

Design Course

## Exploring Glass

Studies of Drawing Examples from Nature

by

Prof. Avinash Shende and Shiv Kumar Verma

DoD, IIT Guwahati

Source:

<https://www.dsource.in/course/exploring-glass>



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2. Introduction
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Source:

<https://www.dsource.in/course/studies-nature-and-form-exploring-glass/aims-and-objectives>

## Aims and Objectives

This course aims to sensitize the students to study nature and draw inspiration for an understanding and creation of man made form.

The assignments explored in this course study the elements of design as seen in nature and forms the basis and the source of inspiration in the generation of man-made forms. It explores approaches to the study of form and structure that have so optimally evolved in nature to meet specific functional requirements. For example a study of different shapes and their function of beak and claws amongst different birds are. Color as an element in nature can be examined for its attributes of balance and harmony; Concept of Figure and Ground can be examined for the concept of Camouflage. Form studies of structure in nature helps understanding of aspects of form transition, form integration and form transformation for the students of Art, Design, and Architecture.

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Source:

<https://www.dsource.in/course/studies-nature-and-form-exploring-glass/introduction>

## Introduction

The course is supported with lectures and visual studies drawing examples from nature. The elements of design – line plane, volume, texture, shapes and form are introduced supported with examples from nature. Class discussions with presentation of slides of the works of leading artists, designers and engineers who have drawn inspiration from nature in their work are discussed.

”Design is a form of thinking – a spiritual ordering principle at work.”  
- Carl Jung

“Design is the conscious and intuitive effort to impose meaningful order”.  
- Victor Papanek

Taking inspiration from nature is a very creative and novel approach to design products. Early caveman made weapons by observing teeth of carnivores; the Chinese invented artificial silk nearly 3000 year ago. In 1488 Leonardo da Vinci designed a flying machine inspired from wings of bats. The Wright brothers in 1903, made the first successful aeroplane inspired by large birds. Velcro invented by George de Mestral in 1948 was inspired by the burrs.

Nature fascinates everyone, apart from scientist and engineers there are industrial designers who take their inspiration from nature. Luigi Colani who is famous for his ‘biodynamic forms’ and Ross Lovegrove known for his ‘organic design’ both seem to draw inspiration for design from nature.

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## Approaches

Over time, the study of nature inspired innovation has grown into many different domains. Some of the terms related to the study of Nature Inspired Design are highlighted below and they show the different approaches to its study.

- Bionic - A term coined by Jack E. Steele in 1960 who defined it as the science of constructing systems with some functions copied from nature.
- Biomimetic - Otto Schmitt in 1969 introduced the term biomimetic. It is referred to as the study of biological mechanisms, structures and materials to produce products artificially.
- Biomimicry - A new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems.
- Biologically Inspired Design - Looks at the use of designs found in nature for analogy and inspiration in designing technological systems.
- Biomorphism - It refers to an art movement having its roots associated with Surrealism and Art Nouveau. The word 'biomorphic' is commonly used for abstract, free form and organic shapes used in arts and design.

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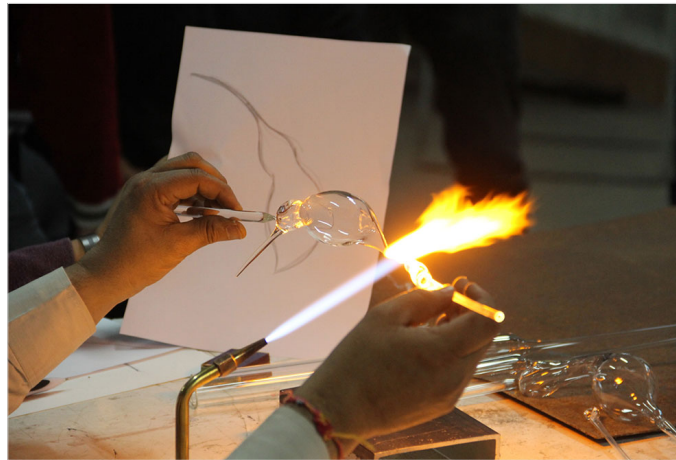
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<https://www.dsource.in/course/studies-nature-and-form-exploring-glass/methods>

## Methods

Visual interaction is the first interaction of a user with a product and this could be one of the reason behind characterizing nature inspired products by their form. The designers approach to design nature inspired products focusing on styling and aesthetics starts with visual thinking.

In this section we will explore the different methods that help students to strengthen their abilities in visual thinking.



