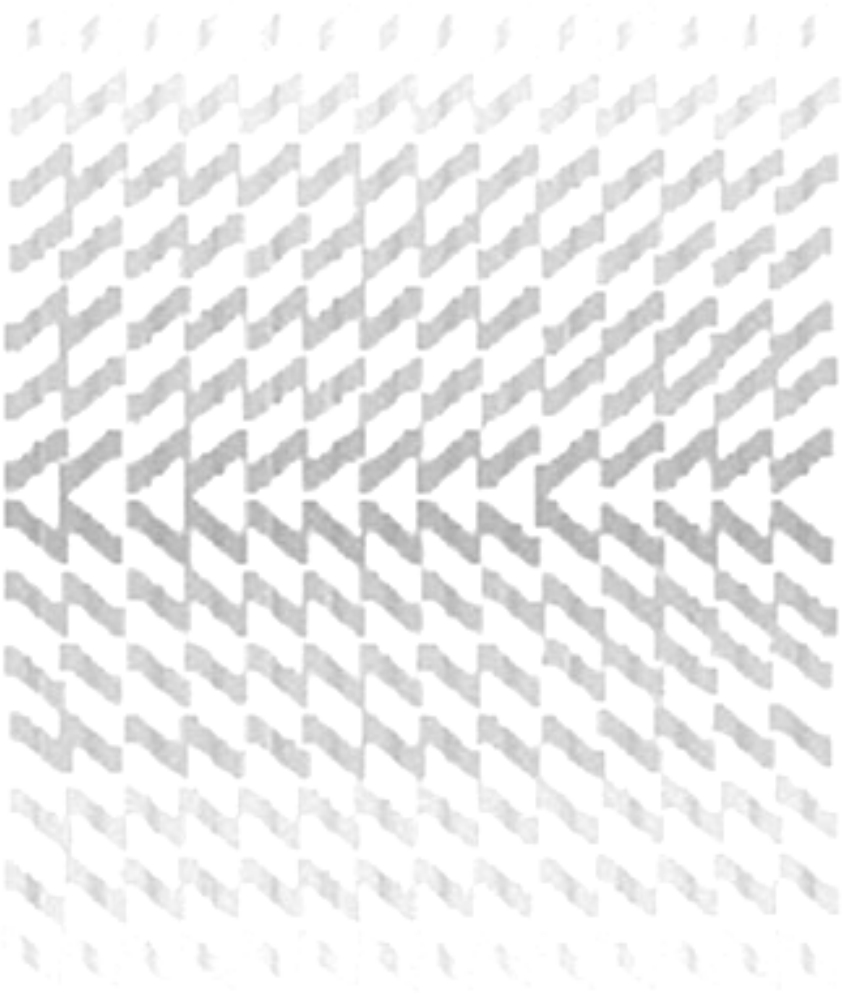
Unit supported by two rods
Similar units are anchored by two rods. This prevents the unit from rotating around the pivot And makes the assembly more rigid and sturdy.



Interlocking and stacking of units..
Similar units can be interlocked one on top of the other to create vertical stacks which can be t transformed into luminaries, trellises, etc.



concept evaluation



Concepts in stage 1 were evaluated and further worked on based on the following considerations:

- versatility in pattern formation
- versatility in methods of assembly
- limitations of material and process of manufacture to produce a particular unit
- permissible sizes of units
- permissible surface thickness and radii in glass
- stresses in glass

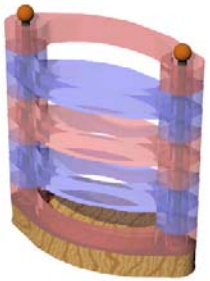
concept generation- stage

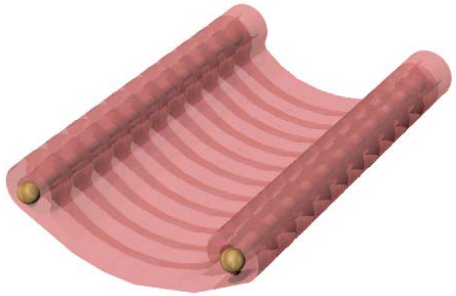
Developing variations in
• form of each unit
• assembly of units

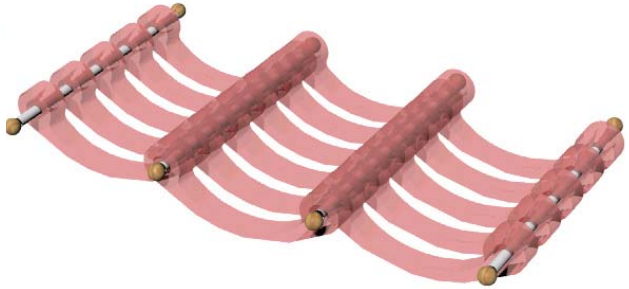
Computer models were primarily used to generate concepts

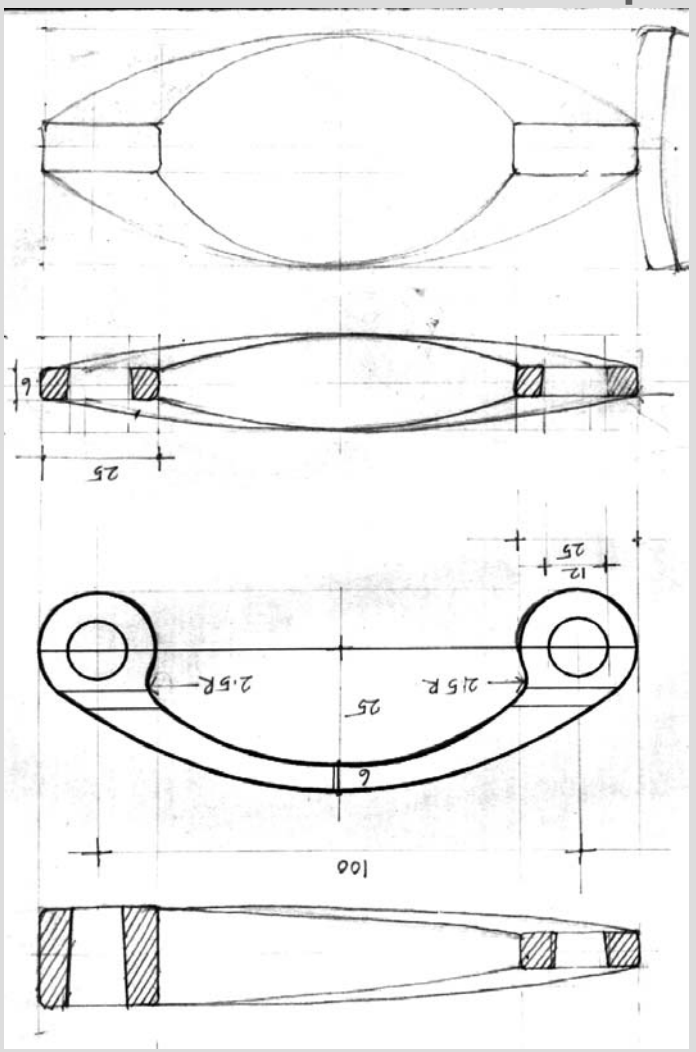
concept1

Units can be stacked on rods and containers, penholders, of varied configurations can be made.



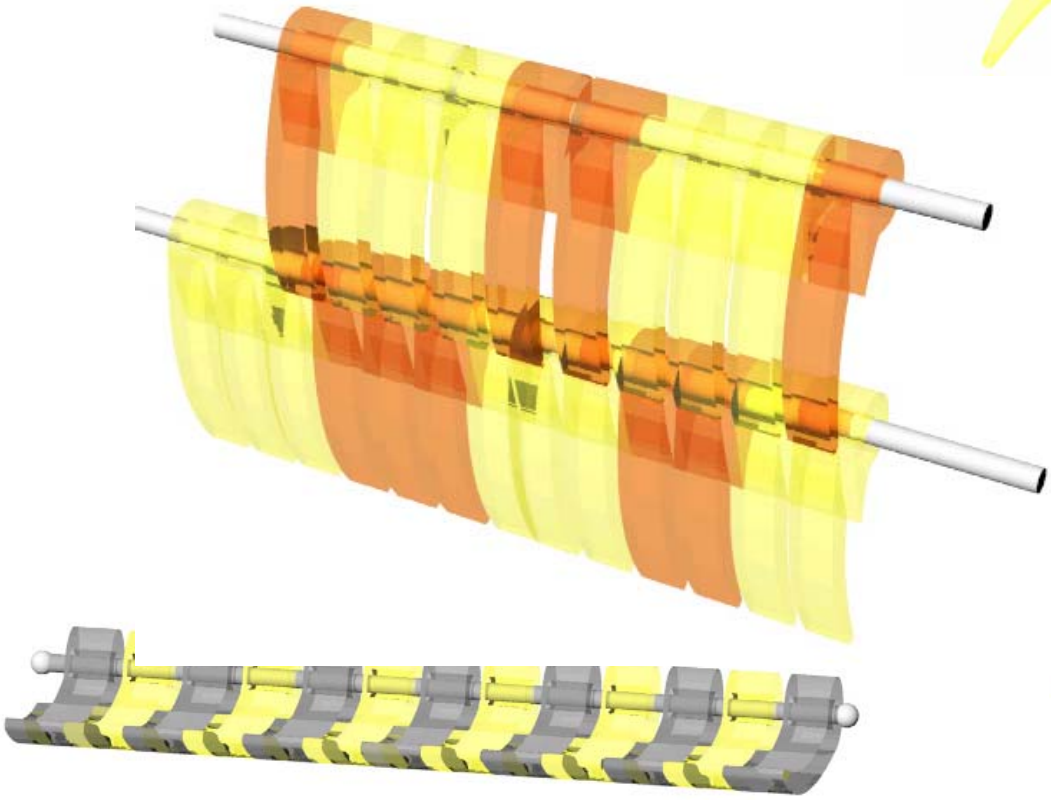


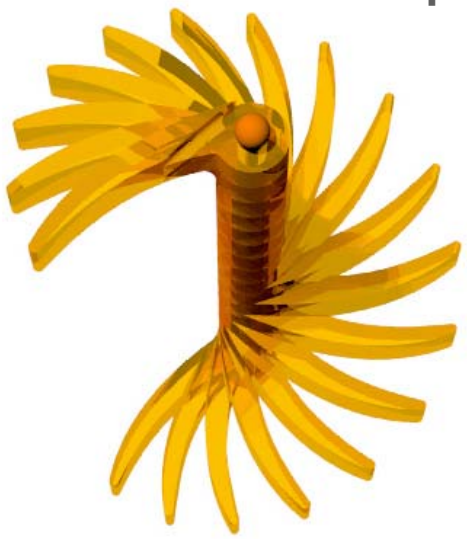


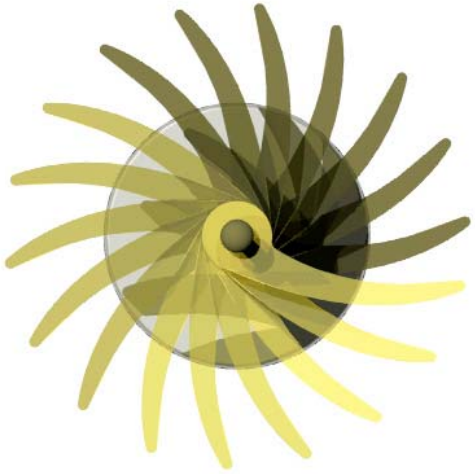


concept2

Units can be stacked on horizontal rods and a a container, penholder,trellis or a screen can be made



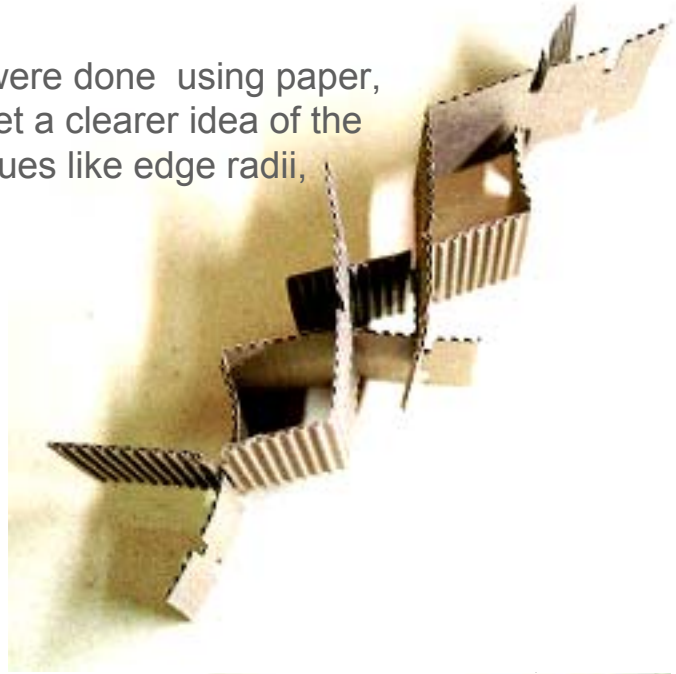


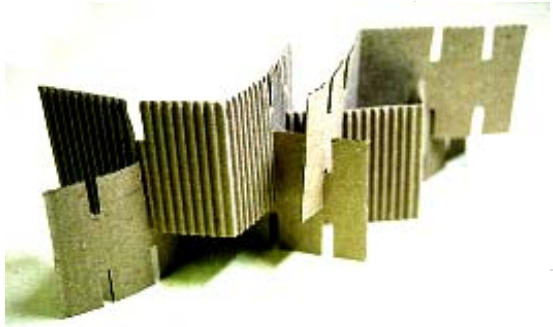


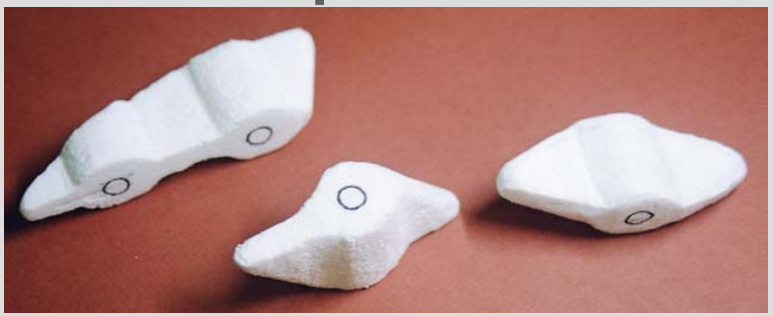
Units are designed for stacking so that when stacked they create a spiral form

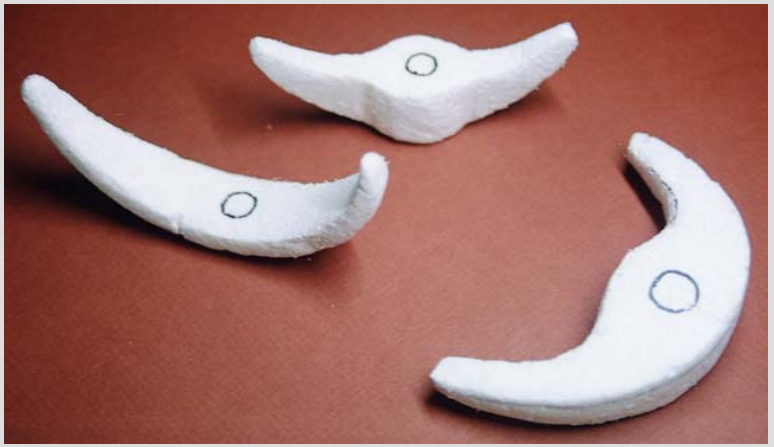
3d–explorations

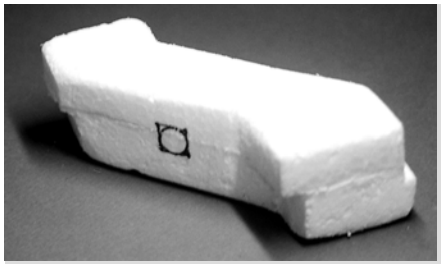
3-d explorations were done using paper, thermo Cole, to get a clearer idea of the form, size and issues like edge radii, corner radii, etc.

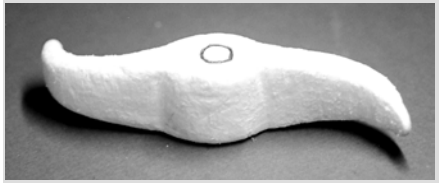




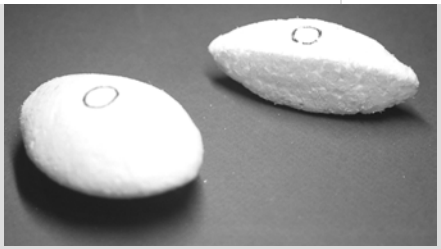


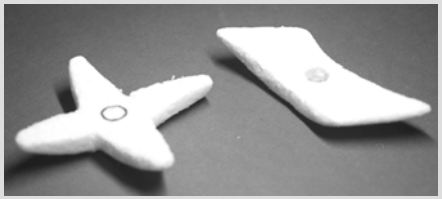


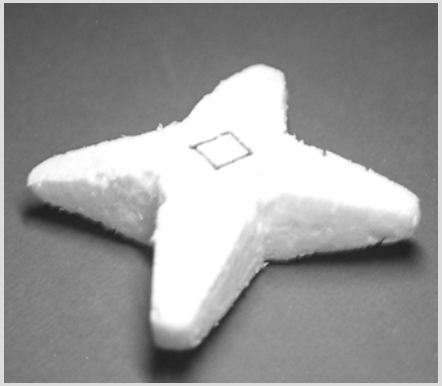




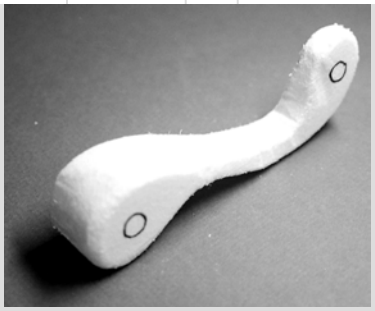
- gentle curves
- sense of movement

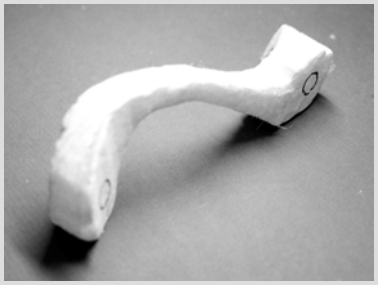


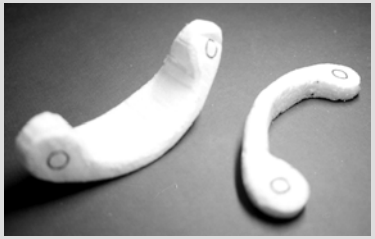




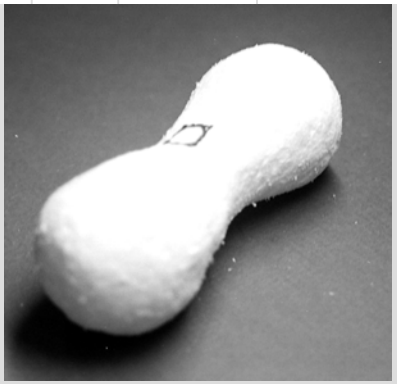
- bulbous, , solid forms
- stark curves
- heavy, solid look



