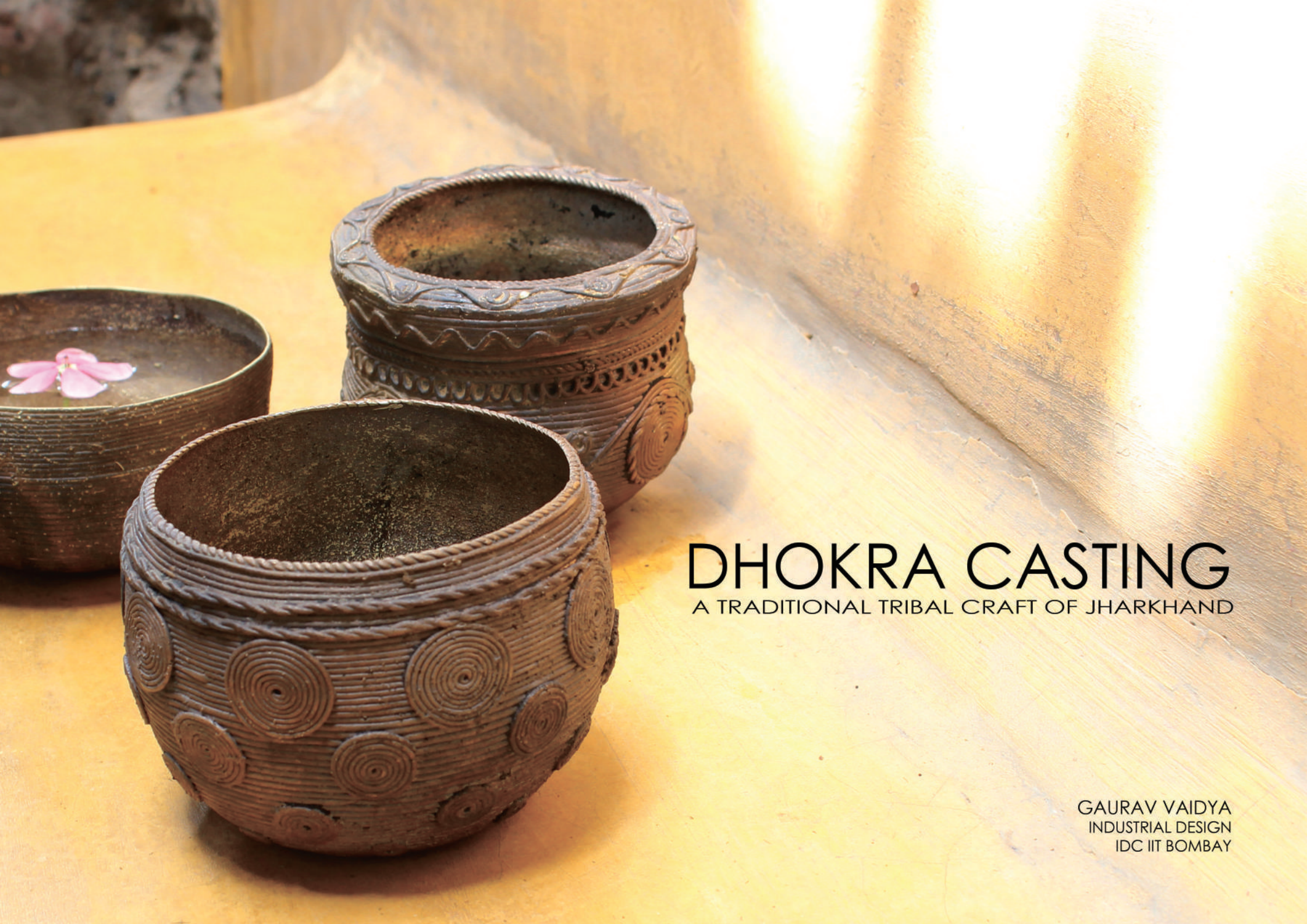

DHOKRA CASTING

A TRADITIONAL TRIBAL CRAFT OF JHARKHAND

GAURAV VAIDYA
INDUSTRIAL DESIGN
IDC IIT BOMBAY

Contents

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Acknowledgement

I would like to extend my thanks to Prof. B. K. Chakravarthy, the HOD, Industrial Design Centre & Prof. Raja Mohanty for giving me the permission to proceed with my internship at Shantiniketan. I would like to extend my thanks to Tata Centre at IIT Bomaby for giving me a wonderful opportunity to visit MIT, Cambridge, Massachusetts to learn research methodology followed there.