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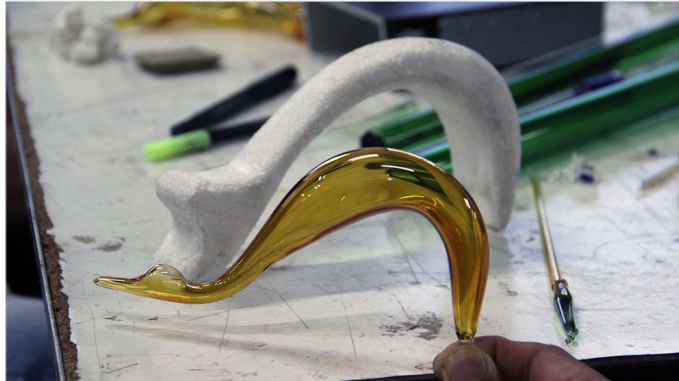
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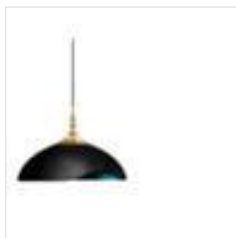
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Method of Form Abstraction



Biomimetic Product Design Method



Applied Aesthetics in Biomimetic Design Method



Method of Aesthetics Experience

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## Method of Form Abstraction

The steps involved in the process as proposed by Wen et al. include observing the natural elements of form, sketching, abstracting them and finally refining them into a novel product form using elements and principles of design.

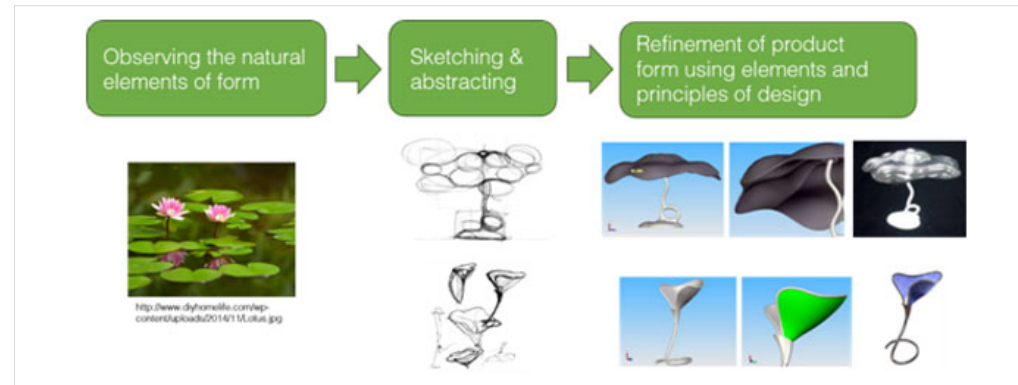


Figure 1. Flowchart for method of Form Abstraction

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<https://www.dsource.in/course/studies-nature-and-form-exploring-glass/methods/biomimetic-product-design-method>

## Biomimetic Product Design Method

Proposed by Hsiao et al. the process (Figure 2) of transforming an organism form into a product form involves a concept transformation stage which is further divided into two sub stages, utilizing the concept of product semantics and morphology analysis.

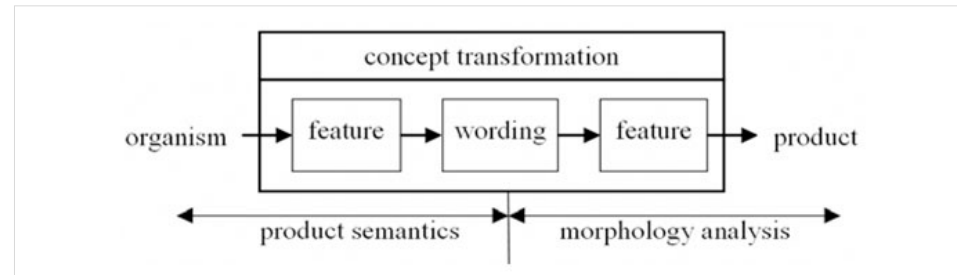


Figure 2. Diagram for Biomimetic Product Design (DBPD) Method

The Steps of the process include (Figure 3):

- Step 0 - Selection of organism
- Step 1 - Explain the features of organism
- Step 2 - Identify unique feature
- Step 3 - Depict other features (Behavior, habitat)
- Step 4 - Describe features in wordings
- Step 5 - Categorize keywords into Noun, Adjectives & Verbs
- Step 6 - Illustrate keywords using pictures, keywords and available objects
- Step 7 - Reproduce the picture in grid
- Step 8 - Formulate conceptual solutions using images from step 2 & step 7
- Step 9 - Produce a detailed mode