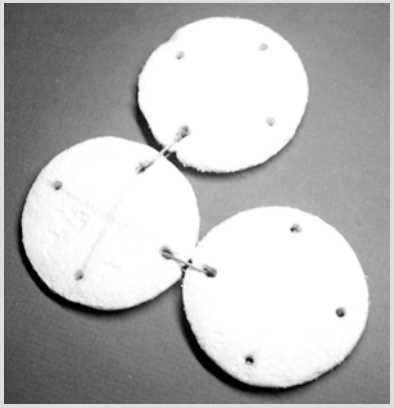




- dynamic curves
- sense of movement and direction



- bulbous, , solid form
-heavy, solid look



- forms connected by wire like a weave

final concept

• **REFINING THE FORM OF UNITS** based on

- getting **more fluidity** in form
- working in all **three dimensions**
- shaping the form considering the **permissible sizes,** radii

• **PRODUCT EXPRESSION**

- **various ways of assembling** the units
- **other materials involved**- metal, wood, marble,etc. in the

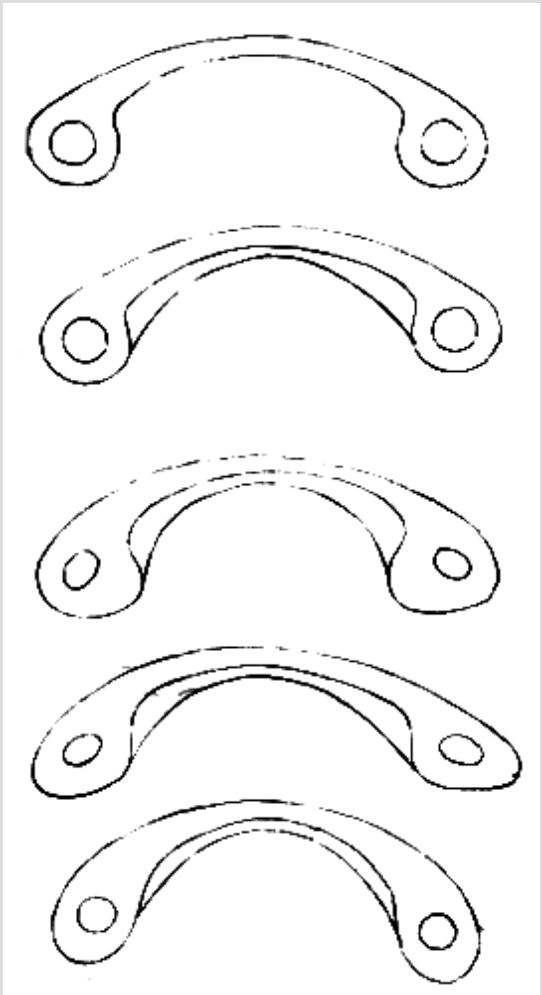
Final concepts chosen are based on :

• **element of 'individuality'** in the unit form
• **scope of products possible** to be created from it

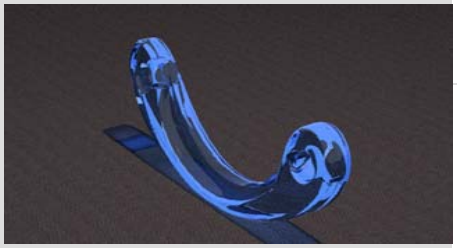
c o n c e p t 1

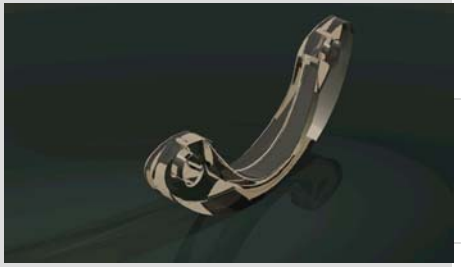
main components –units

The form of the units was refined to induce an element of individual expression in the unit, that is, even if the unit is used as a lone object, say as a paper weight, it would have a distinct formal value.

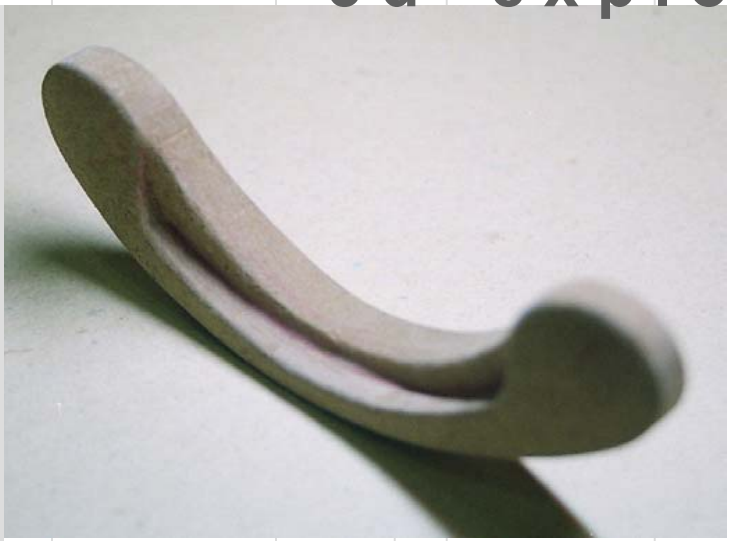


Various colors and some texture options were tried out by way of computer models. Extent of transparency also was varied to see the effect of light on the form.

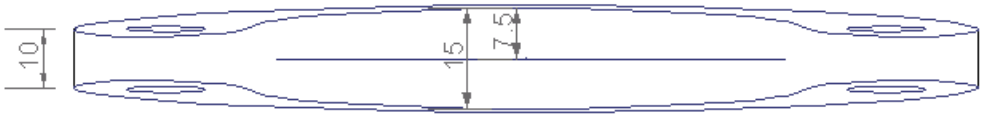




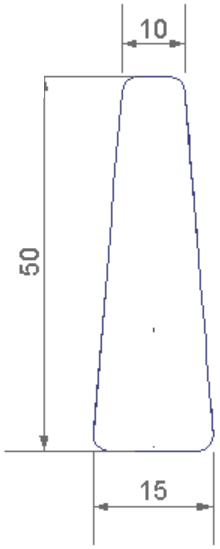
3d–explorations



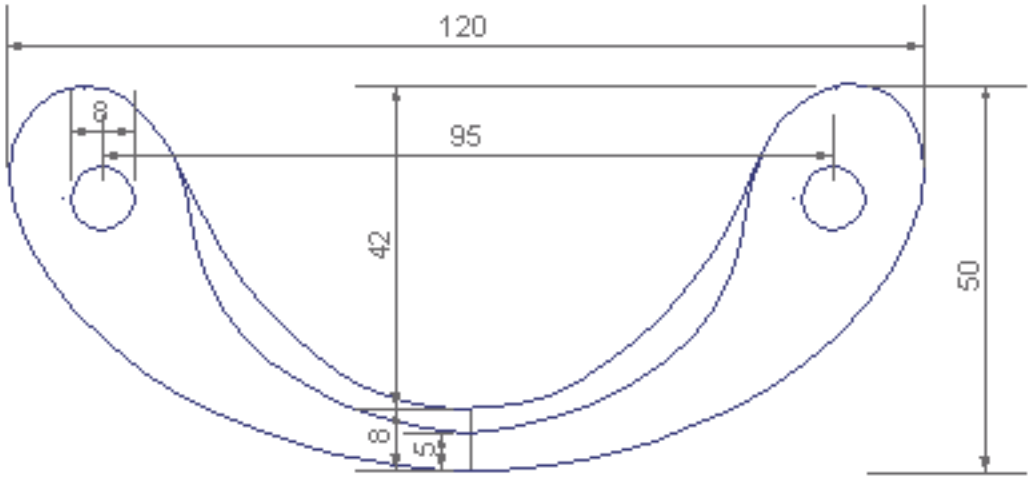
drawings



TOP VIEW

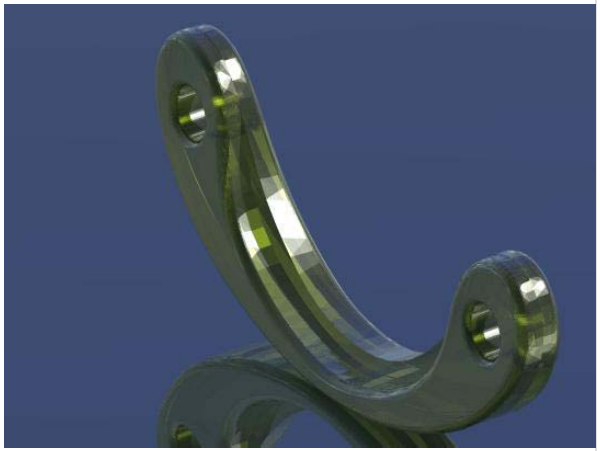


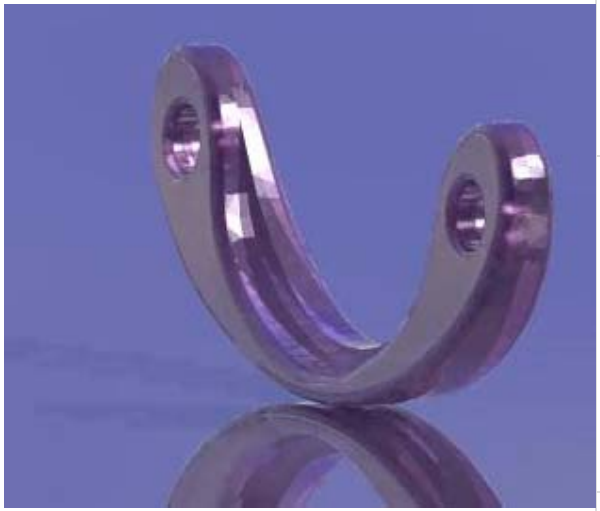
SIDE VIEW



FRONT VIEW

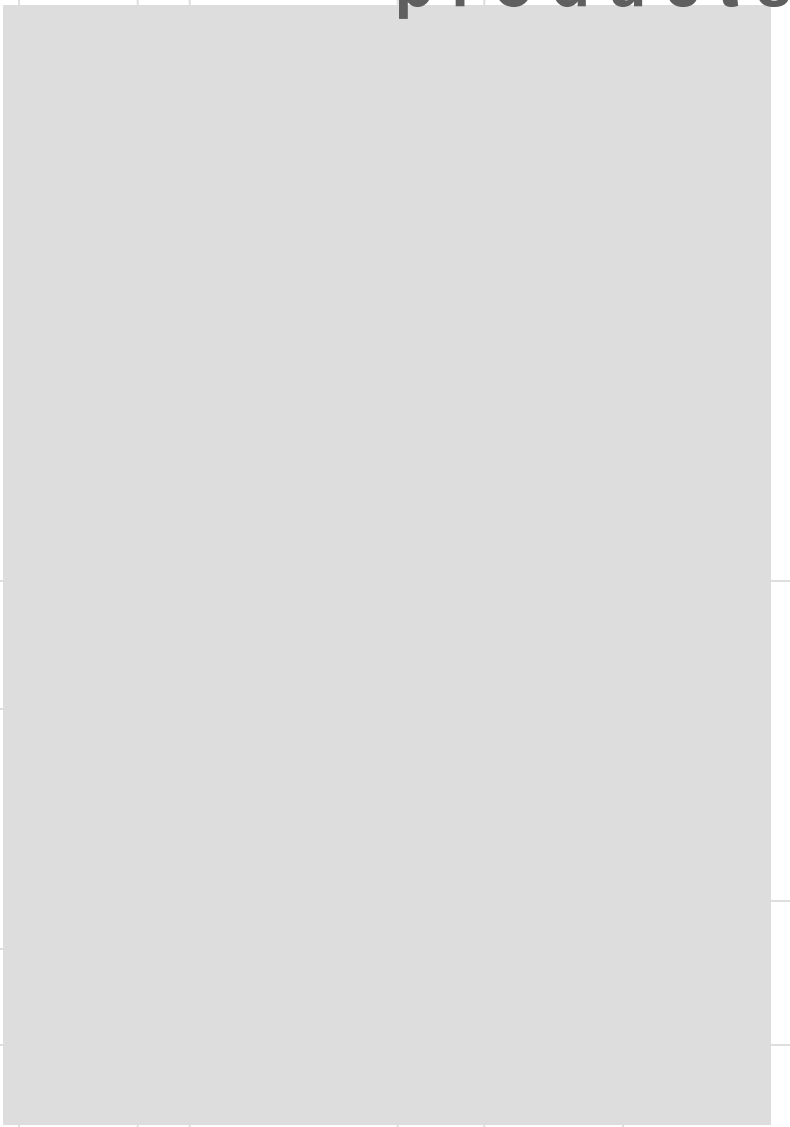
all dimensions are in mm.

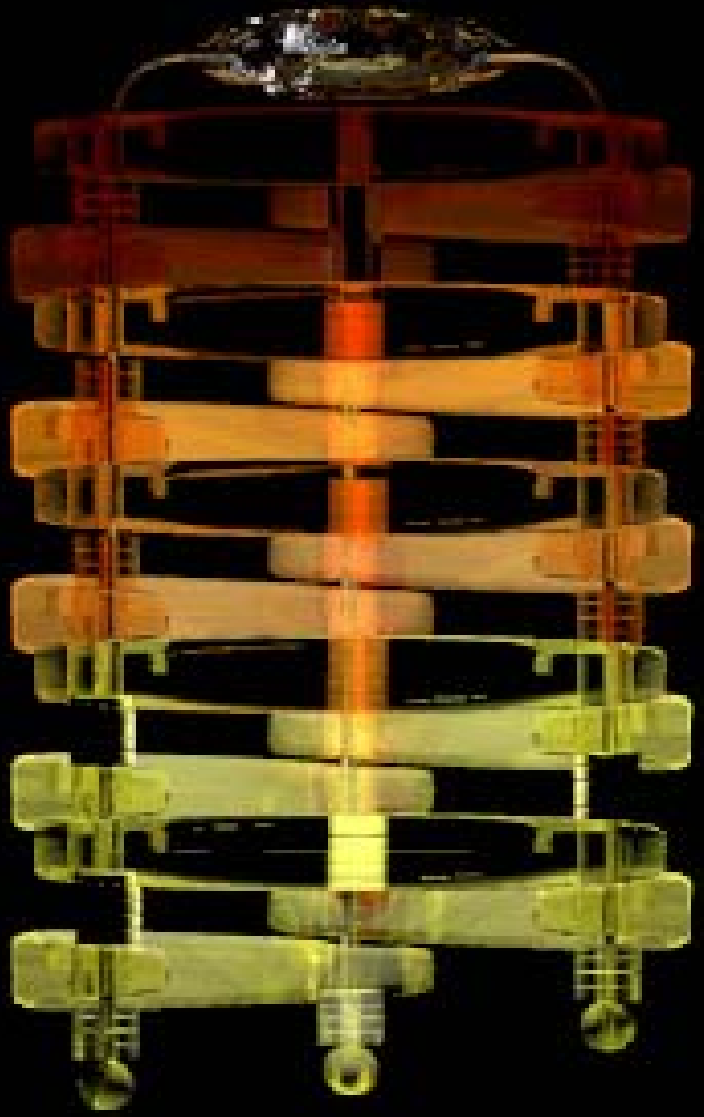


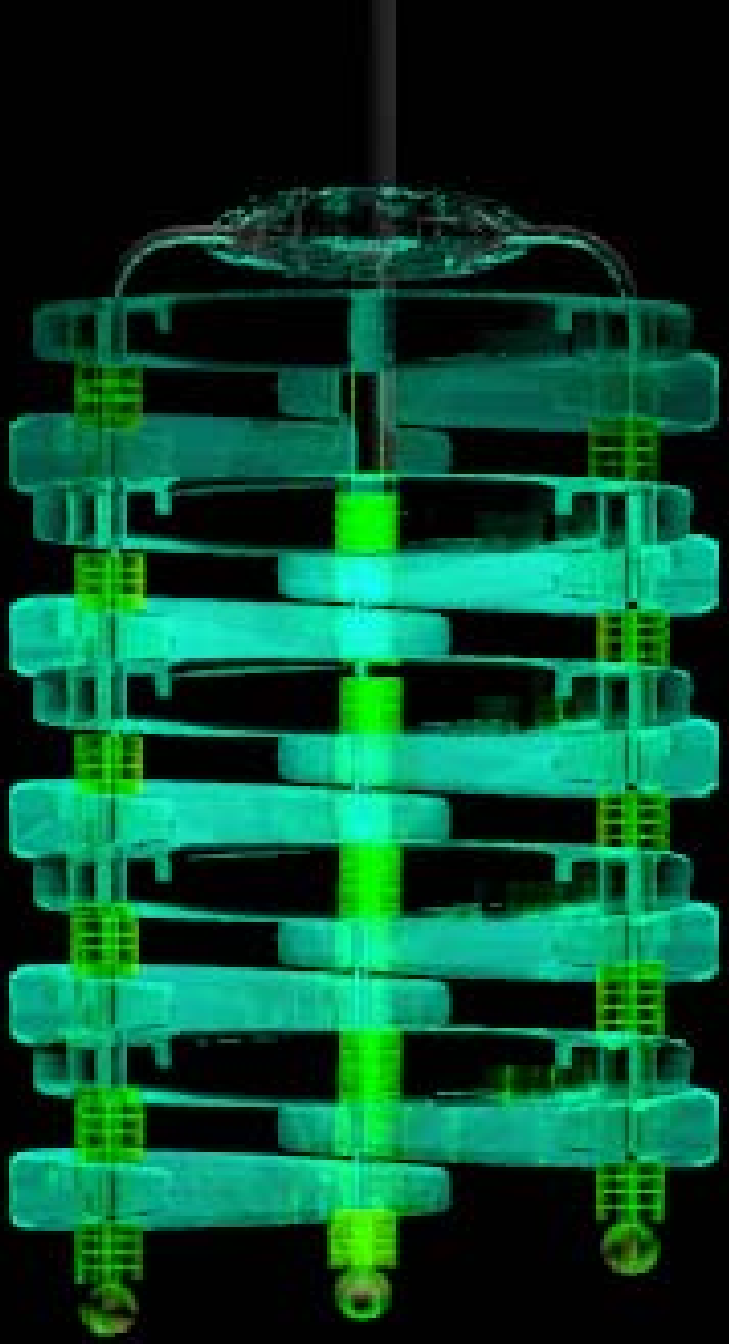


The refinement of thickness, corner radii,edge radii, was done by way of computer generated models.. Computer models helped me to visualize the play of light on the surfaces, and edges.