This internship would not have had its true meaning without the support, encouragement and guidance I received from Mr. Bidyut Kumar Roy and his wife Mrs. Lipi Biswas.

I am greatful to Mr. Hakim (metal casting artisan) and his son Mr. Nizam for appriciating my work and helping me adjust into dissimilar environment of Jharkhand. I would like to thank Mr. Lala (tribal artisan) and Mr. Pranab Bhaskar (wood artisan) who not only let me use raw materials but also taught me necessary skills to work with those materials.

I am greatful to all those people who wished me well and helped me making my internship days most memorable one.

Introduction

My internship happened in two parts. First part was to observe and understand the things and the second part was hands on exprience with different materials. Both the parts were done in completely different environments.

In my first part of internship, through Tata Centre at IIT Bombay, I got a chance to visit MIT Cambridge, Massachusetts. A group of 20 students from IIT Bombay went there to see the problem solving approach and research methodology followed at MIT. There we observed the institute's working culture, different lab facilities, presentation techniques etc. We also interacted with faculties, students and entrepreneurs.

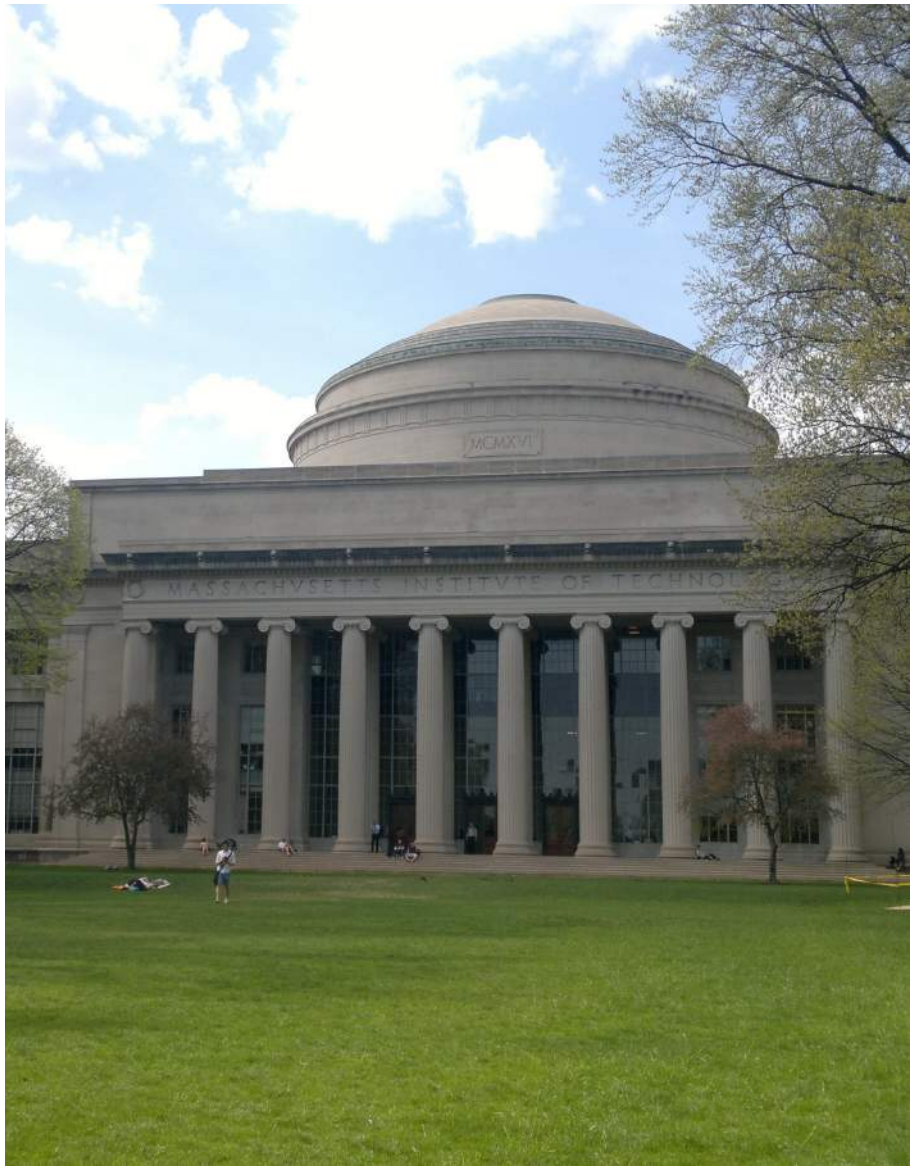
One more important feature of the first part was that I got a chance to visit different museums like Museum of Modern Arts, NY and Museum of Fine Arts, Boston where I could see works of well known artist, product designers, graphic designers. And of course, the fun part like visiting places like Times Square, the Statue of Liberty, World Trade Centre, Central Park, Rockefeller Centre etc.