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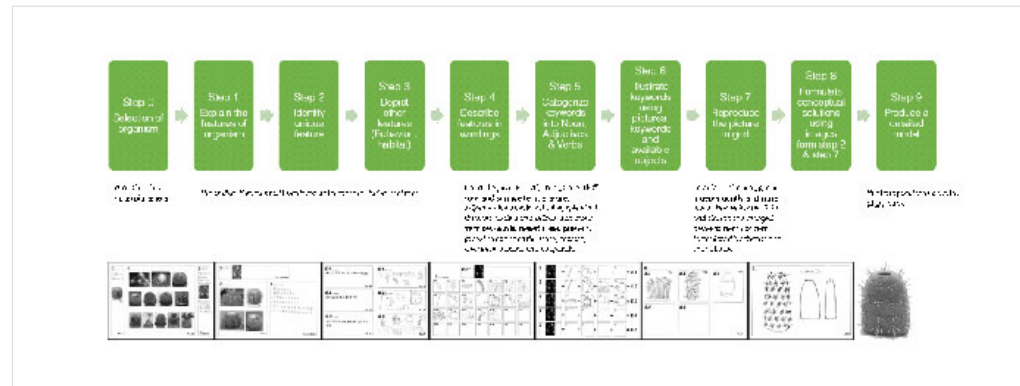


Figure 3. Steps for Diagram for Biomimetic Product Design (DBPD)

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<https://www.dsource.in/course/studies-nature-and-form-exploring-glass/methods/applied-aesthetics-biomimetic-design-method>

## Applied Aesthetics in Biomimetic Design Method

'Applied aesthetics in biomimetic design – a guide', is a work by the Technical University of Denmark (DTU). They propose a seven step methods (Figure 4) that can be used individually or complement each other in taking inspiration from nature's aesthetic attributes in a methodical way.



Figure 4. Flowchart for method 3

The Steps of the process are:

- Nature as product (Analyse natural elements)
- Action reaction (Observe change in form)
- Split feeling (Decompose the natural element into areas with opposite feelings)
- Impressions on the spot (Describe the overall expression on the spot)
- Inspiration boards (decompose an area of natural elements into surfaces, colours, materials and shapes of existing materials and products on separate collages)
- Pattern of inspiration (Categorization & mapping)
- Use of inspiration wheel

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## Method of Aesthetics Experience

The study by Huang et al. employed a method (Figure 18) in which students first identify the objective pattern in nature, which are responsible for aesthetic experience. After analyzing these aesthetic patterns, 2D and 3D compositions were developed based on aesthetic principles like unity, harmony, proportions, balance, rhythm, symmetry, repetition etc.

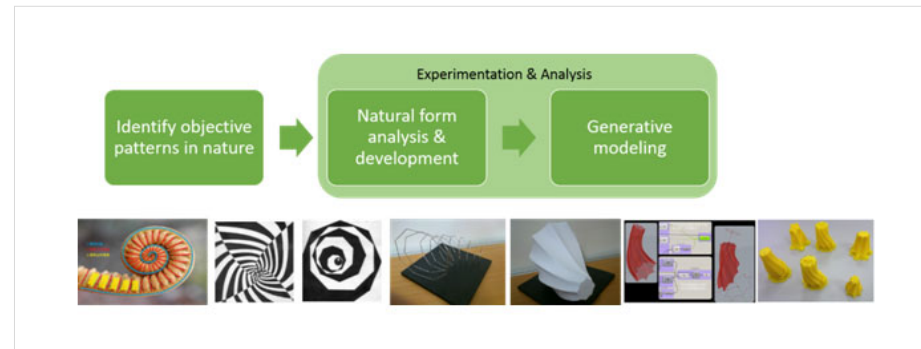


Figure 5. Flowchart for method 4

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<https://www.dsource.in/course/studies-nature-and-form-exploring-glass/limitations-designer%E2%80%99s-methods>

## Limitations of Designer's Methods

Dealing with complexities of natural forms, their manufacturability at the same time satisfying the customers psychological needs always remained a great challenge for industrial designers. Due to the complexities of natural forms, designers often face a problem in analyzing and extracting the design elements for product form. Designing a product form is based on the designers experience and intuition. Therefore, many times it is difficult to design a product which exactly meets customer psychological needs.

According to Kamehkhosh et al. “designers usually reduce complex forms to their basic geometries and proportions, in order to find orders in their complexity and to harmonize them with their design paradigms. We believe that this common vision to the nature, deprive us from perceiving its reality”. Maintaining a balance between natural inspirational form and abstractive form is a challenge for both novice as well as professional designers. Degree of abstraction of a bios form is an important factor in consumer pleasure as less abstractive bios forms have higher pleasure response than those with more abstractive form.

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## Importance of Looking Towards Nature in Industrial Design

There is a bond between humans and nature explained by Edward O. Wilson in his book 'Biophilia'. He defines Biophilia as  
*"The innate tendency to focus on life and lifelike processes"*.