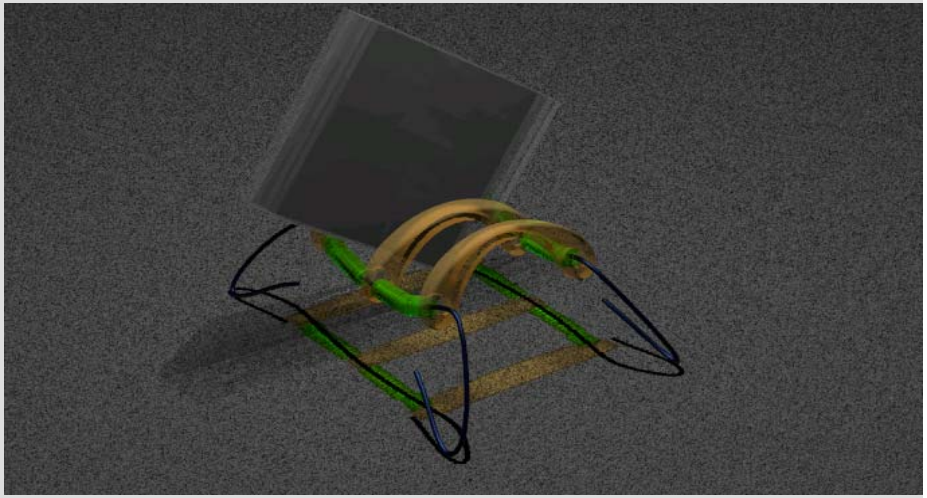
products

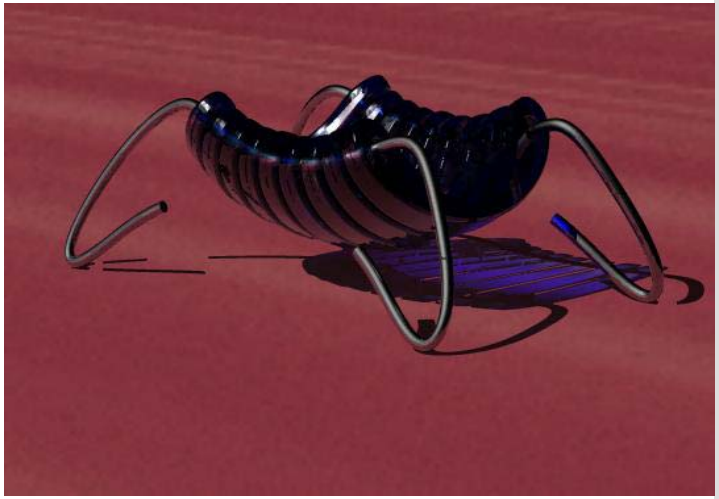


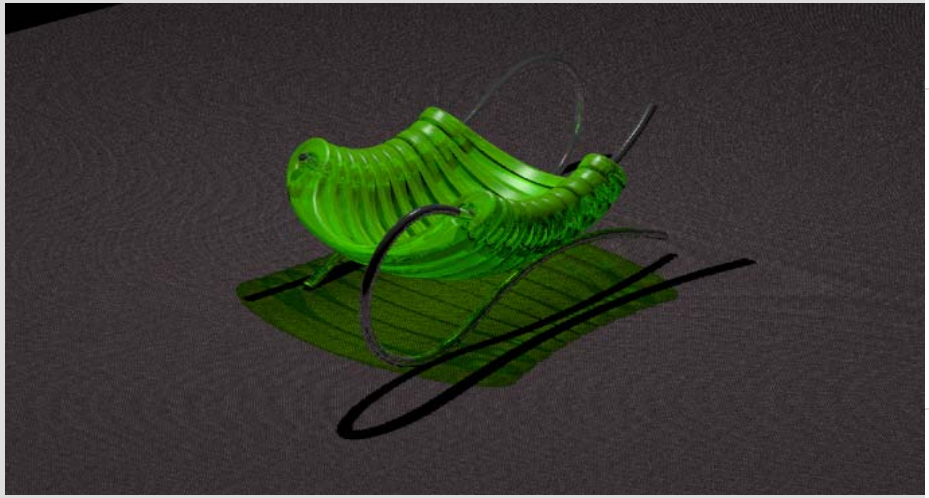




CD rack







fruit bowls or containers
for the table top

refinement

of product form

•modifications and refinement in product concepts

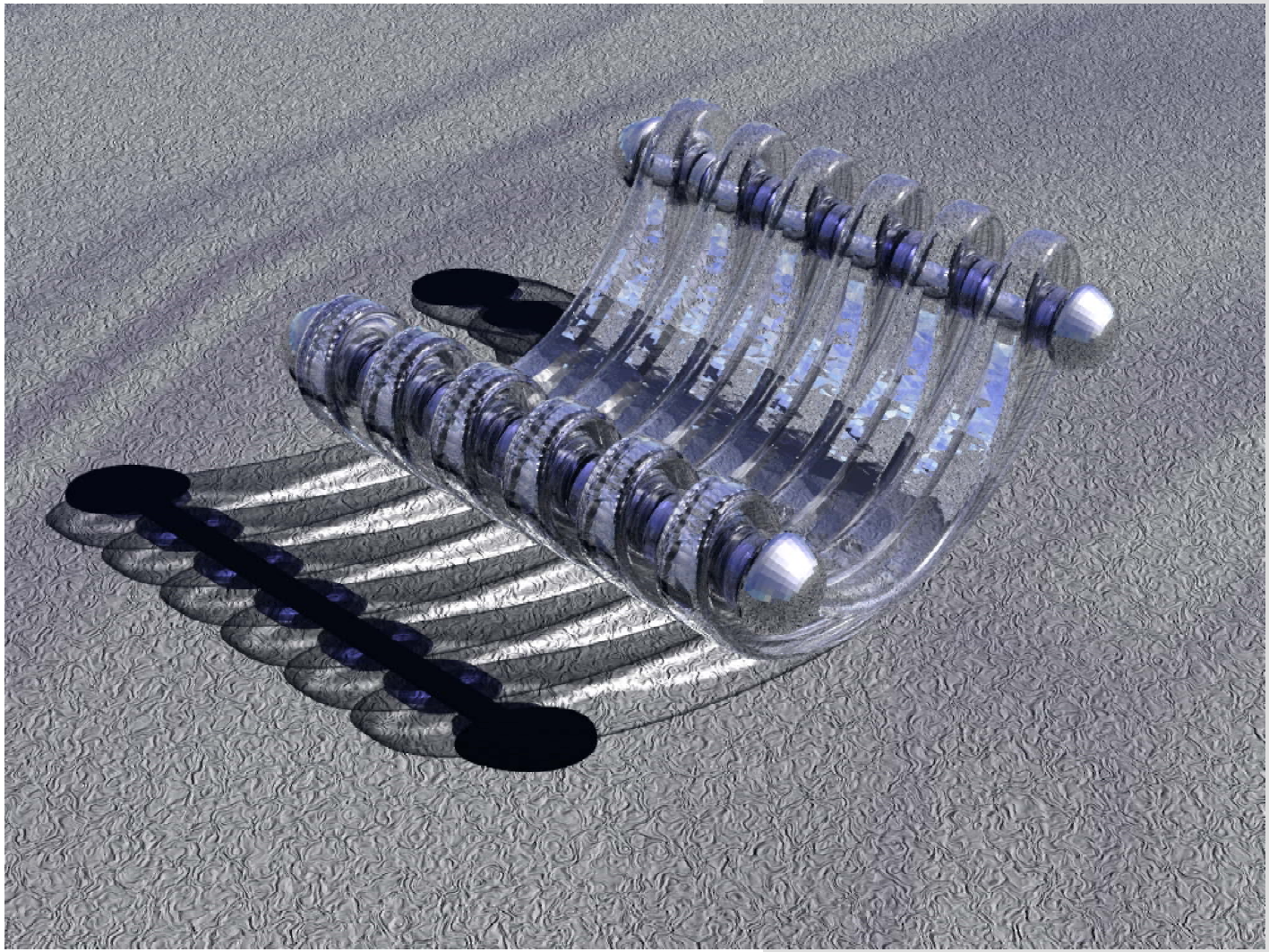
• further possibilities of products

• formal exploration of components like spacers, stoppers, terminal units,etc

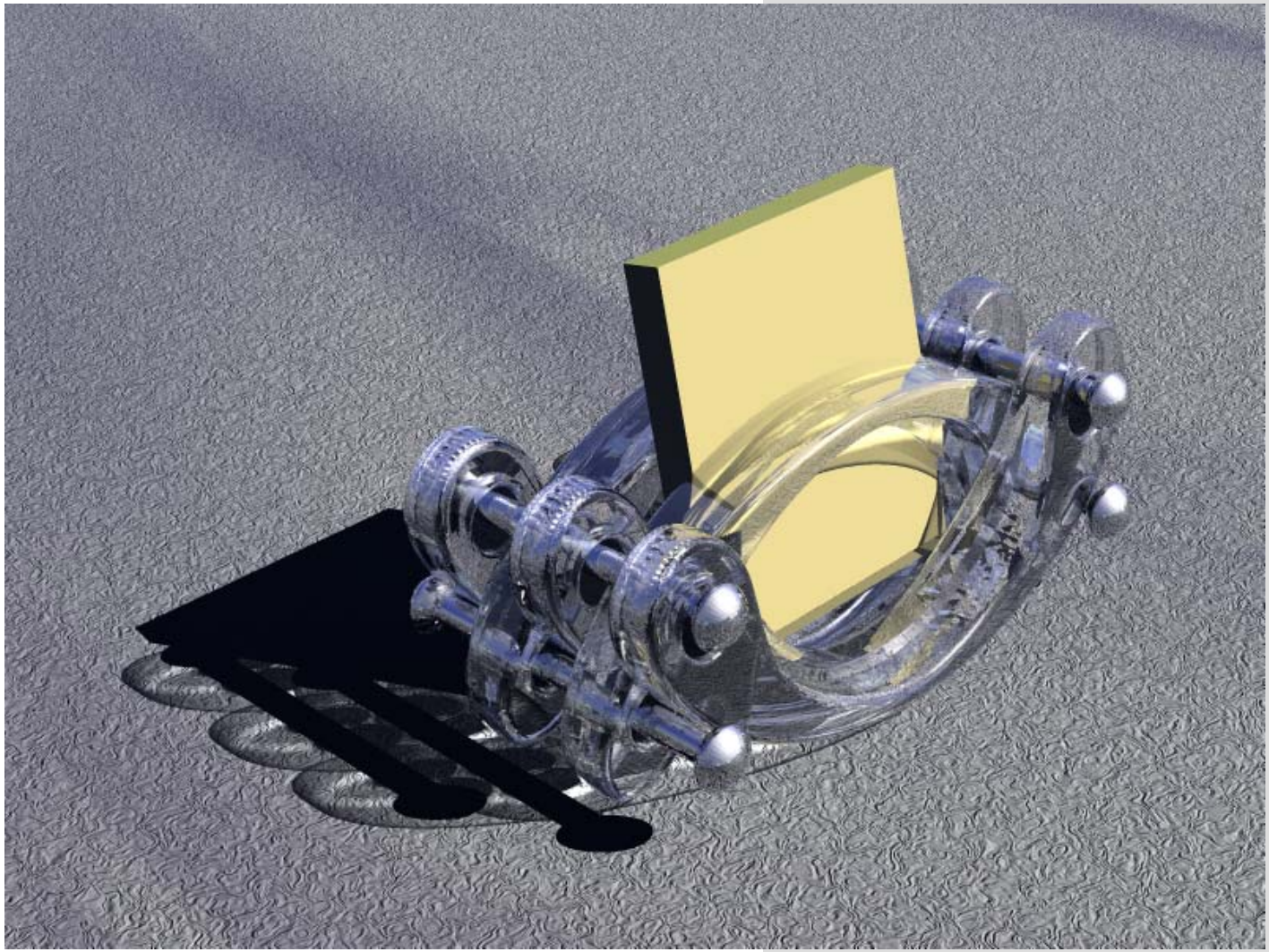
• product details

container

container



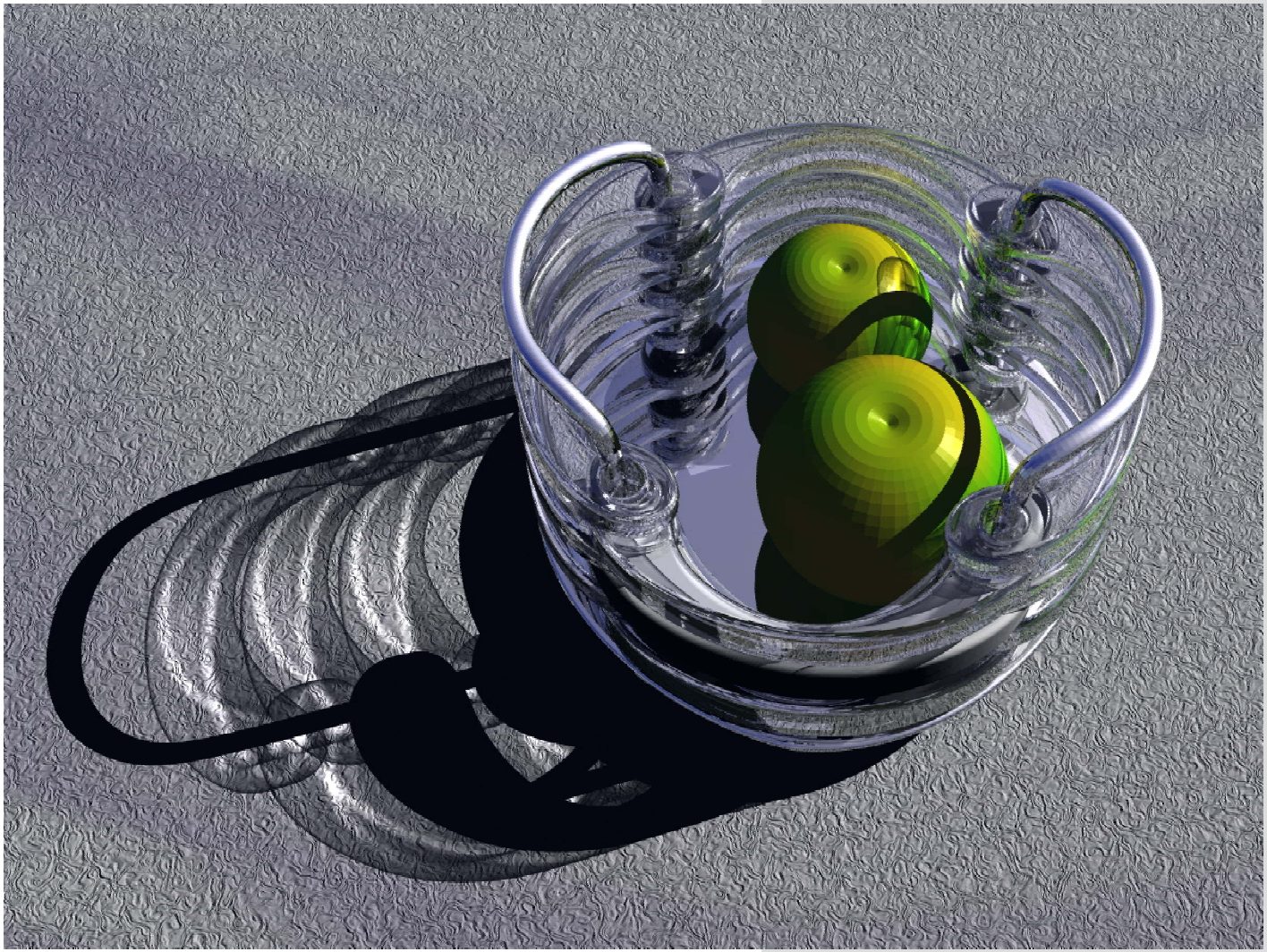
container



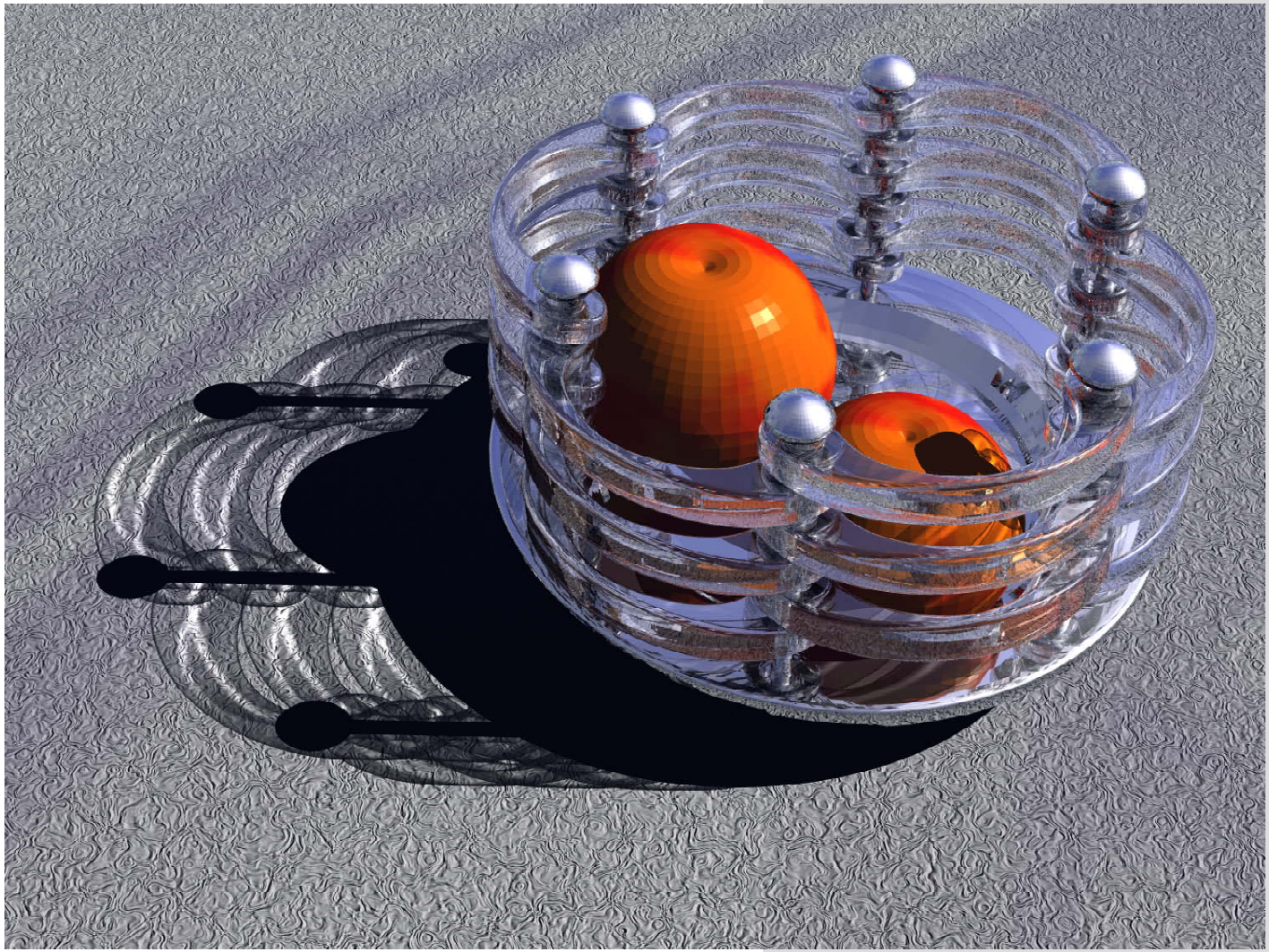
paper /card holder

This can be part of home or office setting. At home it can be a spoon holder for the table top. If at office, it can be a pen stand