To explore newer frontiers of design I was unfilmiliar with, in second part of internship I chose to work in a completely new

environment rather than mainstream production and industry. To explore crafts, I went to Shantiniketan, Bolpur in West Bengal. Who would know the traditional crafts and art in Shantiniketan region better than an artist, Mr. Bidyut Roy who has spent more than 30 years of his life in Shantiniketan. I feel fortunate to stay with him and understand his philosophy and his views on different issues.

During the second part, I explored various things and worked with different materials but majority of my time I spent on Dhokra Casting which is a traditional craft of Jharkhand. Within one mont of my summer internship, I could experiance and explore people, their life, style, food, culture from different places like New York, Boston, Shantiniketan (W.B.) and tribal villages in Jharkhand.

MIT Visit



MIT's Building 10

Tata Centre for Technology and Design, IIT Bombay organized a visit for its fellows to its sister centre at MIT from May 2nd -9th, 2015. We reached at Boston airport after almost 20 hours of travel in British Airways flight. All the tiredness due to long journey got away instantly due to warm welcome at hotel and chilly weather of Boston.

During the visit, many exciting opportunities came forward for us to interact with numerous eminent academicians and entrepreneurs. It also generated new ideas and collaboration opportunities. MIT Tata Centre visit offered project discussions and interactive sessions spanning across five domains i.e. agriculture, energy, housing, waste management and water.

In addition to the project discussions, another great learning experience was the opportunity to interact with Dr. Robert Stoner, Deputy Director of MIT Energy Initiative, Prof. Kothari, Associate Dean of MIT Sloan, Prof. Walter Bender from SugarLabs, and the founders of exciting new organizations like Mimo products and Loci controls. Prof. Kothari shared his experiences from engagement with entrepreneurs in US, and discussed possible strategies for BOP-focussed business.

IITB Tata Fellows attending Project Presentation

Camera Culture Lab, MIT Media Labs

Prof. Bender shared his rather inspirational experience in successfully developing and executing the one laptop per child initiative with characteristic passion and zeal.

The visit to Deer Island waste treatment facility was an impressive example of effective waste management. The plant is able to treat nearly half of the state's population and also collects water from rain water runoff from sewers. It removes water from human, household, business and industrial pollutants that creates in homes and businesses in Boston.

This visit gave me an opportunity to explore new country, people and places. The exchange of knowledge, ideas, enthusiasm and enjoyment will remain in my mind for a long time.

Shantiniketan

Viswa-Bharati University

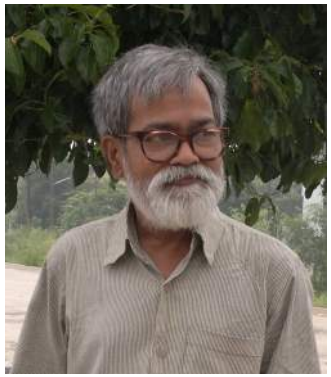
Kala Bhavana

After coming back from MIT, I went to Shantiniketan. Shantiniketan is a small town near Bolpur in the Birbhum district of West Bengal, India, approximately 180 kilometres north of Kolkata. It was established by Rabindranath Tagore, whose vision became what is now a university town, Visva-Bharati University.