Many researches have reported the positive effects of natural environment and its features on human health and psychological comfort. The biophilic design is an application of biophilia concept in built environments. Biophilic design uses the natural elements as the design inspiration in the design of built environment. Nature is a rich source of analogies and metaphors. Designers use metaphors in their designs to make product more communicative and expressive both functionally as well as aesthetically. Exposure to biological examples during design process helps in increasing the novelty and variety of ideas generated.

Natural forms have always been a source of inspiration in developing new products by industrial designers. Products with bios form evoke higher intensity of consumer pleasure and emotional responses than those without bios form. Automotive industries encourage the use of animal form for styling because of optimized mechanical performance and wide appeal of the vehicle. Understanding the semantic and emotional responses related to animal inspiration can help designers to develop highly expressive design solutions. All these studies explain the importance of nature in industrial design and the designers approach in designing creative products inspired by nature.

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## Assignments

Nature is a great source of inspiration for both form and function. For an industrial designer it is very important to extract the underlying principles for both form as well as function as per the demand of the project.

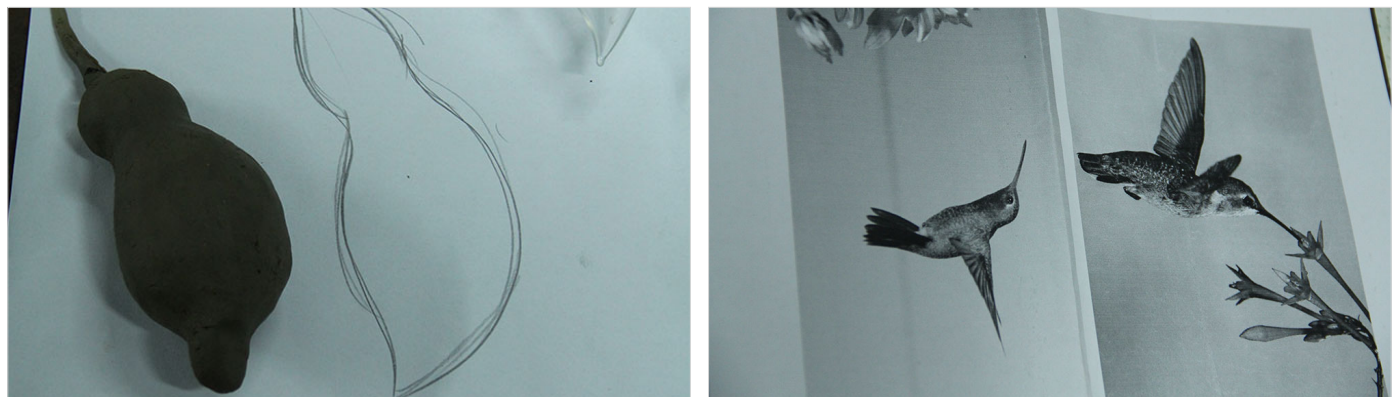
The true nature inspired design is all about the abstraction of the principles in nature. It could be the abstraction of a functional principle or the abstraction of a natural form to evoke certain emotions but both kind of abstraction require the understanding of the underlying principle existing in nature.

In this assignment the students were asked to study any natural form and generate forms by studying it thoroughly and interpreting the essence of the form by studying the elements of design and their attributes. The essence of co-relation between the selected theme and its functional elements were examined. Drawing and sketching of the form was encouraged to help students to understand the process of form extraction and its simplification. This helped to clarify an understanding of concepts in shape and form, colour and its attributes, sense of scale and proportion.

Having completed these studies through 2 dimension sketches and drawing, the student explored materials such as thermocol, clay and paper to generate 3-dimensional form.

Following this, glass was introduced as the medium of study and discussions were held on its properties and attributes such as opacity, translucency, and transparency; colour and its effect on form. The processes for forming glass such as hand blowing, casting and forming were introduced.

A critical analysis of the forms that the student had finalized was undertaken and finally translated into glass. A glass blowing artist Shri. Rajesh Sharma, was invited from Firozabad for a one week workshop, during which time the students worked with him to translate their form studies exercise exploring glass as the medium of choice.