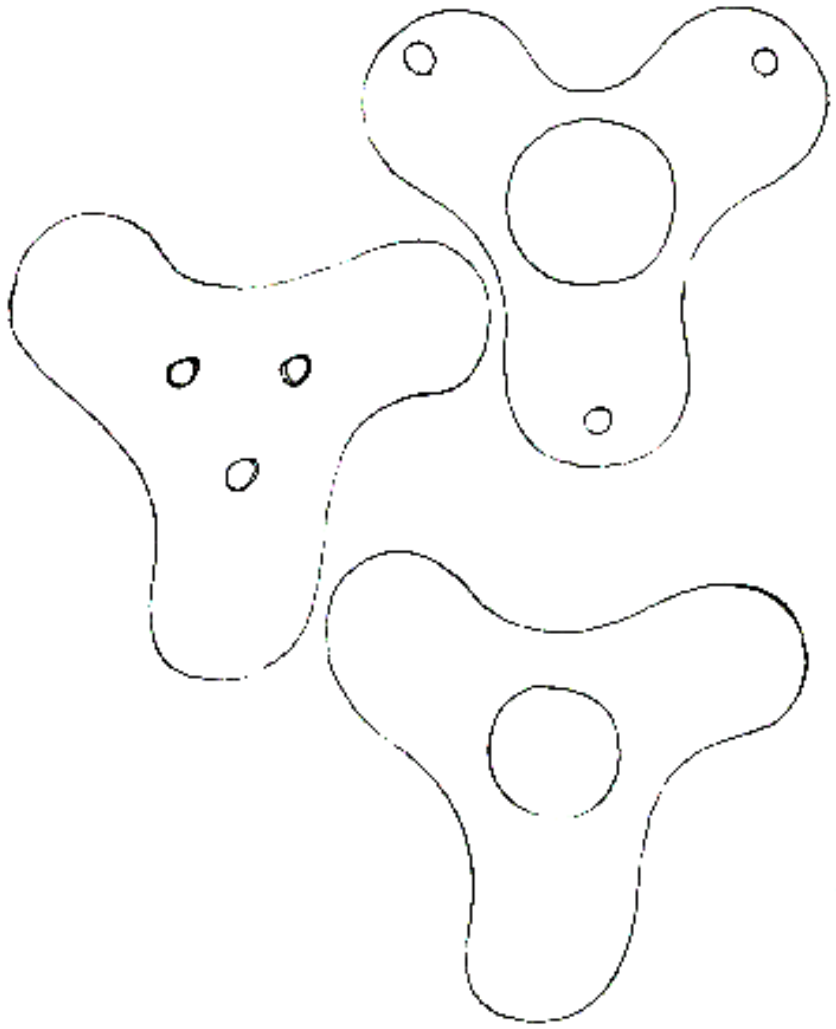
container for fruits, small items,
This can be used both in a hom
or office setting



This is a bigger container for fruits, small items,etc.This can be used both in a home or office setting



c o n c e p t 2

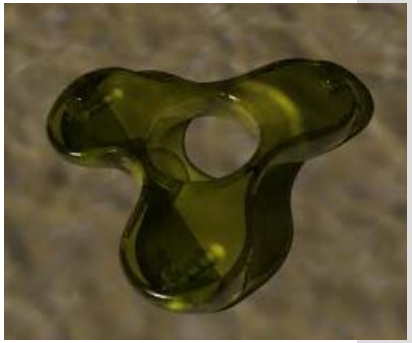


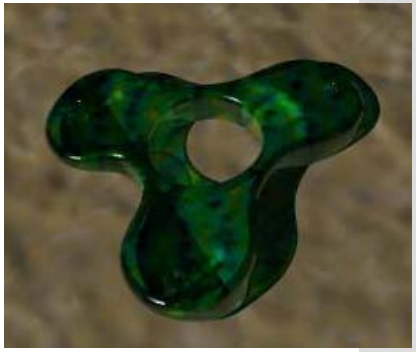
main components –units

form is more fluid and provides versatility in assembly

Various colors and some texture options were tried out by way of computer models.

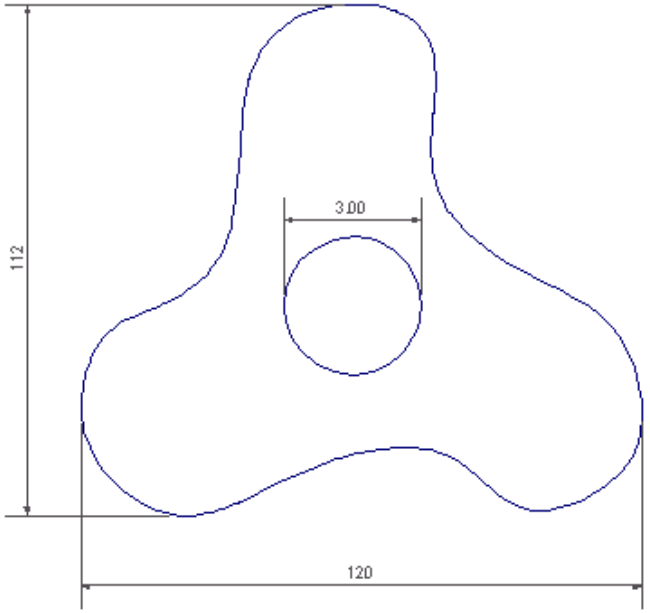
Extent of transparency also was varied to see the effect of light on the form.



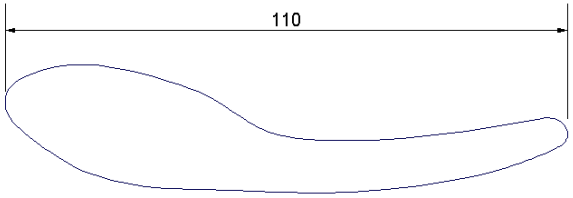


3d–explorations

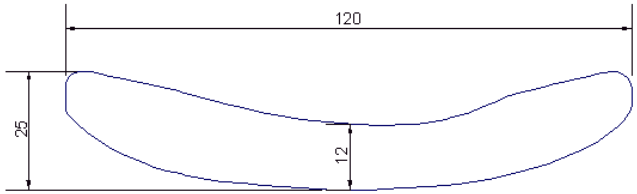
drawings



TOP VIEW



SIDE VIEW

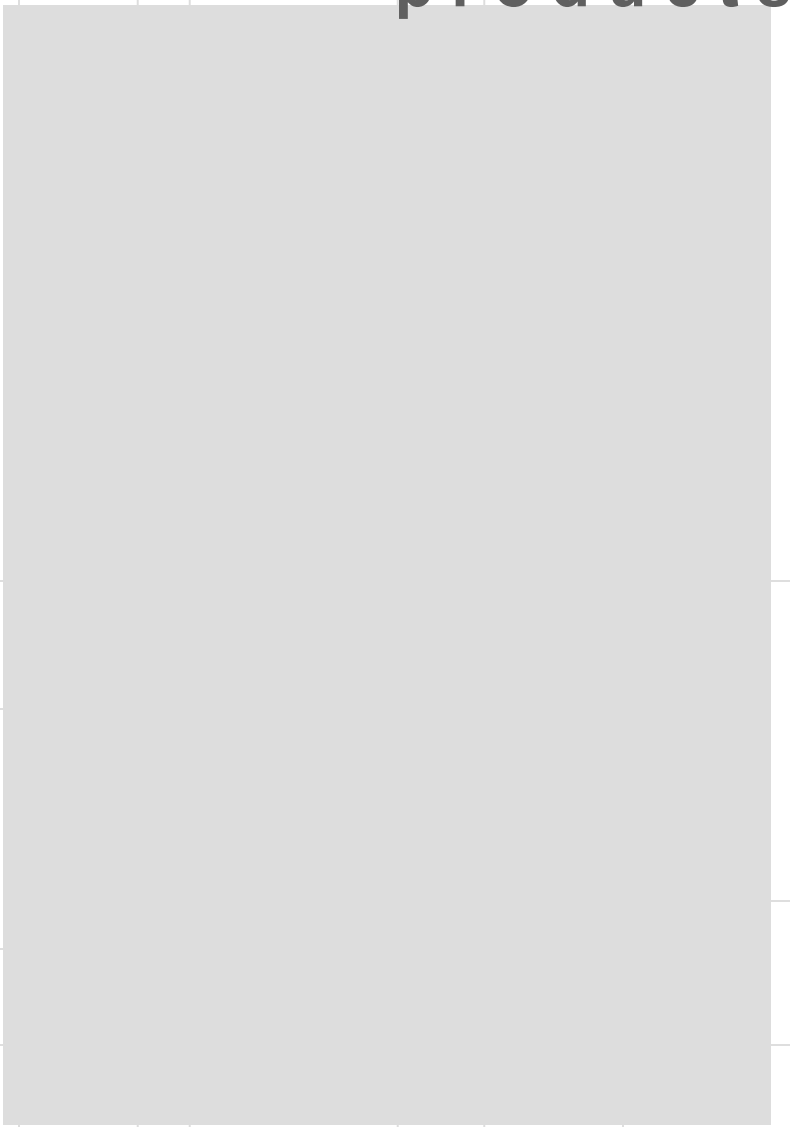


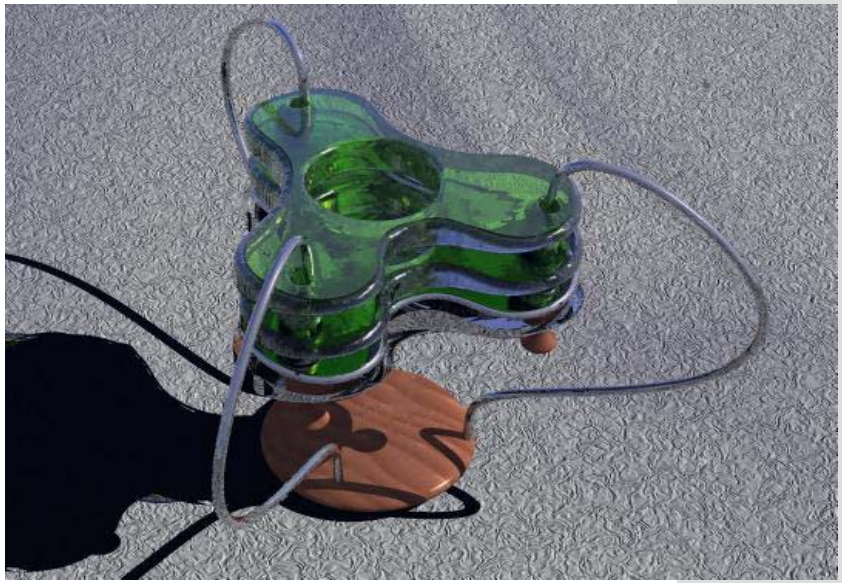
FRONT VIEW

all dimensions are in mm.

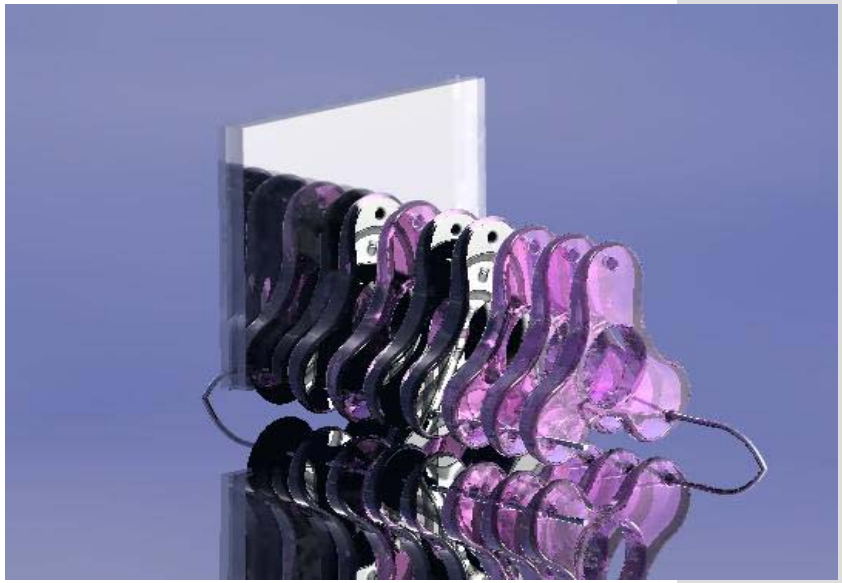
The curves and surfaces were further worked on to create a stronger element of fluidity in the form.