The university includes Vidya Bhavana; the Institute of Humanities, Shiksha Bhavana; the Institute of Science, Sangeet Bhavana; Institute of Dance,Drama and Music, Vinaya Bhavana; the Institute of Education, Rabindra Bhavana; the Institute of Tagore Studies and Research, Palli-Samagathana; the Institute of Rural Reconstruction and Palli Shiksha Bhavana; the Institute of Agricultural Sciences.

There are other centres also like, Shilpa Sadana, Nippon Bhavana, Palli-Charcha Kendra, Centre for Biotechnology, Centre for Mathematics Education, Centre for Environmental Studies, Computer Centre and Indera Gandhi Centre for National Integration. Also there are schools for primary, secondary and higher secondary education. Shantiniketan is also home to Amartya Sen, the 1998 Nobel Prize winner in Economics.

Housing - Bidyut Roy



Bidyut Roy (top left), Lipi's Residence (top right & bottom)

In Shantiniketan, I went to a small tribal village called Boner Pukur Danga which is 4km from Bolpur station. Mr. Bidyut Roy who is a visual artist, stays near the village. Though he is a visual artist, he is an architect by profession without any formal training in architecture. He makes beautiful houses using natural materials like clay, wood, bamboo, terracotta stone, khaparail, logs of taal tree etc. He learnt effective use of these materials through experience and experimentation by designing and constructing his own house.

He follows a rigorous process while designing and constructing a house. He makes sure that he understands the space carefully and thoroughly. He spends a lot of time on the place where he is going to design a house. Seasonal variations on the place, direction of sunlight, wind direction, nature of soil, abunduntly available local natural material, regional crafts, character & behaviour of the users etc. are taken into consideration before starting the work. He takes care that the natural environment of the place is always kept intact.

During my stay in Shantiniketan, I stayed in one of his designed houses. It is a double storeyed house for his wife Lipi's parents. Every moment in the house, it feels like you

Balcony with seating area

Bathroom interior with bamboo & wood

are with the nature exxperiencing its beauty. Every corner gives you inspiration and you stop, relax and appriciate the vision of the creator. Materials are so wisely used that they blend seamlessly with each other but make their presence felt in the space. He expalined his philosophy of using natural construction materials and his concept behind making this house through several discussions we used to have at his place.

Dancing Girl (Mohenjo-daro)
(http://nationalmuseumindia.gov.in/prodCollections.asp?pid=44&id=1&lk=dp1)

Dhokra Casting

If the Mohenjo-daro craftsman who famously cast the bronze figurine of a dancing girl some 4500 years ago were to visit central and east India today, he would undoubtedly feel at home. In the Dhokra metal-casting process he will recognize the lost wax technique he himself would have used in his time.[1] Dhokra casting is non ferrous metal casting which uses investment casting or lost wax casting process. Metal used in this type of casting is brass (copper+zinc) or bronze (copper+tin). If tin content is high then it is called as bell metal. It is amongst the earliest known method of casting.

The Name

Dhokra casting is believed to be named after Dhokra Damar tribes which are the traditional metal smiths of West Bengal. The process is well known for its primitive simplicity.
This process is mainly followed in West Bengal, Jharkhand, Chattisgarh and Orissa. Dhokra craft from around Shantiniketan is popular.

History

Lost wax technique is very ancient process followed in India almost for over 4500 years. One of the most celebrated artifact made by this process is the dancing girl of Mohenjo-

Jagudi Village

Shantiniketan to Bagnal (google maps)

daro from Indus civilization. Ornaments, animals, birds, traditional figures, measuring bowls, idols are the most popular handicrafts made by this process.

The Place

Many craftsmen who bring their craft to Shantiniketan market are from Jagudi. Jagudi is a very small village in Dumka district of Jharkhand. It is nearly 90 km from Shantniketan and 22km from Dumka. The village has only 105 houses and none of them is built using cement concrete. All the houses are kachha houses made from locally available materials like mud, wood, stones. Backwater of Massanjore dam has come very near to the village. The way to backwater from the village goes through a small forest.