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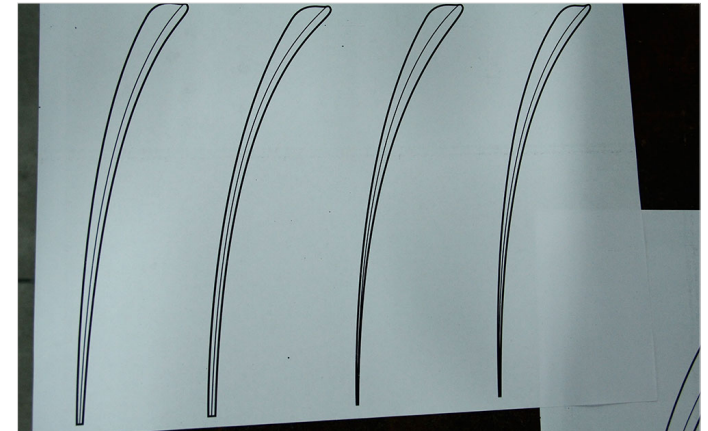
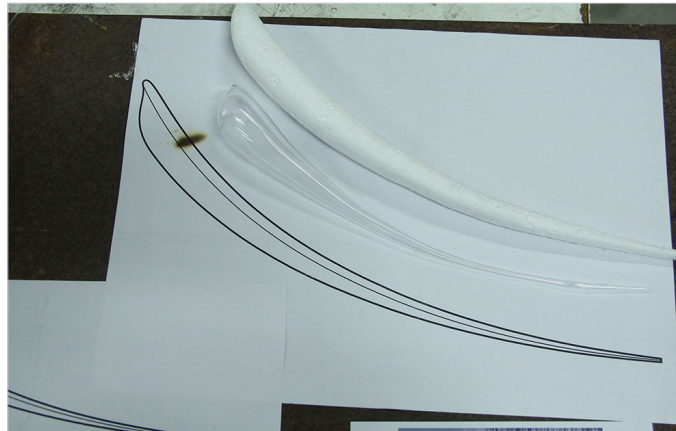
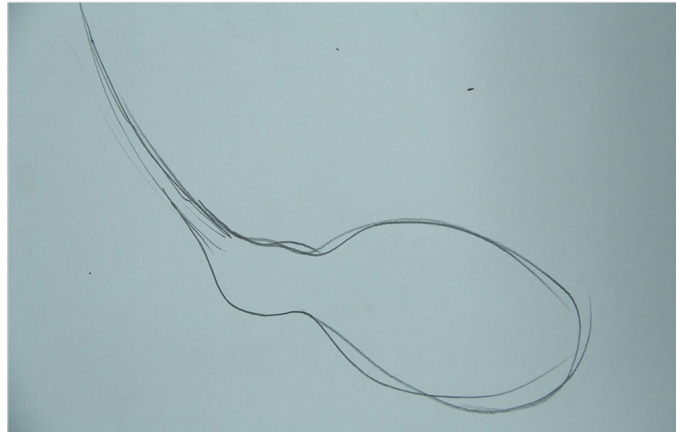
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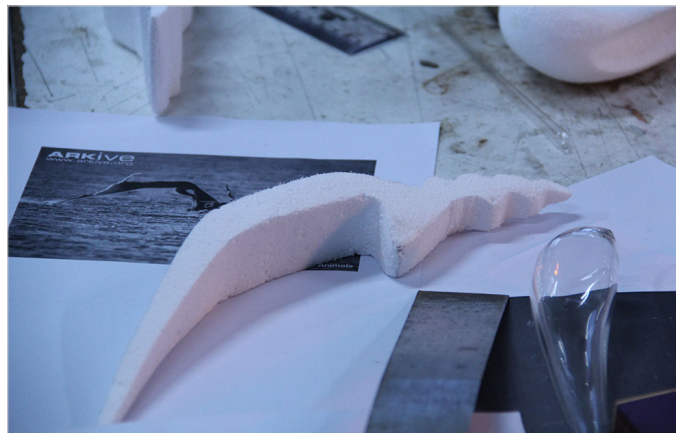
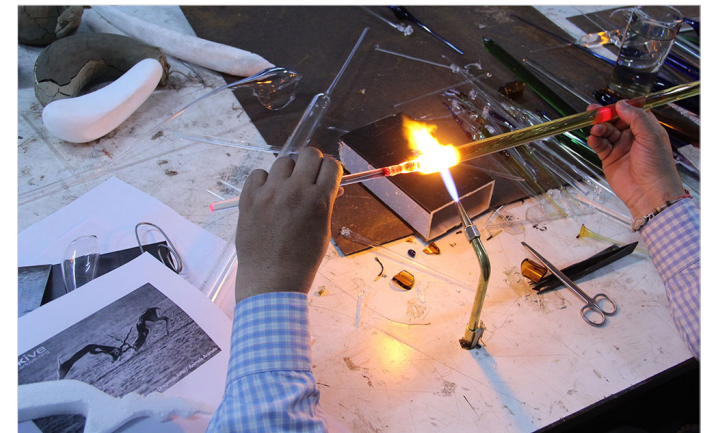
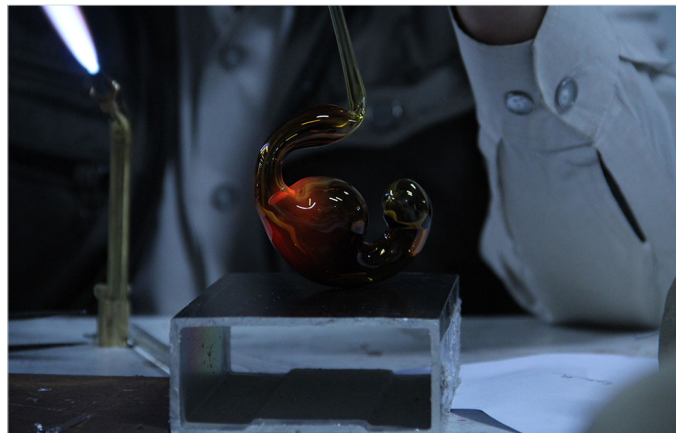