products





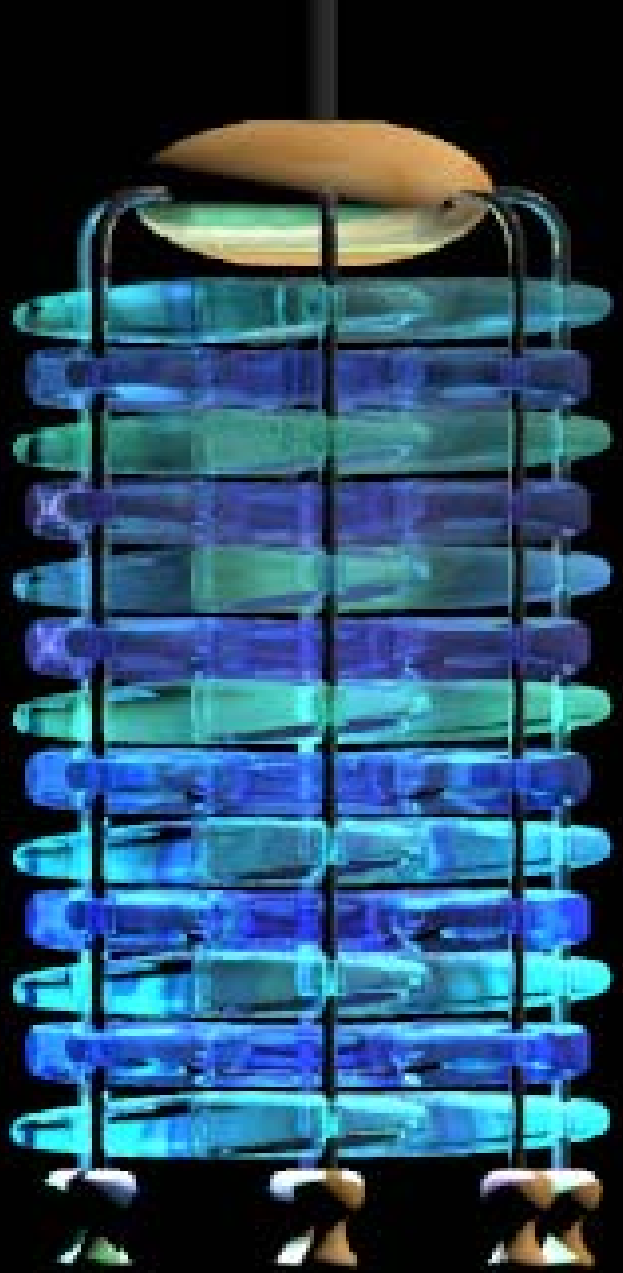
ash tray

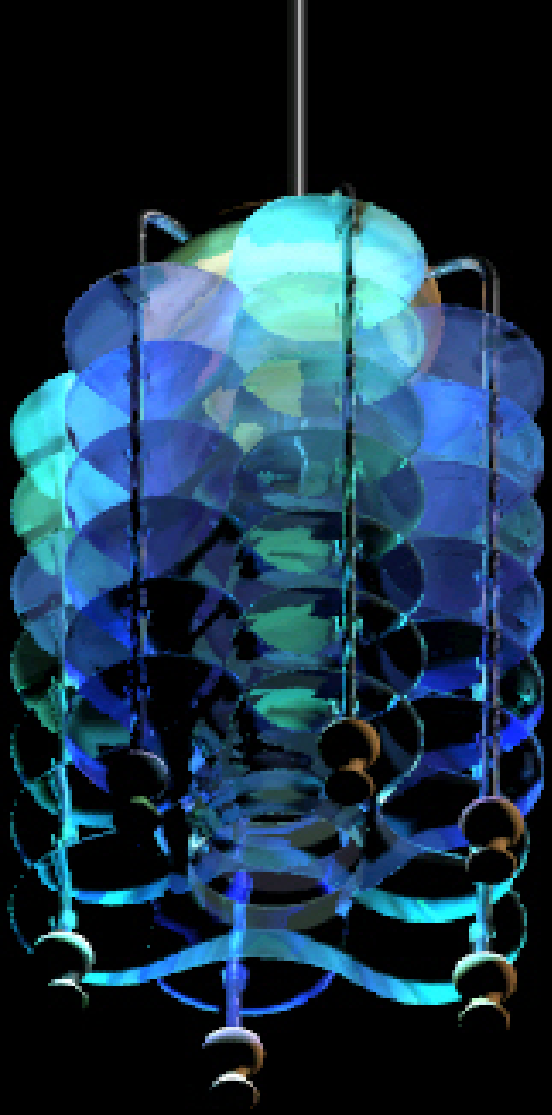


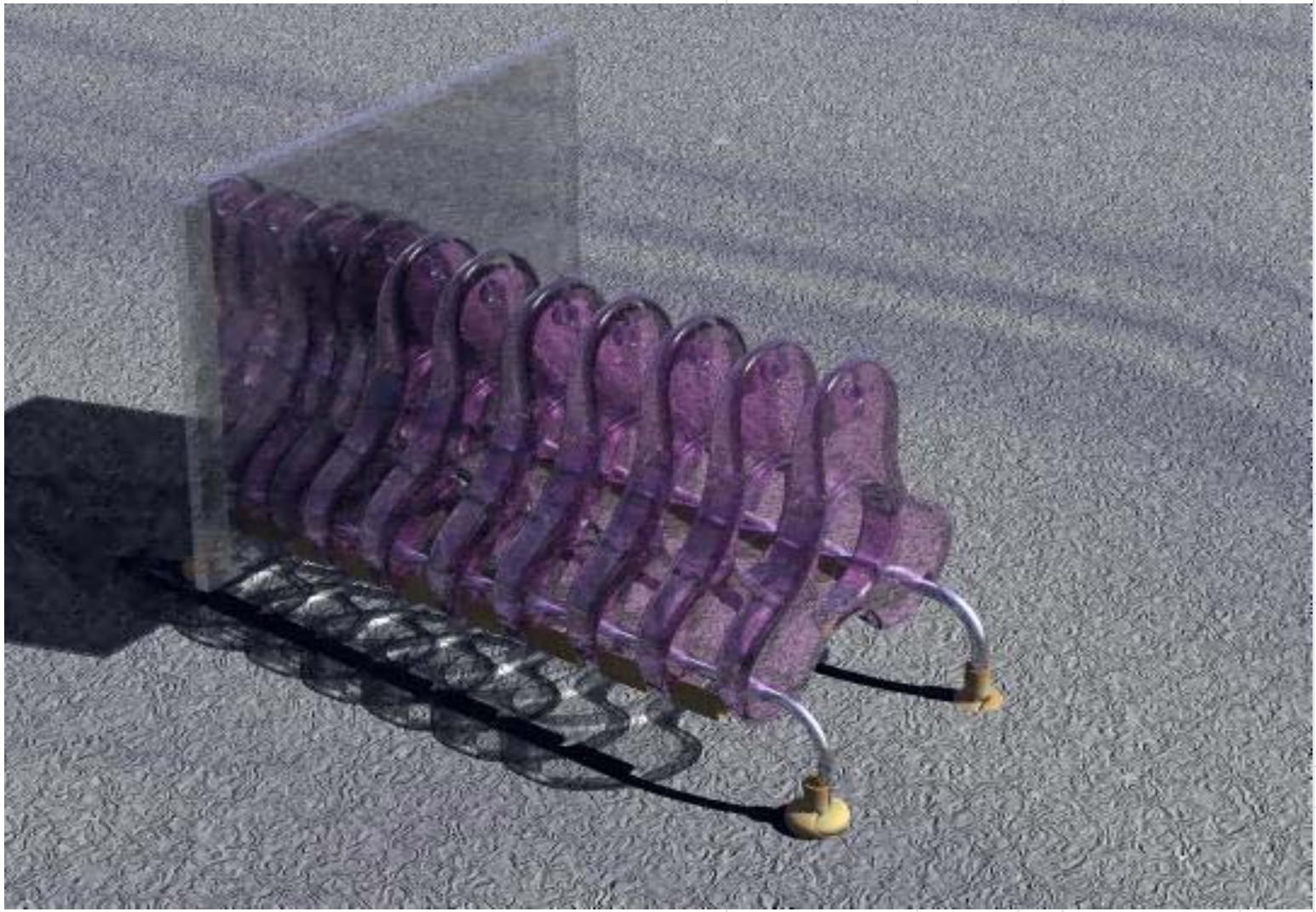
CD rack

refinement

of product form

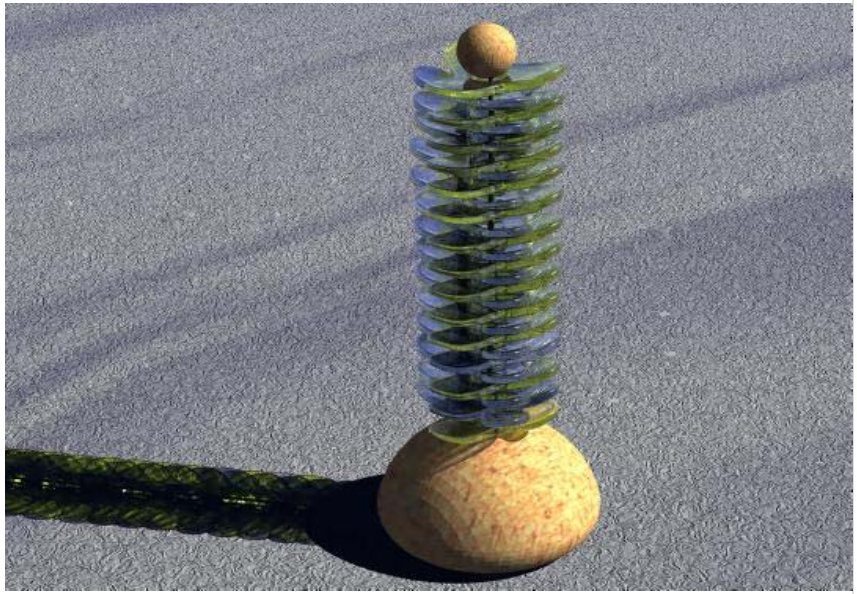






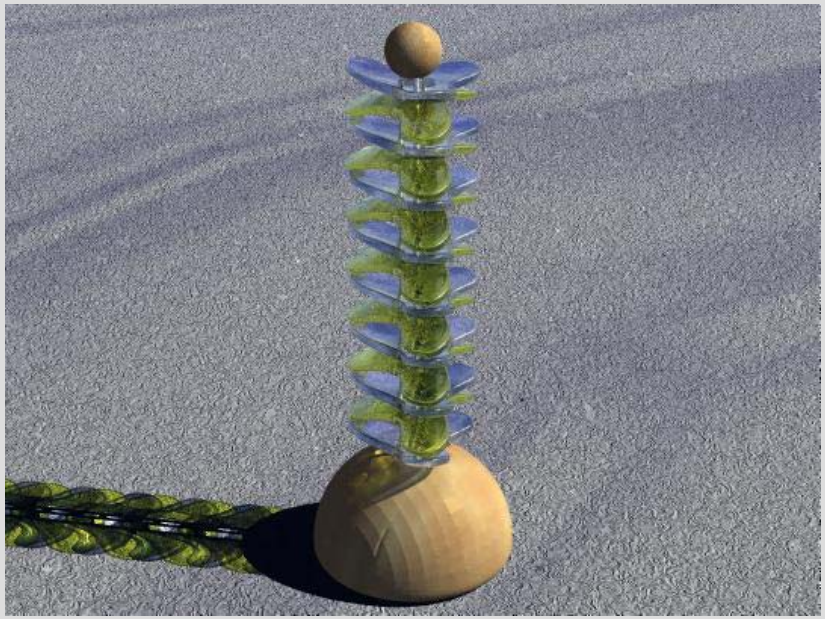
cd rack

ash tray



Similar units can be stacked on vertical rods in various configurations to form interesting pieces of sculptural value.

These can be decorative pieces, which when dissembled, each piece can function as a paperweight.



The stacking pattern can keep changing to generate a fresh look every time.

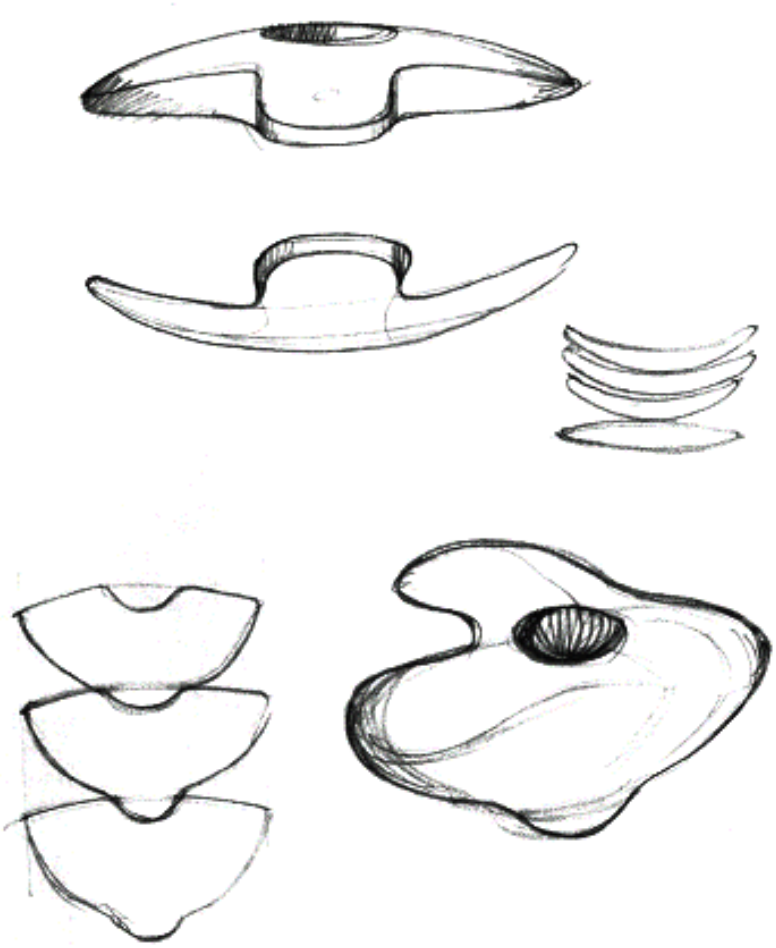
candle holder with
a glass base

The distinct formal value of an individual unit can be used to design products. Here, a single unit is used to make a candle holder.

Variation in certain components , like the base , by way of material, texture, etc, can result in varied expressions.

candle holder with
a marble base

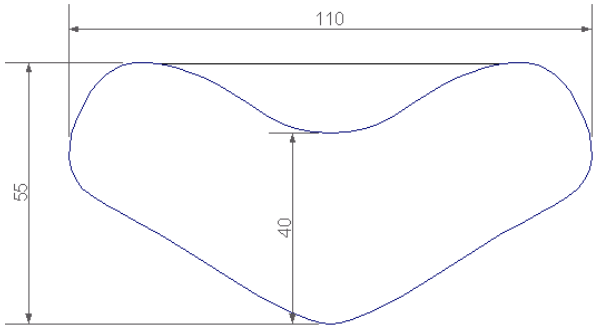
c o n c e p t 3



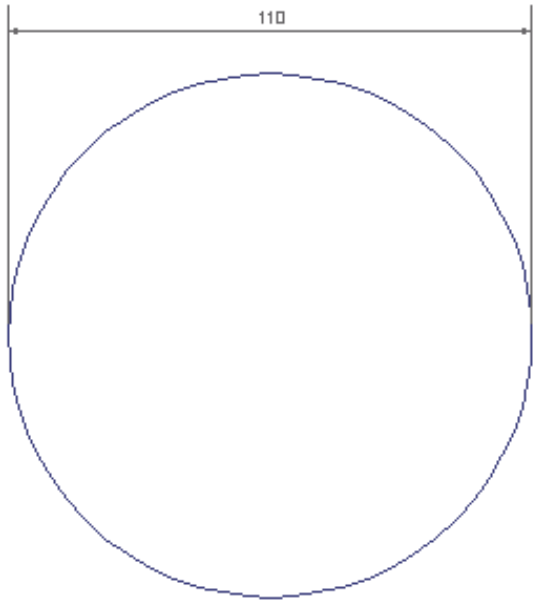
main components –units

form is more bulbous and provides scope for assembly by way of interlocks.

drawings

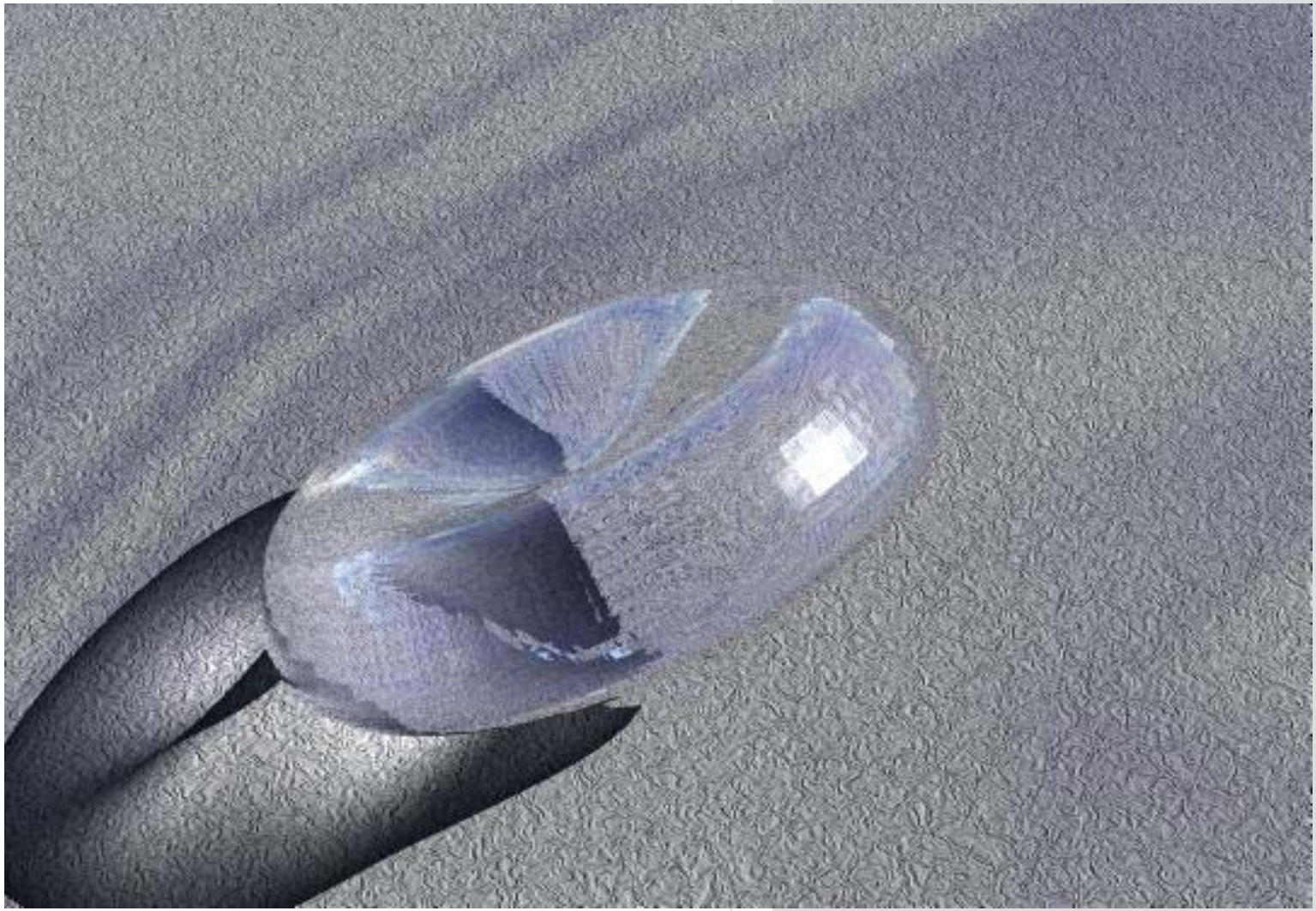


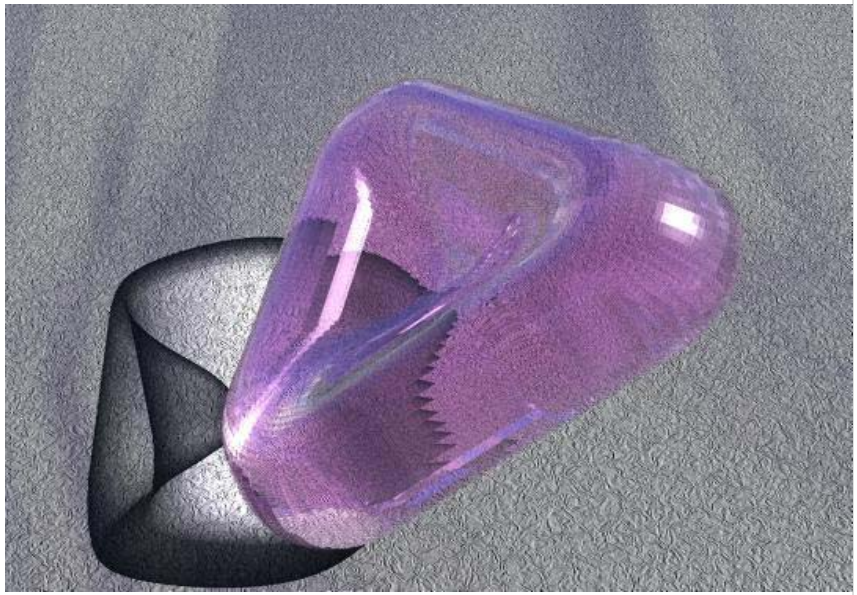
SECTION



TOP VIEW

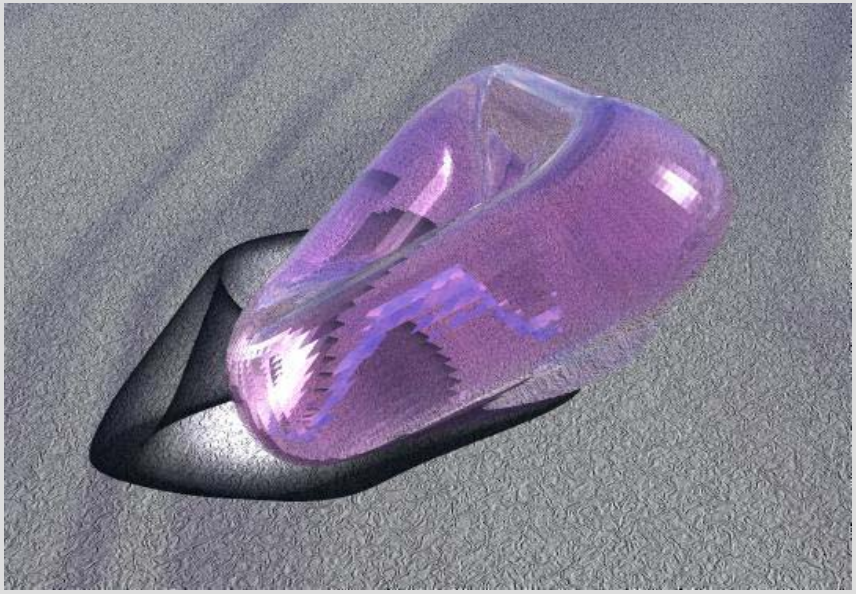
all dimensions are in mm.



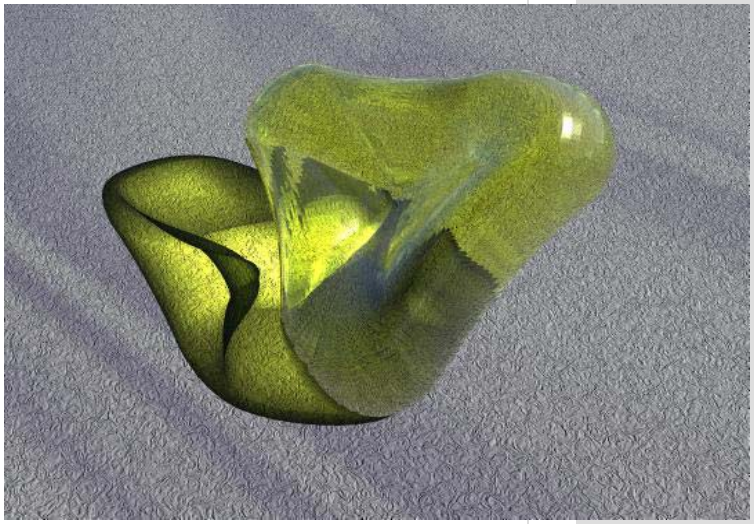


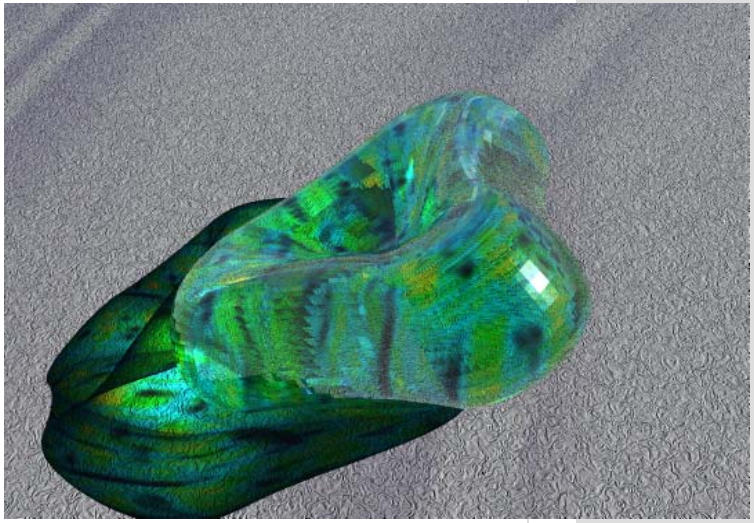
The curves and surfaces were further worked on to create a stronger element of fluidity in the form.

Various colors and some texture options were tried by way of computer models.