Jagudi has three padas according to the communities Hindu, Christian and Muslim. The main tribes in the village are Santhal, Dom and Chik Baraik. Craftsmen who practice dhokra casting are from Muslim community of the village.

How to reach Jagudi

Nearest bus stop from Jagudi is Bagnal village. One can reach Bagnal from Dumka or Shantiniketan. Private bus from

Shantiniketan generally takes 4 hours to reach Bagnal and costs Rs.60 per person. The distance between Bagnal and Jagudi is 1.5 km which is to be covered by walking.

Hakimda

Hakimda's house

Traditional Dhokra castings of Jharkhand

The unique feature of traditional casting is that the crucial for melting the metal is attached to the mould and they are fixed together. One casting is produced by each mould that is completely broken after casting is over. I fill fortunate to learn this traditional process from a skilled craftsman, Mr. Hakim. He is the specialist craftsman in the village and his crafts are very popular in around Shantiniketan. Hakimda is practising Dhokra casting for last 30 years and earning his living. He casts anklets, measuring bowls, dancing bells, idols, lamp shades etc. I lived in is house while I was there in Jagudi. He made sure that I feel comfortable at his place.

Process

There are two types of Techniques that are followed by Hakimda :

• Hollow casting -It involves the use of the clay core.

• Solid casting - In this, a solid piece of wax is used to create the mould instead of a clay core.

Scrap Metal

Red Soil

Rice Husk

Coal

Wax

Incense

Raw Materials

Scrap Metal

The primary raw material is brass or bronze metal which is purchased from district market metal shops at Rs.320/- per kg.

Riverside Soil (Lal Mati)

The red coloured riverside soil is collected from riverbanks.

Rice Husk (Dhan)

It is obtained from rice farm owners. It is mixed with red soil in order to prevent cracking of mould during sun drying.

Black Soil (Kali mati)

It is collected from the beds of fields.

Cow Dung (Gobar)

It is mixed with black soil.

Coal

Coal in procured from local traders.

Wax, Incense and Edible Oil

These are mixed together and heated for making threads.

Hand Press

Weighing Pans

Furnace

Tools

Hand press (tool for making wax threads)

Hammer

Knives

Iron files

Tongs

Weighing Pans

Wire Brush

Furnace

Wax & Incense

Crushed Incense

Heating wax & incense

Filtering

Filtered Wax

Solidified Wax Disc

Making of Wax

Candle wax and incense powder are mixed together in equal proportion. The mixture is then heated in a pot over a fire. Some edible oil is added into it. The molten wax is filtered through a cotton cloth into another pot filled with water. The wax solidifies in the pot and forms a disc.

Heating wax

Hand Held Press

Making Wax Threads

Bunch of Threads

Taking out wax threads

A piece from wax disc is taken and heated again to form a soft dough. It is then put into the pipe of hand held press (wax thread making tool). The pipe has bottom opening with very small holes and top opening to put pressure from above. As the pressure is applied on the top handle, the soft dough of wax comes out of bottom holes in the form of threads. These threads are directly put into the water in order to prevent them sticking to each other. The heat of the day makes these threads soft and they tangle easily. Therefore these threads are then taken out and kept in a wet cloth.

Red Soil in Forest

Red Soil

Rice Husk

Soil & Husk in Proportion

Mixing Soil & Husk

Dough of Mixture

Soil Collection and Preparation

The good quality red soil for making moulds is available 1km inside forest. The soil is collected in cement bags and taken to the place of working. It is then mixed with rice husk in appropriate ratio. It is made into a soft dough by adding water in it. Similarly, black soil is mixed with cow dung and formed into a soft dough.

Moulds of Red Soil

Moulds coated with layer of black soil kept for drying

Mould Making

Basic moulds are prepared of red soil by shaping it with hands. The hand pinching technique learnt in Lipi Biswas's studio at Shantiniketan helped me a lot get different forms while making moulds. The moulds are kept for sun drying. Due to extremely hot weather and temperature rising upto 45 deg. C during day time, the moulds dried very fast in almost 6 hours. The dried moulds are coated with a layer of black soil and again kept to dry in the sun. The hard and dried moulds are scrubbed with the help of rough stones to make surface smooth. They are then scrubbed with hands to remove dust.