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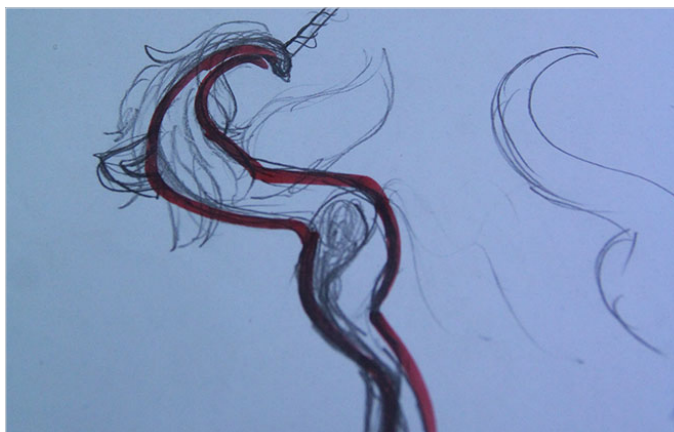
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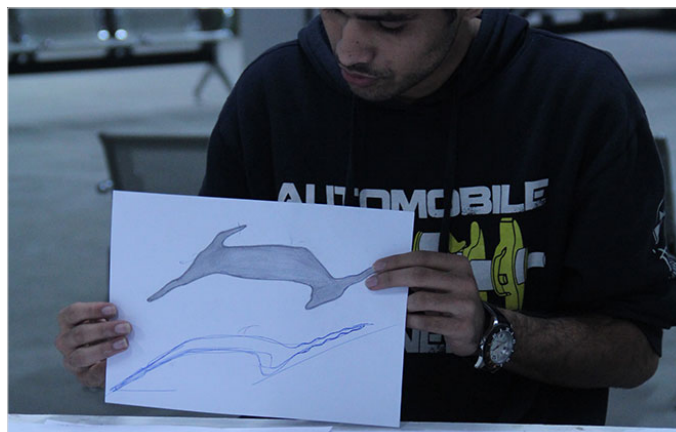
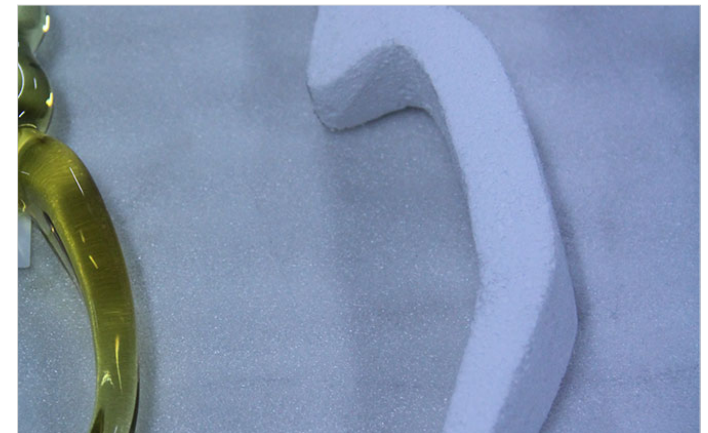
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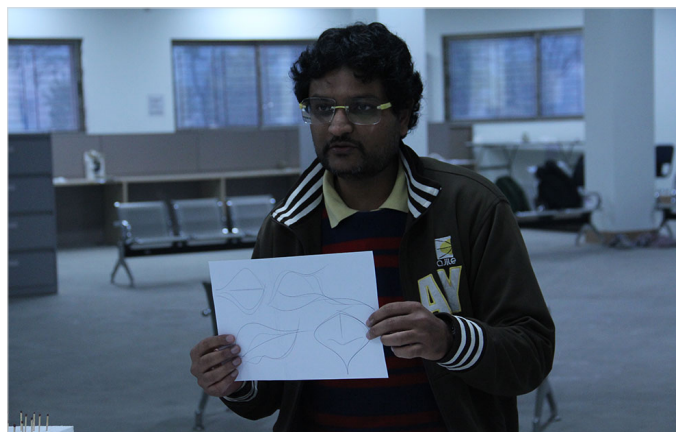
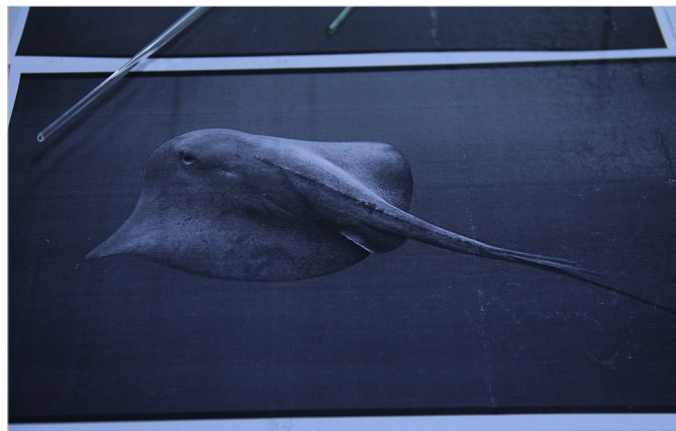
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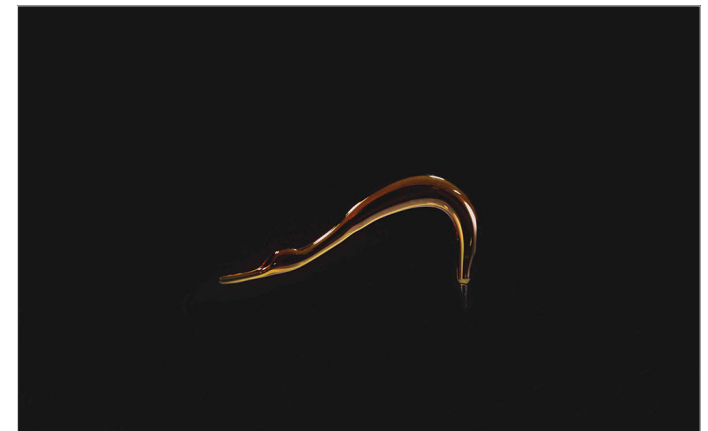