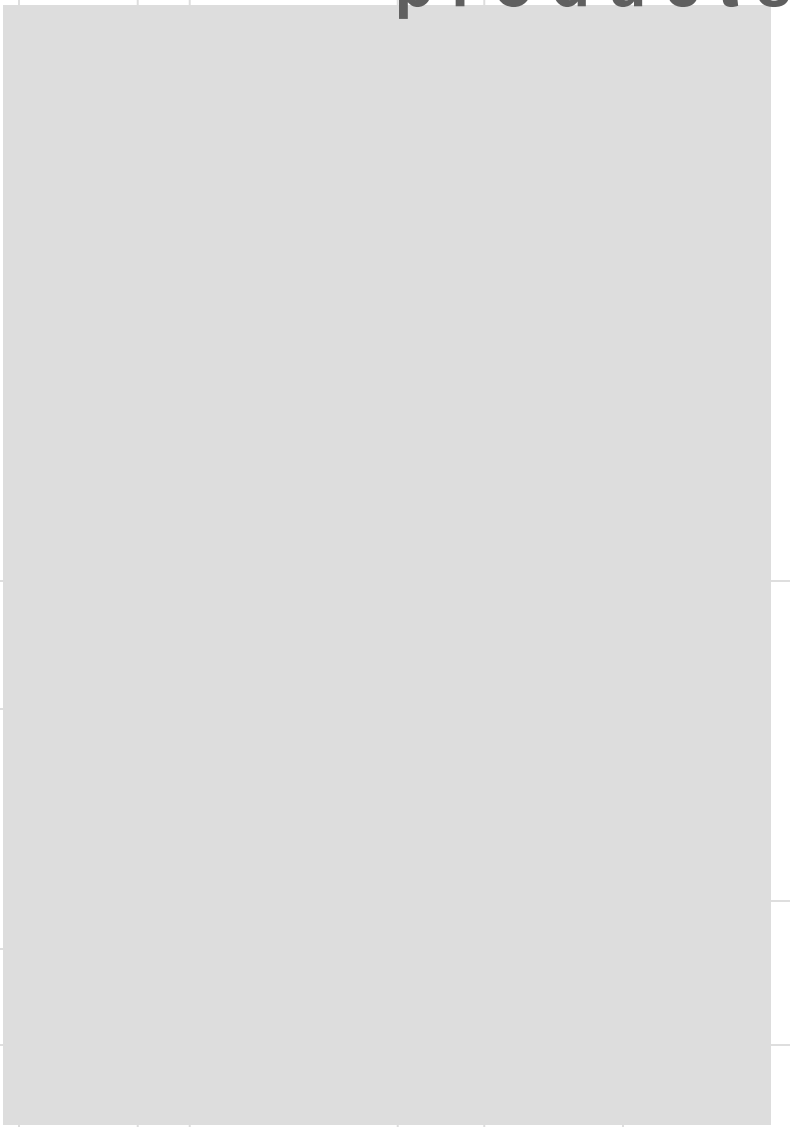


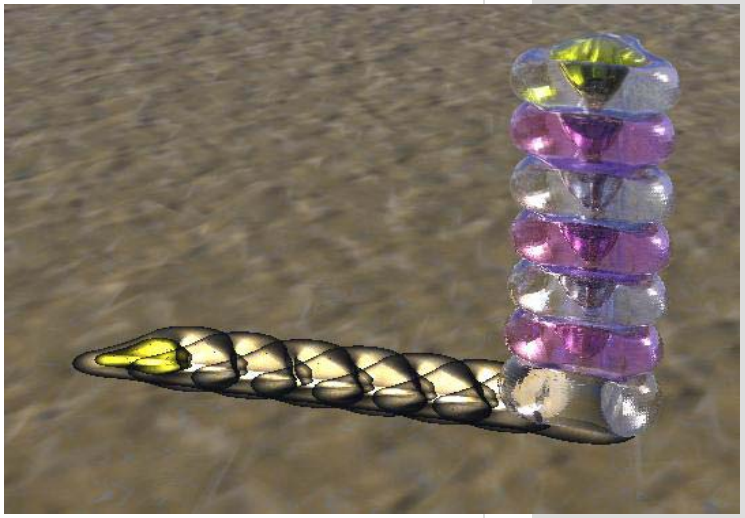
Transparency also was varied to see the play of light on the form.



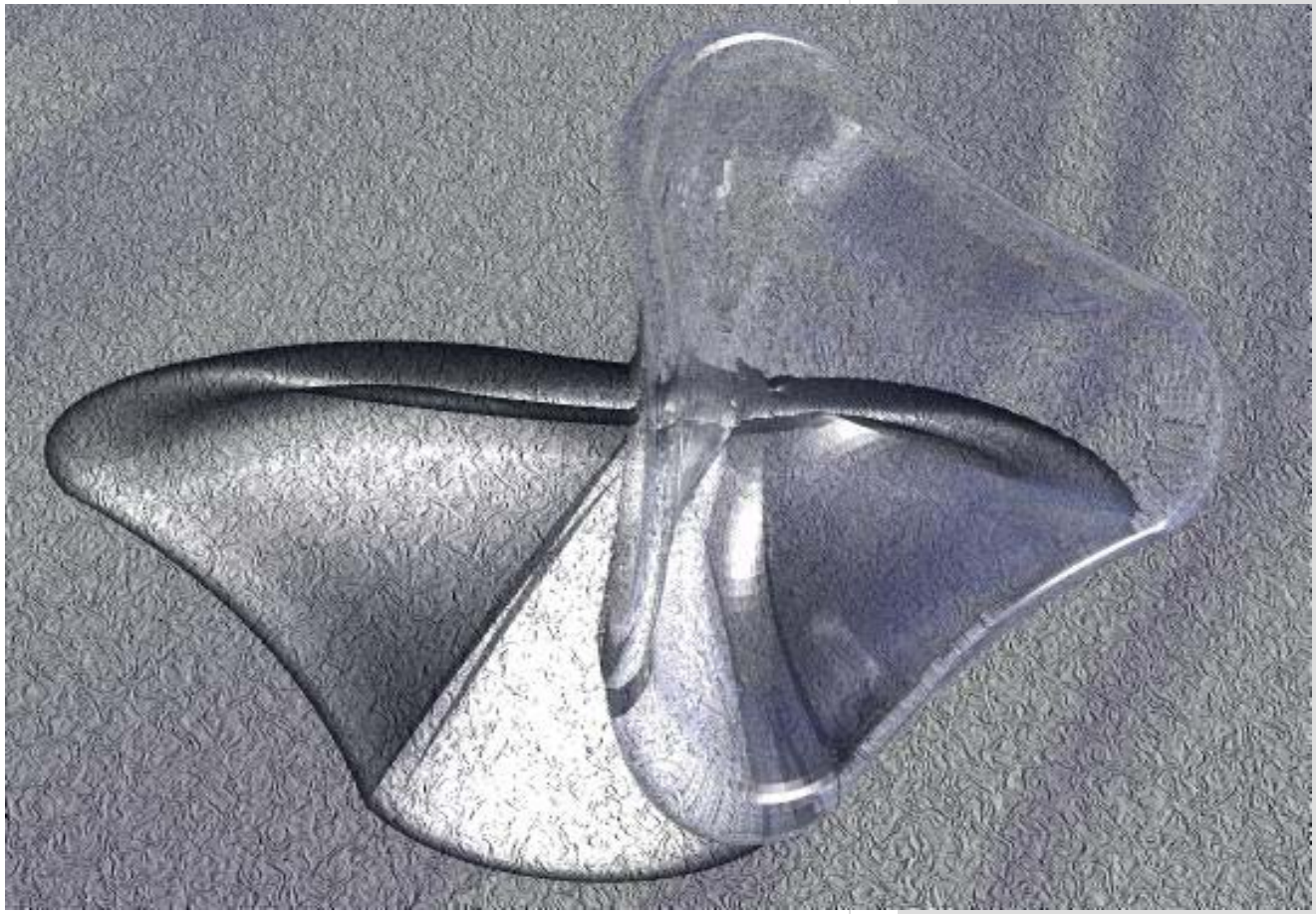


products





c o n c e p t 4

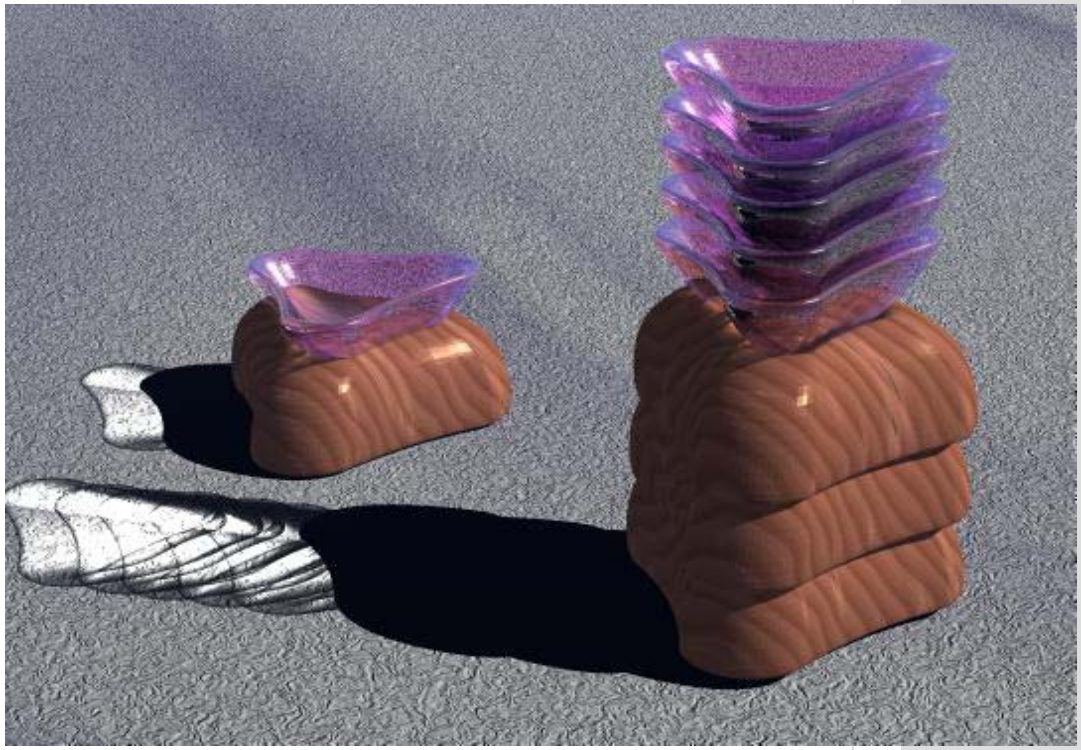


main components –units

Concept 3 was further worked on by varying wall thickness to create interesting play of light

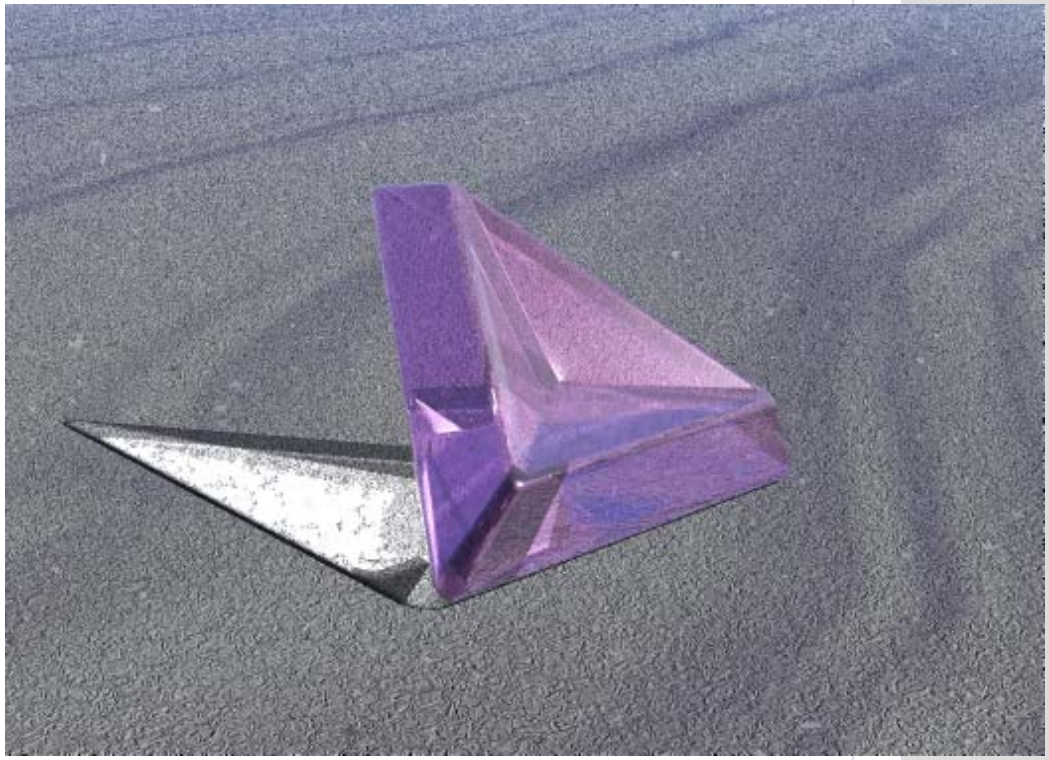
The base unit also becomes a stack here.

When required, one glass element can be interlocked with one wood element to Form containers that can be use to carry varied things for the table top.



c o n c e p t 5

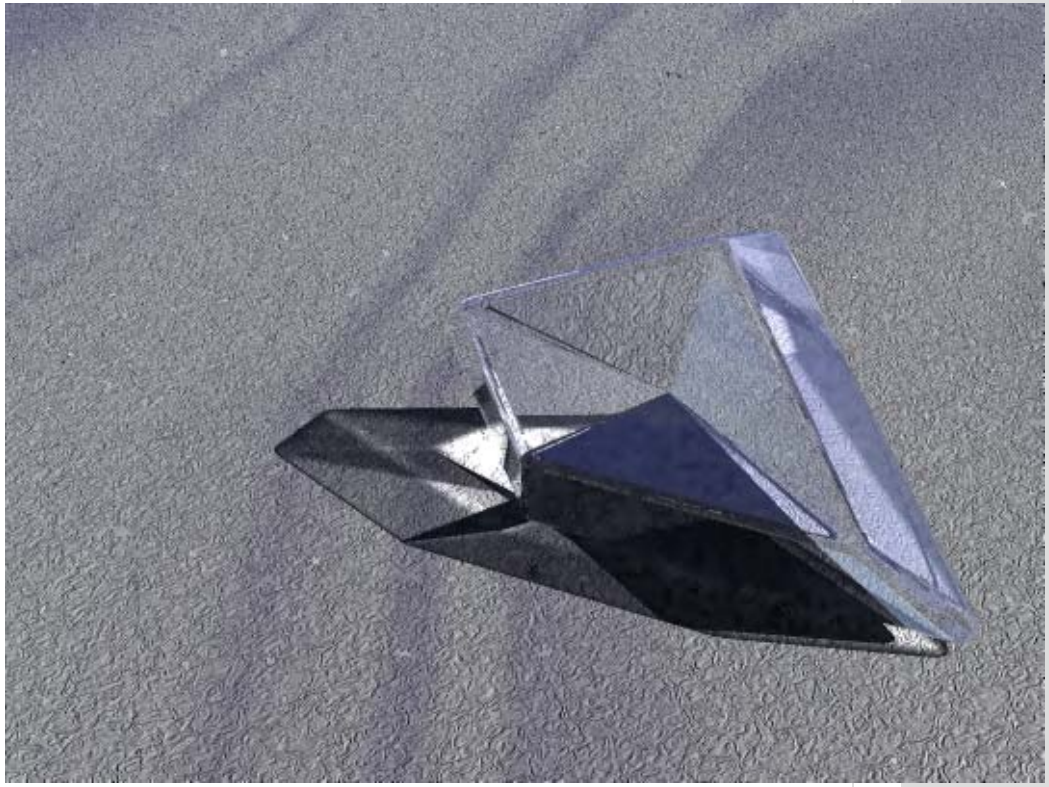
main components –units



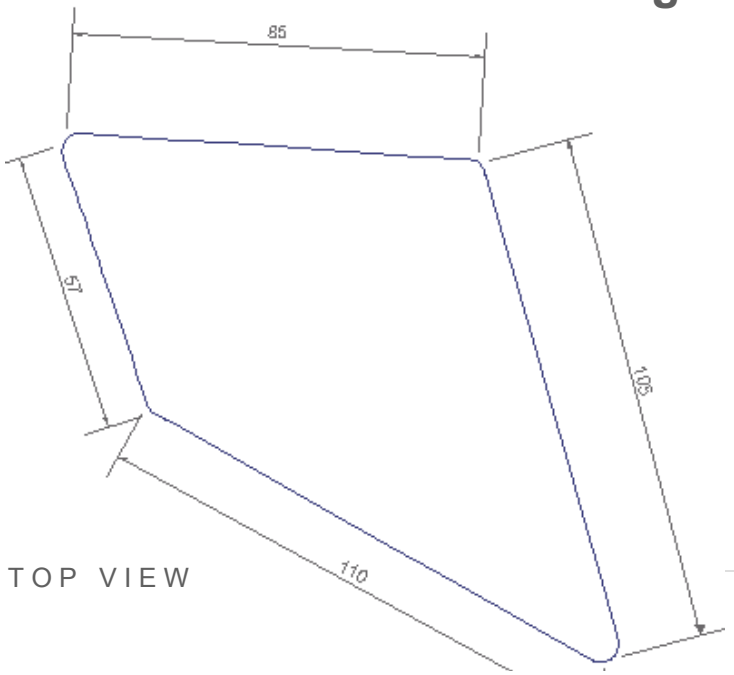
Glass objects become exciting because of the play of light possible with glass.

In this concept, the glass form is more sharp and faceted to achieve a starkness in the play of light.