Coiling of Wax Threads

Before winding wax threads on the moulds, the moulds are kept in sunlight to get heated slightly. Wax sticks easily on the heated moulds. Coiling is started from the top of the mould with thinner diameter thread. Thicker diameter threads are selected progressively as we go down in coiling.

Care to be taken while coiling:

Dip your fingers in oil so that wax does not stick to the fingers.

Do not leave gap in between two rings while winding.

Do not use wax threads which have air bubbles.

One can do design on the top of coiled threads with the help of same wax threads. A channel of wax is attached to the coiled wax. The molten metal will flow through this channel.

Black Soil Layer

Red Soil Layer

Attaching two moulds

Crucibles for scrap metal

Covering Mould with soil layers

A layer of black soil is applied over the wax coiling. This layer is pressed on the coiling so that the soil goes inside the intricate design made on the surface of mould. It is again kept to dry in the sun. A thick layer of red soil is applied over the dried moulds and again kept to dry in the sun.

Attaching two moulds and making bowl at channel openings

Dried moulds are attached with each other in such a way that their channel openings are brought near and a bowl is attached on their openings. It is kept to dry. Crucibles are made to fill the scrap metal.

Scrap Metal Utensils

Heating Scrap Metal

Breaking in Small Pieces

Pieces kept in Crucible

Attaching with mould

Sealing with Red Soil

Scrap Metal

Metal shops in Dumka town sell scrap metal pots, utensils for Rs.320/- per kg. Those pots are put into fire so that they become nard and can be broken in small pieces with the help of hammer. Scrap metal is then weighed for each mould and filled in crucibles. These crucibles are attached to the mould and gap is sealed with red soil.

Moulds kept in Furnace

Furnace Preparation

Hakimda has built a small furnace in which approximately 8kg metal can be casted in single firing. The furnace is a cylindrical structure with brick walls covered with mud layer. The furnace is open from the top and it has passage at the bottom for firing.

The coal pieces are arranged in the furnace in such a way that big coal blocks are at the bottom on which small pieces are kept. Moulds are arranged on the top of the coal in such a way that metal portion of the moulds is at the bottom touching the coal and wax portion remains on the top. The furnace is then fired using dry rice husk. The wax coiled on the moulds melts and evaporates due to high furnace temperature.



Mould Turning

Breaking Moulds

Casted Piece


Mould Turning

The moulds are kept in furnace for 3 to 3.5 hours so that the scrap metal melts completely. After that moulds are taken out one by one and turned upside down. Due to turning, the molten metal flows in the cavities created due to evaporated wax. The moulds are kept to cool down. The hard soil is then scrapped out with the help of tools to get casted metal artifact. The casted piece is then cleaned with wire brush to remove soil stuck in corners.

Final Products

Pottery - Pinching Technique

Clay brought from forest

Sprinkling water and mixing

Hand pinching

Shaping with fingers

Exploring different forms

Pots kept for drying

In this technique, clay is shaped with the help of fingers. For making a pot, one needs to make a ball of clay. Then make a hole in the middle by inserting thumb in the ball. After this, start shaping the clay by pressing thumb slowly from inside and index finger and middle finder from outside. While doing this, rotate the ball gradually and support it at the bottom with palm of the other hand. Pots made this way are called as pinched pots.

The process involved in making pinched pots :

1. Sprinkle water and mix the clay properly to form a dough
2. Make small balls of clay weighing 100 gm each. Exact weighing helps during firing the pots
3. Make thumb opening in the ball
4. Shape it using thumb, index finger and middle finger
5. Make the wall thickness uniform
6. Slightly push the pot on a flat floor to make stable base
7. Pinch the lip of pot slightly outwards if required
8. Allow it to dry for a few days before firing

Tips

- Start shaping the clay ball from bottom to top in spiral way.

Works of Lipi Biswas

- Maintain uniform thickness while shaping.
- Weld deep cracks immediately by applying slurry or small amount of water.
- Make inside of pot smooth by applying small amount of water.