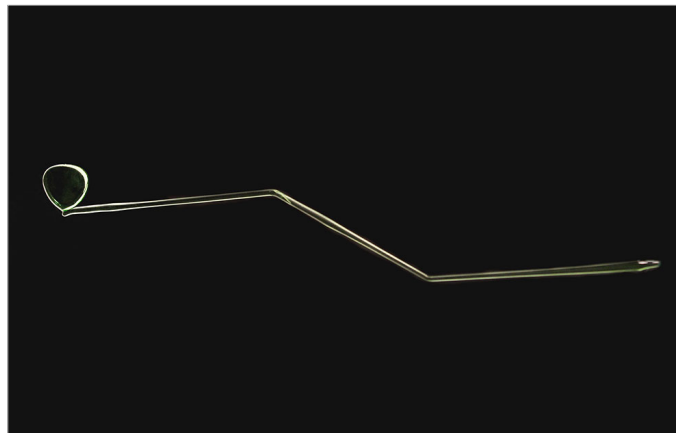
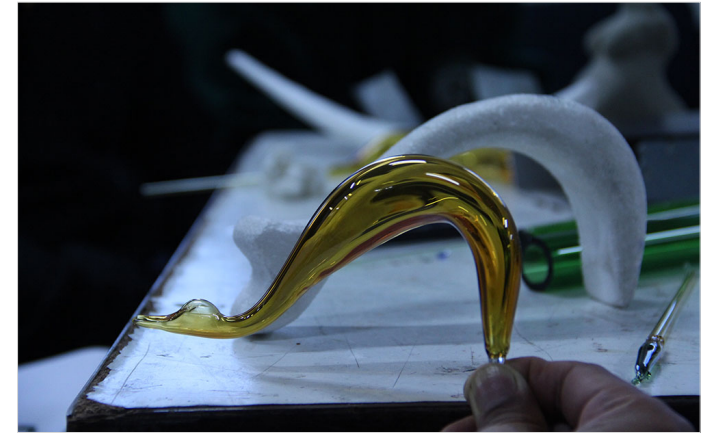
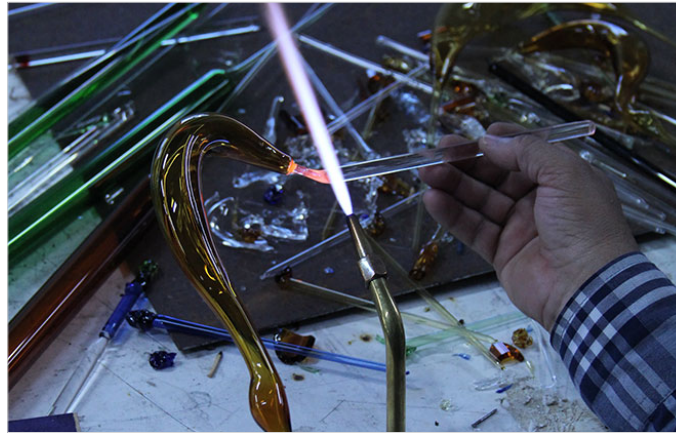
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2. Introduction
3. Approaches
4. Methods
5. Limitations of Designer's Methods
6. Importance of Looking Towards .....
7. Assignments
8. Video
9. Contact Details