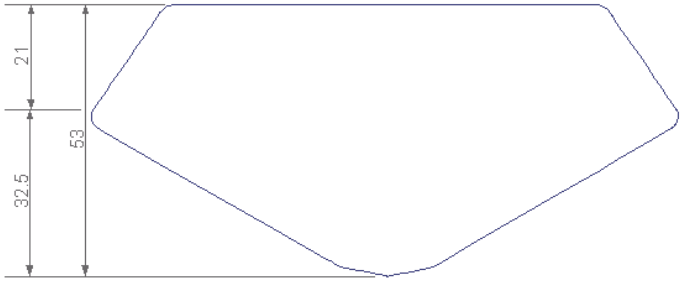
Also, a certain randomness is brought in the facets to break the symmetry that is so evident in the previous forms



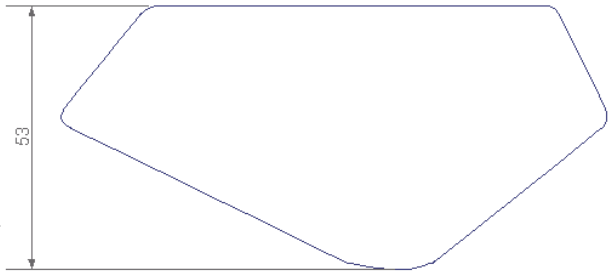
drawings



TOP VIEW



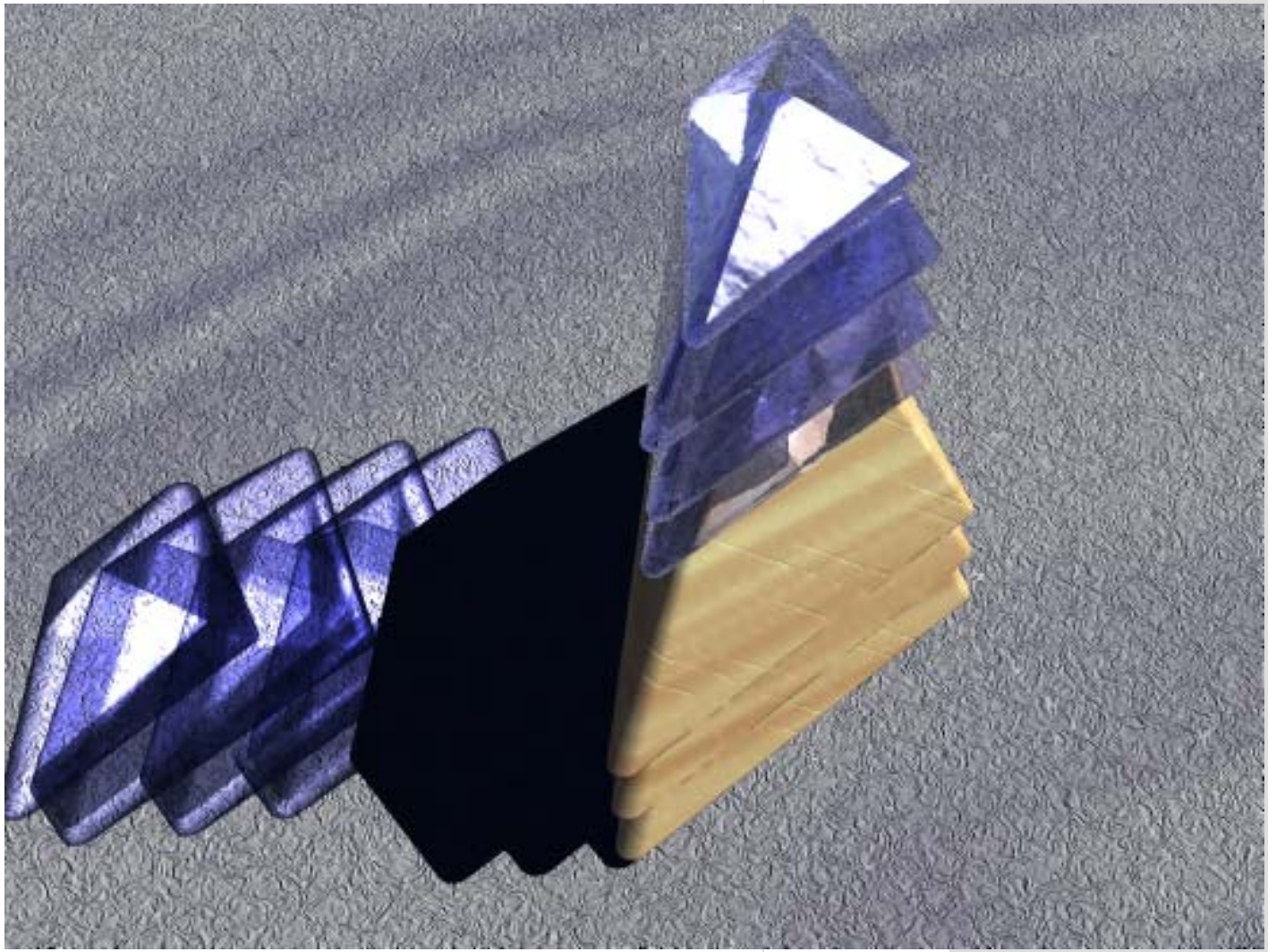
SIDE VIEW



FRONT VIEW

products

container made by interlocking a glass unit with a base piece also in glass



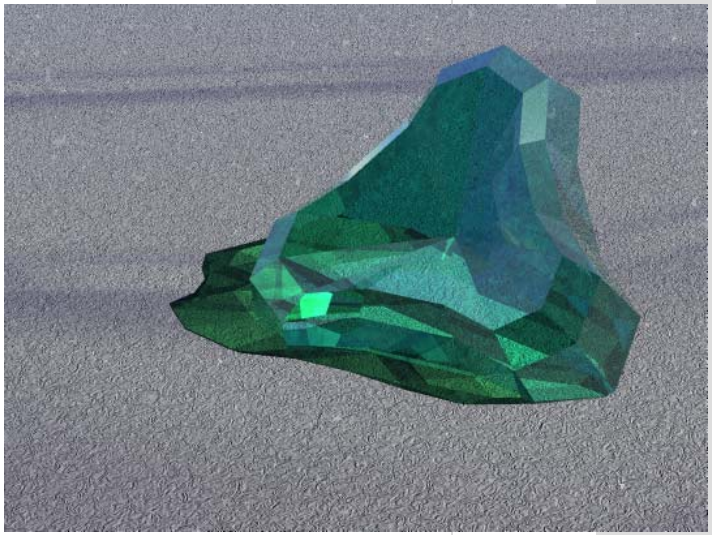
stack of containers made by interlocking glass units and wooden base pieces

c o n c e p t 6

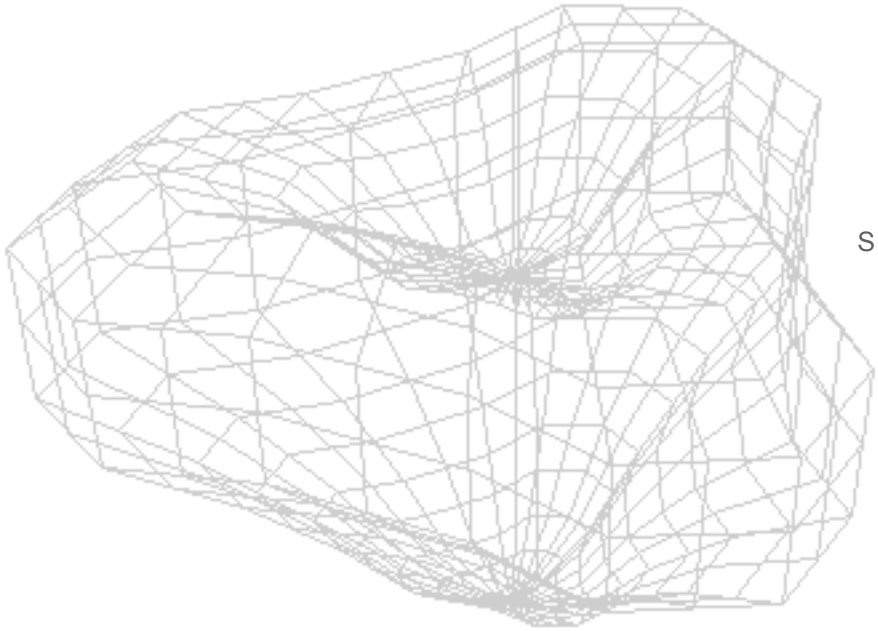
main components –units

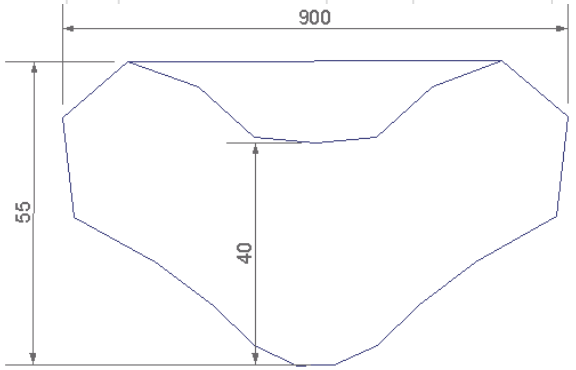
Units with finer facets like this can be produced by moulding or, in case of smaller units, facets can be produced by grinding and polishing a moulded unit.

Grinding is a post treatment of units.
It requires lot of skill.
Thus, it would increase the production cost of the unit

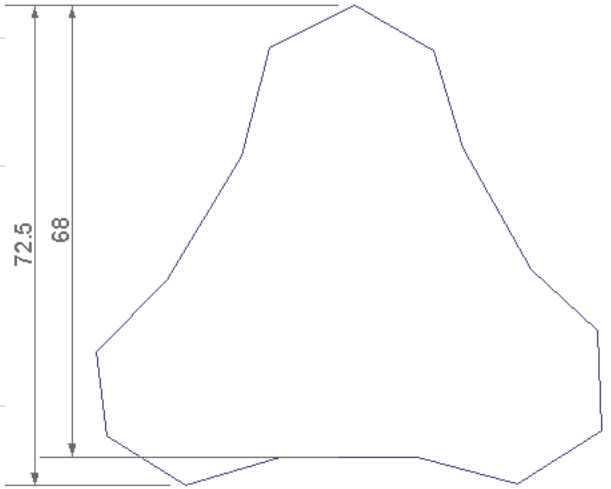


drawings





SECTION



TOP VIEW

all dimensions are in mm

products

container made by interlocking a glass unit with a wooden base piece.
This can be used for keeping small items lik
pins, etc. or can function as an ash tray

marketing and distributio

building the product

small scale manufacturers
standardizing the production of the unit component.

Units of different colours-
batch production
used in various configurations to make the product..

Other components
metal rods, components in wood, metal stone, etc.
can be made by the related small scale set-ups.

machinery used

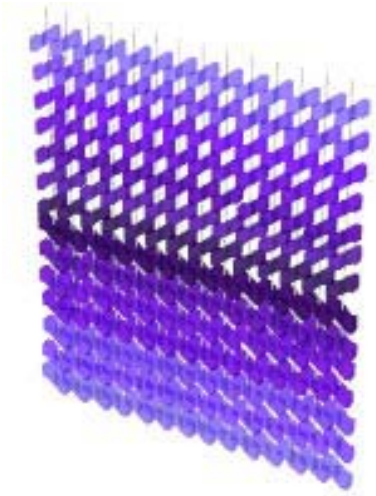
All glass units are **moulded components**.

- Metal rods are **bent** to the desired profile
- Components proposed in wood, stone, etc. can be made by using the **lathe, bench drill, milling machine,** etc which are readily available in the small scale set up

How are the products projected? – system of marketing and distribution

containers and table top items

So, it can be marketed as a '**do it your self'** kit with a n instruction manual with the help of which the users can themselves build the product.



luminaries, furniture components, and **architectural elements**-

These products could be transported to the site of assembly as separate components and assembled on site by the dealer.

target market and costing

The products are targeted for the lifestyle markets.

They can be sold at departmental stores, design galleries, etc. or can function on dealership basis.

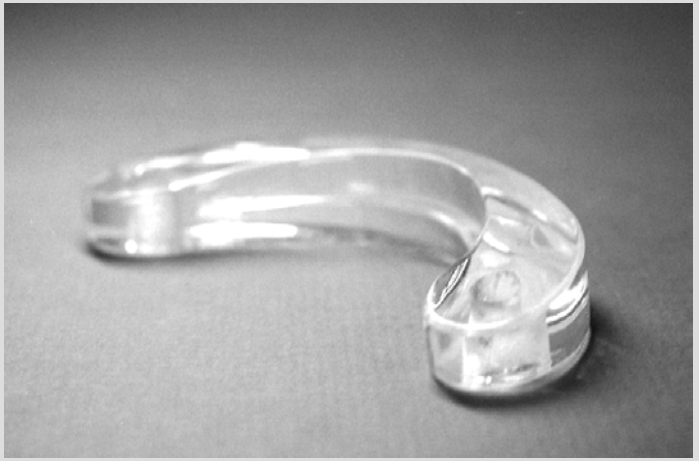
Most of the tabletop products and luminaries can be priced between Rs. 300 to Rs. 500.

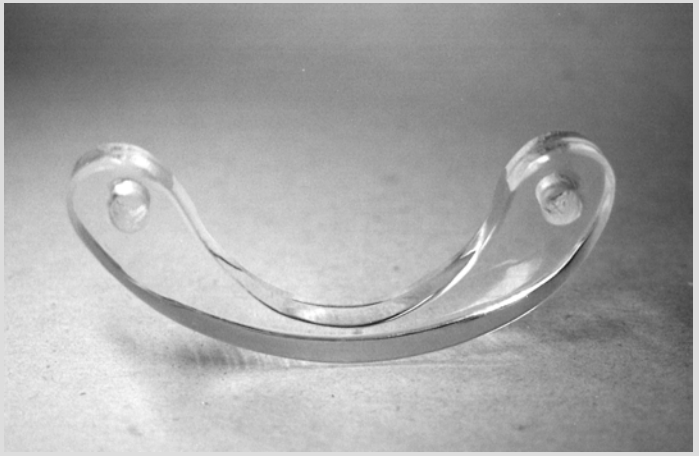
p h y s i c a l m o d e l

Considering the time,cost and infrastructure available, concept1was chosen for making physical models. Glass forms were simulated in acrylic to achieve a near glass effect.

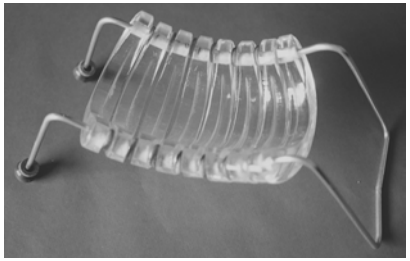
main components -units

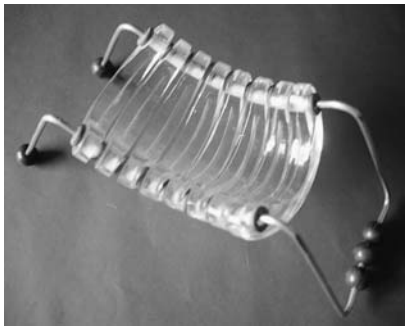
model making - working with acrylic
Cutting
Shaping
Milling
hand finishing