Design Course

## Exploring Glass

Studies of Drawing Examples from Nature

by

Prof. Avinash Shende and Shiv Kumar Verma

DoD, IIT Guwahati

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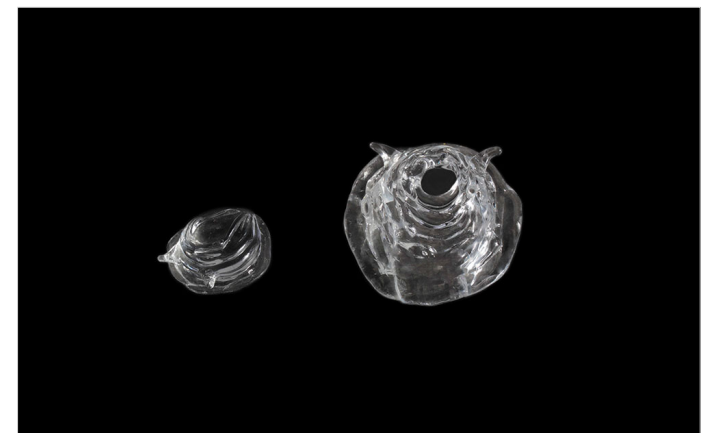
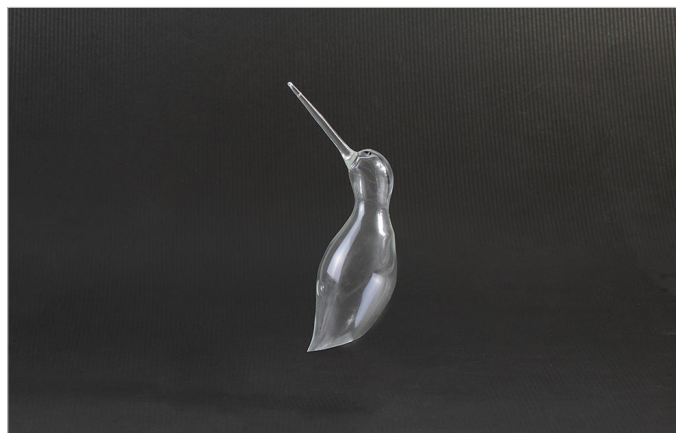
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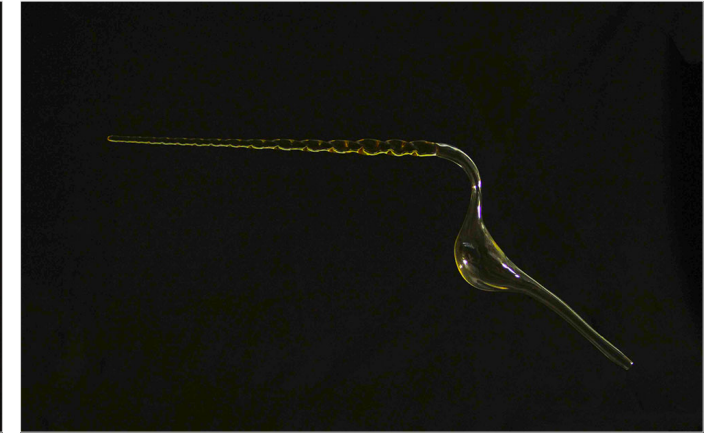
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## Video



Glass Workshop



Interview Part 1



Interview Part II

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## Contact Details

This documentation was done by Prof. Avinash Shende and Shiv Kumar Verma at [DoD, IIT Guwahati](#).

You can get in touch with him at [savinash\[at\]iitg.ernet.in](mailto:savinash[at]iitg.ernet.in)

You can write to the following address regarding suggestions and clarifications:

### Helpdesk Details:

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Project e-kalpa

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