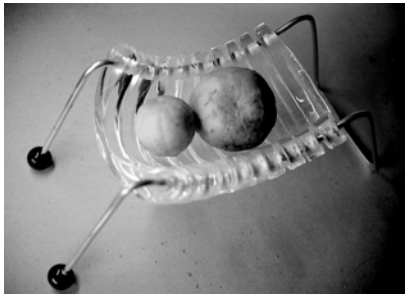




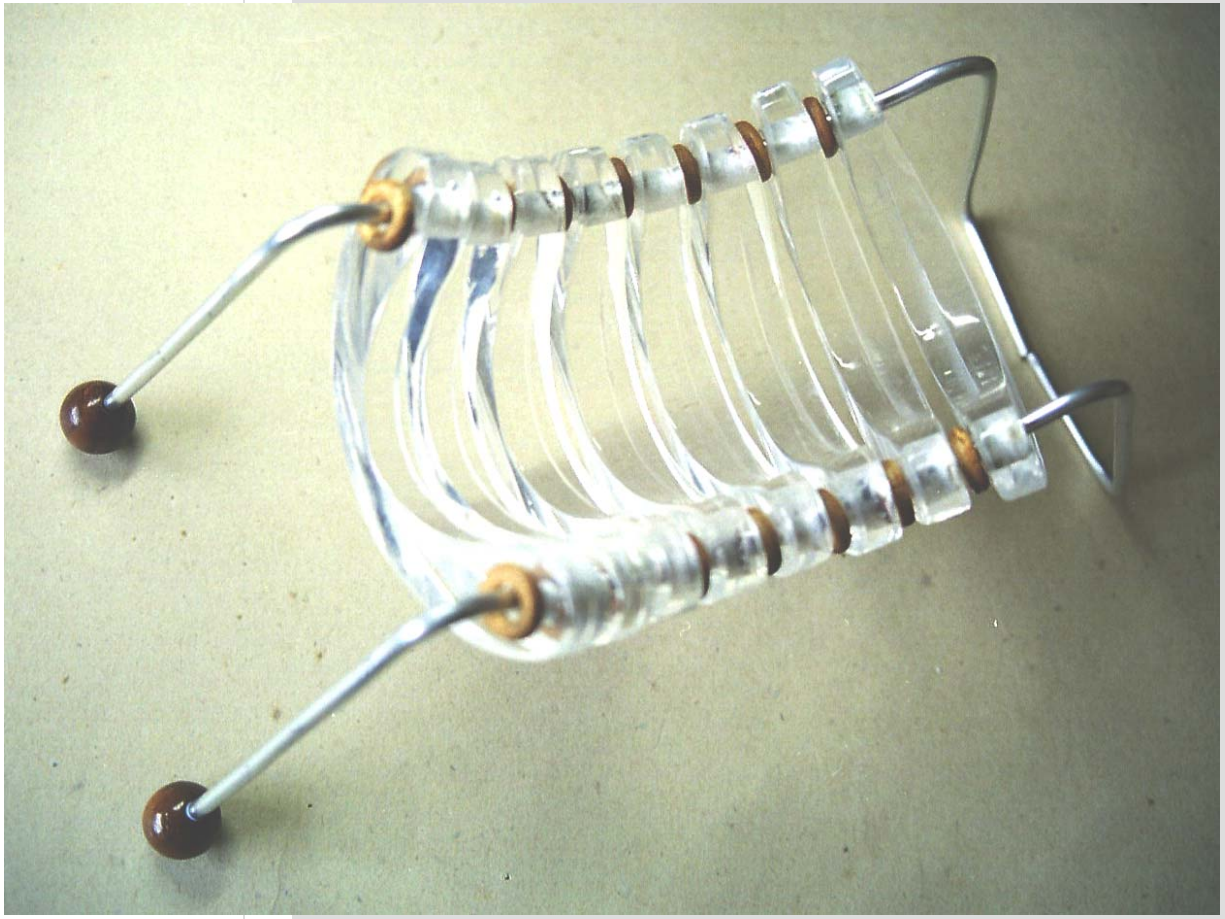
stage 1



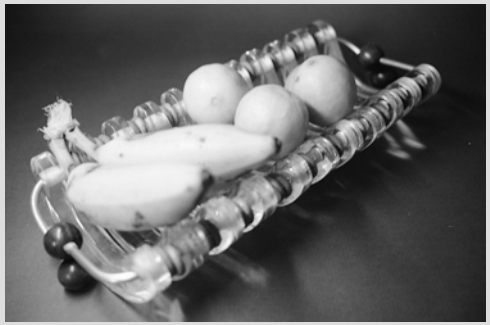


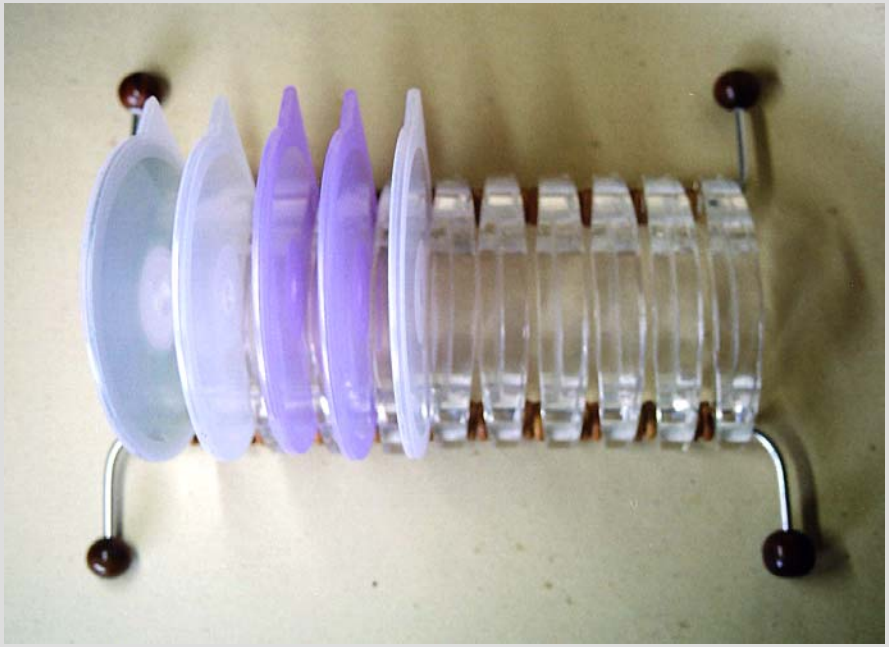


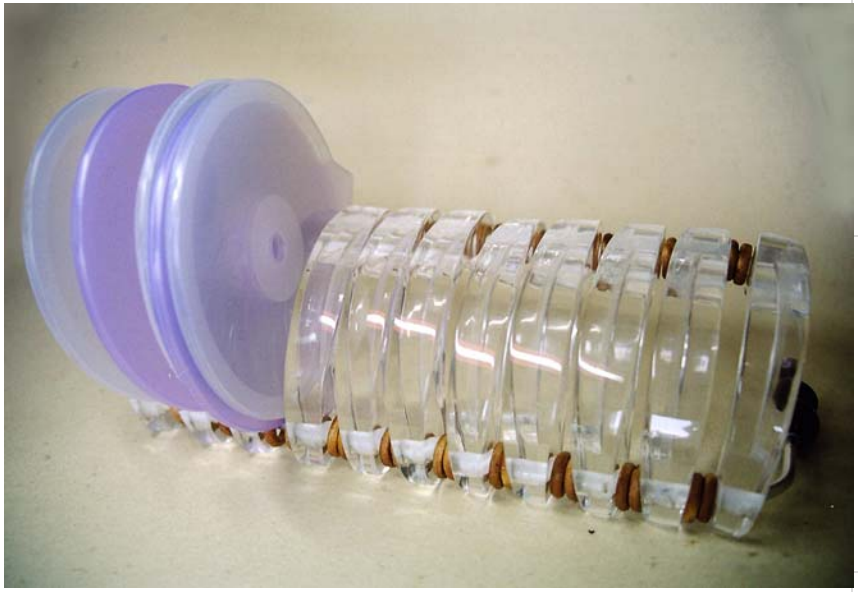
container



container

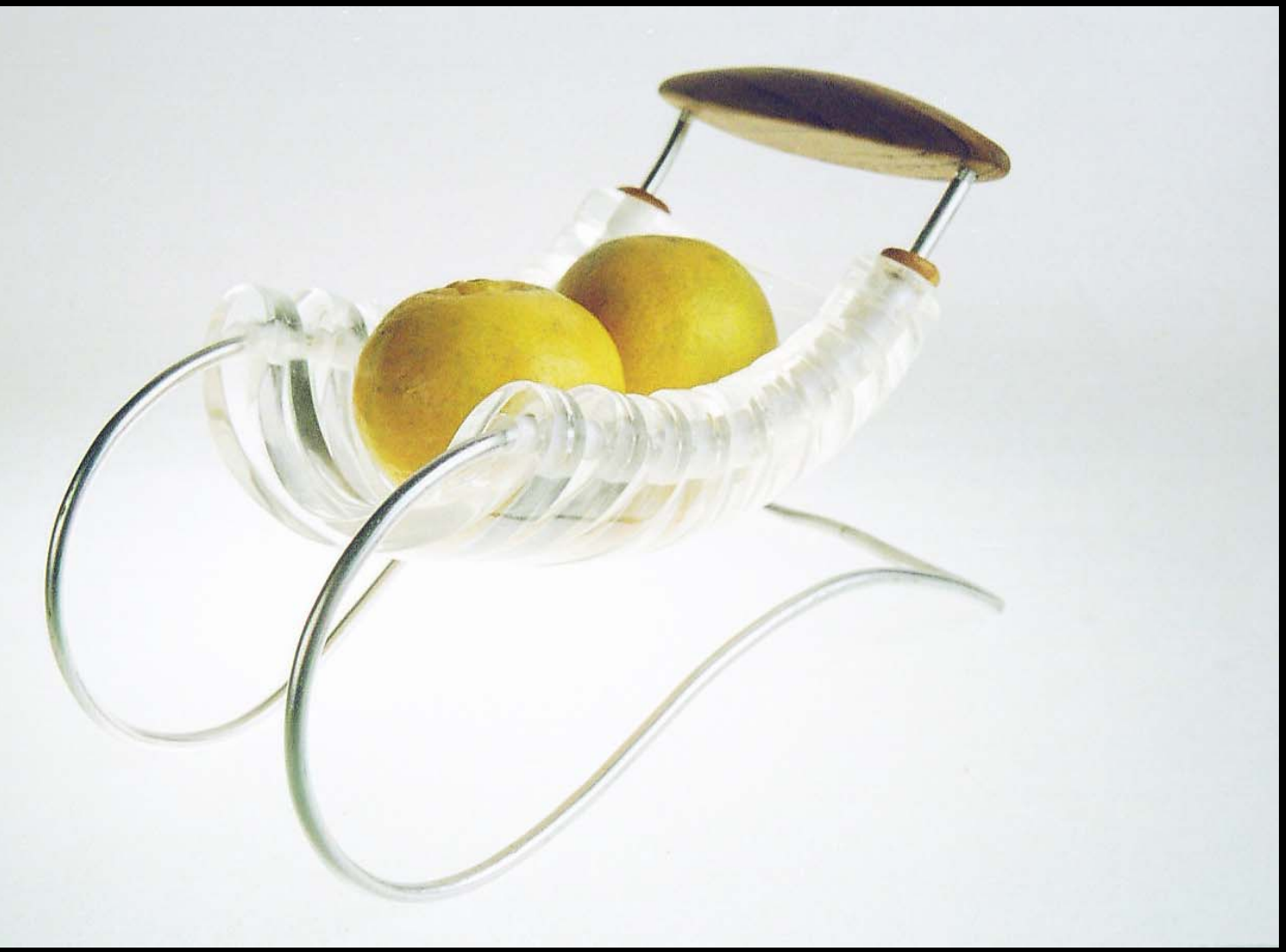


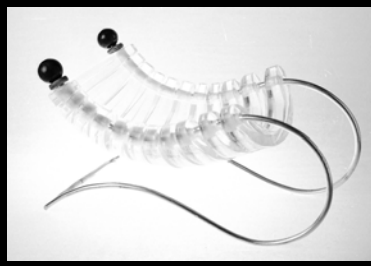


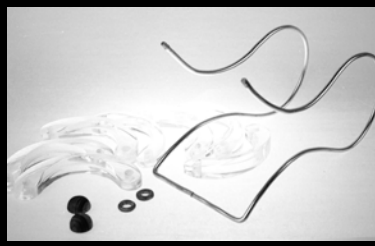


stage 2

Making components in wood finishing







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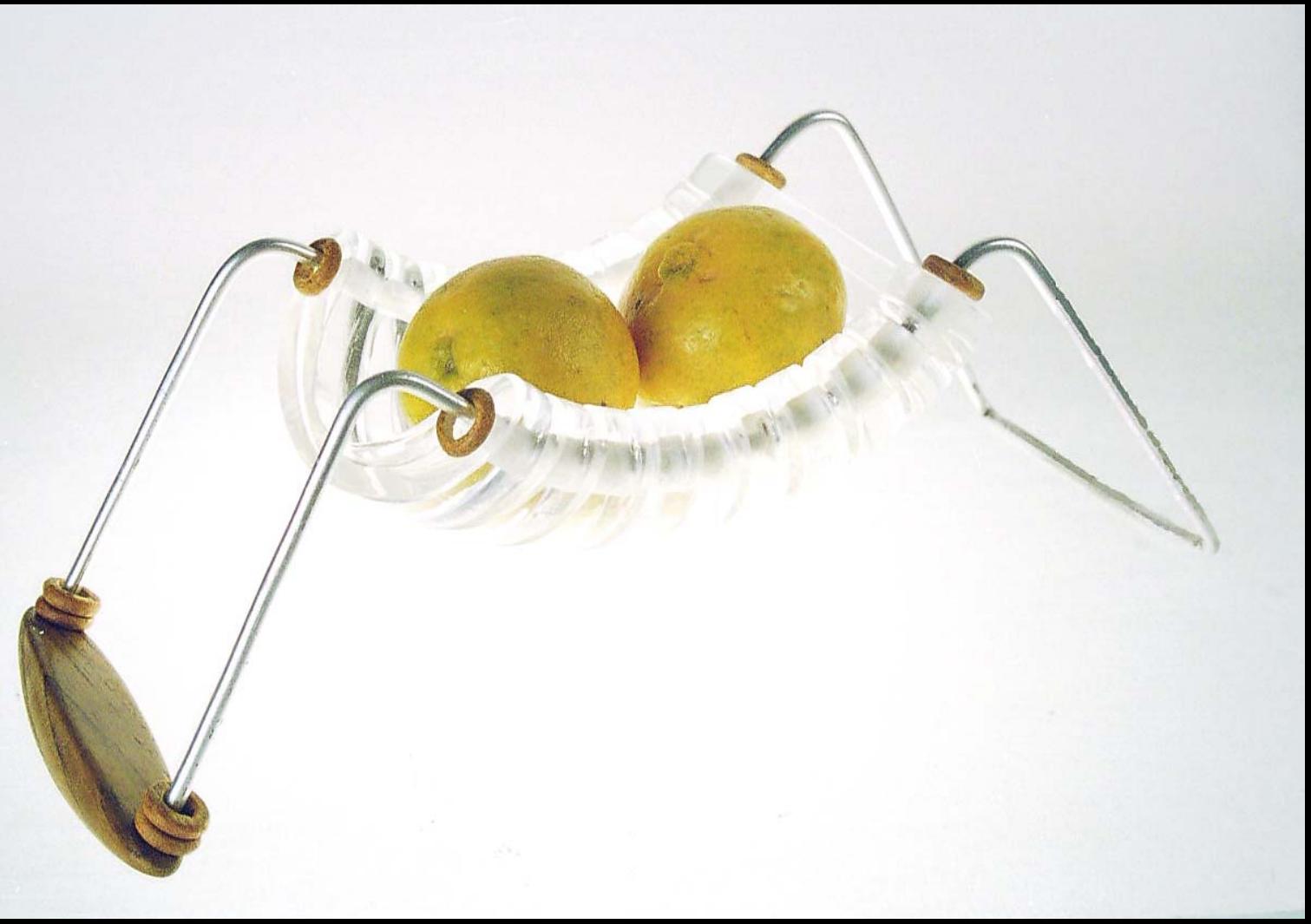

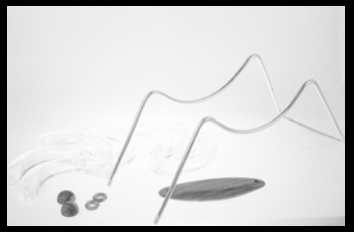

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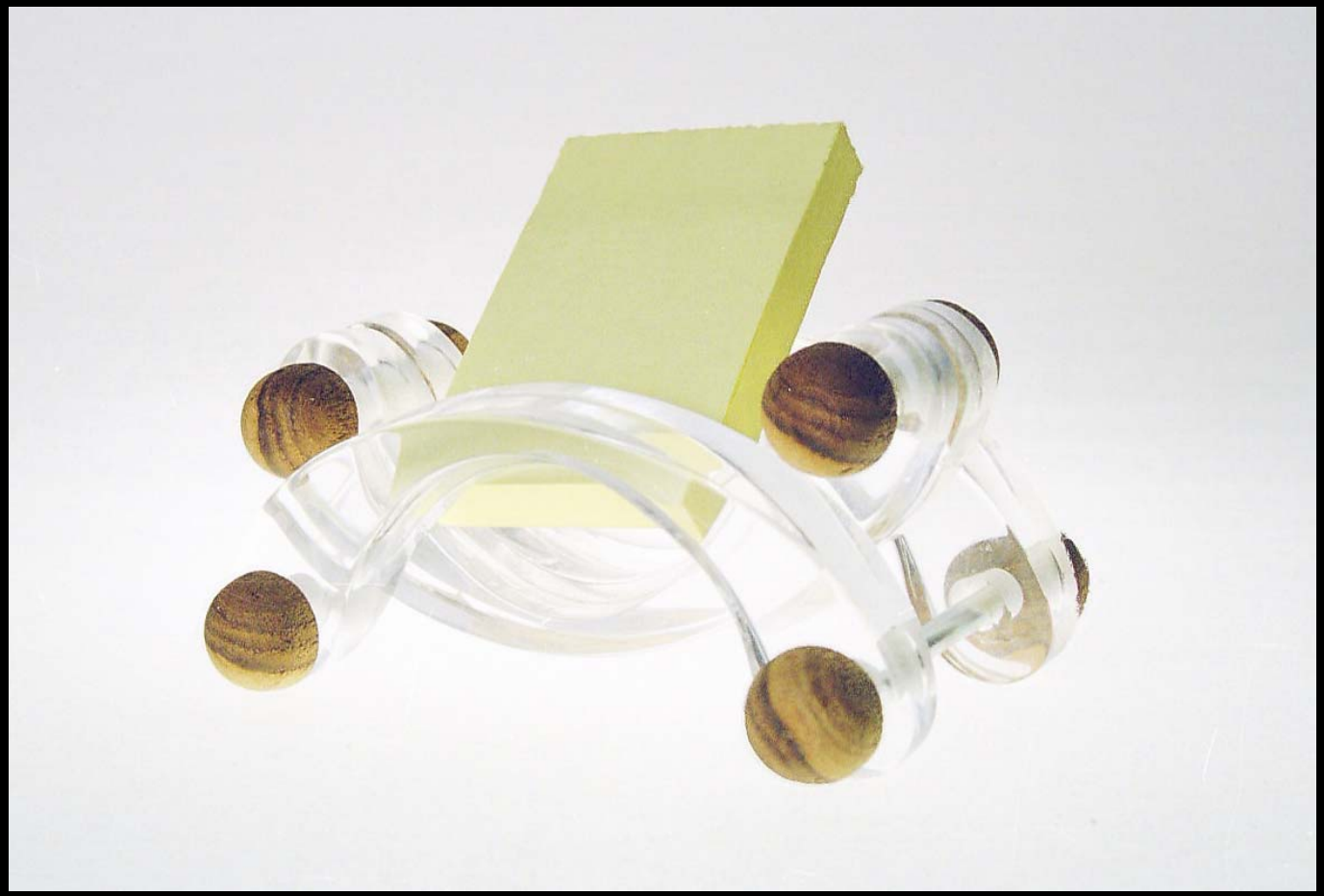
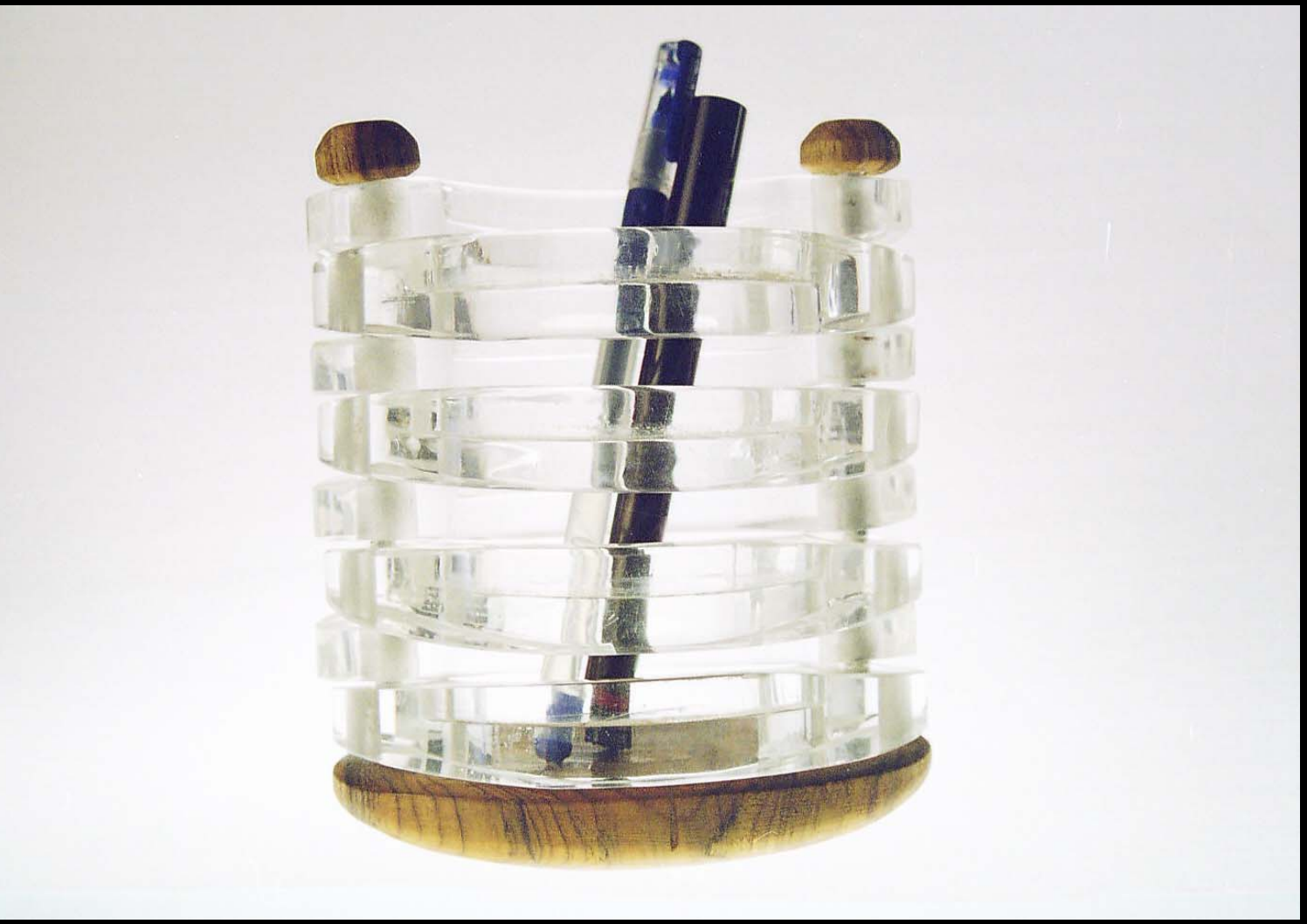
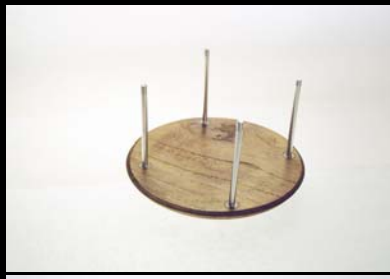
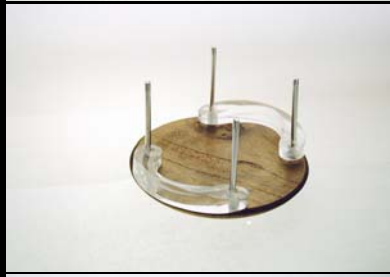


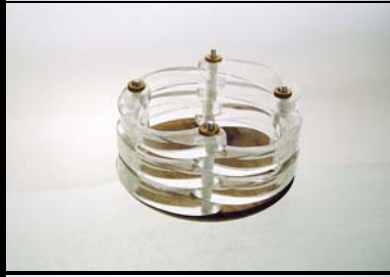
card holder

stack









THANK YOU