I learnt this technique of hand pinching at Lipi Biswas's ceramic studio from a lady residing in nearby tribal village. Small but very useful tips provided by didi helped me to acquire this technique very quickly.

Lipi Biswas has her ceramic studio in a village Boner Pukur Danga near Shantiniketan. She works there with five other local artisans. Her pottery forms and shapes are inspired from nature. All her works are beautifully arranged in her showroom. The place looks extremely pleasant in the afternoon when the sun rays fall on the pots. The drama of light and shadow gets created due to wisely built studio around a tree. The sunlight falling on walls and pebbles makes the whole atmosphere very delightful. Wise use of flowers, plants and other elements like pebbles on floor, bronze sink and door handle makes the place visually appealing. Visit to this studio is a must thing to do in Shantiniketan.

Wood Carving

Chisels used for carving

Electric Sander

Marking and rough cut

Chiseling

Final product

Wood carvers in West Bengal are popular for their Katwa Dolls. These artisans carve wood and decoratively paint it to make characters like lord Krishna, Radha, Ganesha, Kartikeya, owl, godess Durga etc. Wood atrisans are called as 'Sutradhar' which means narrator or story teller. This may be because make characters from ancient folk stories and tell mythological stories through their dolls.

Tools used for carving

Chisels (Straight, V and U)
Mallet
Hand Sander
Tool sharpening block
Paint brushes

The process involved in wood carving

1. Take a wooden piece cut it to the size required
2. Sand all the faces to make it levelled on all sides
3. Mark the carving design with the help of pen
4. Make a rough cut with the help of 1" or 1 1/4" chisel
5. Details of carving to be done with V and U chisels
6. Apply paint, lacquer coating or burn it with fire torch according to the requirement.



Wooden crafts of Pranav Bhaskar

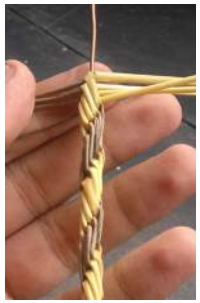
Tips

- The angle of chisel and its cutting edge should be properly kept for each stroke.
- Grip on the wooden piece should not be loose.

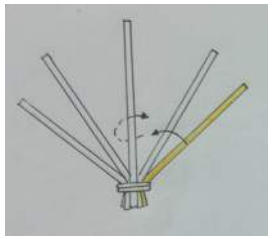
Pranav Bhaskar, the wood artisan, from tribal village Boner Pukur Danga, has wood workshop in the village. The final product is similar to the traditional carving followed by him. There are eight other artisans working with him at his workshop. They make Katwa dolls as well as wooden furniture, doors and carvings on it. They sell their works at Saturday Market called as Shanibarer Haat at Sonajhuri. Many other artisans from nearby villages also bring their work in this weekly crafts market.

Weaving of tree fibers and grass

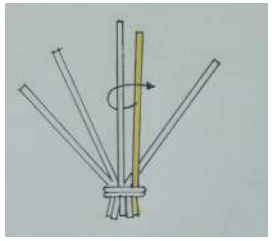
Raw materail used



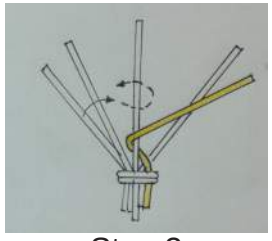
Criss-cross and round weaving



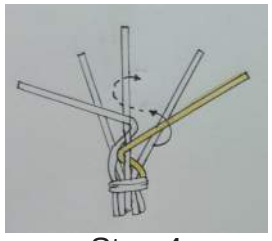
Step 1



Step 2



Step 3



Step 4

Four strands Criss-Cross weaving

Santhali tribe people make jewellery made from tree fibers and grass. They use tree fibers of local tree Hanubela and a type of grass called as Bena which generally grows near water. They weave these fibers on a copper wire. Before weaving the fibers are sun dried.There are two weaving methods they follow

1. Four strands criss-cross
2. 6/8/12 starnds round

Raw material used

Hanubela tree fibers

Bena grass

Copper wire

Sonjhuri tree seeds

Feviquick

Tools used

Wire cutter

Paper cutter

Scissors

Plier

File

Lala’s House

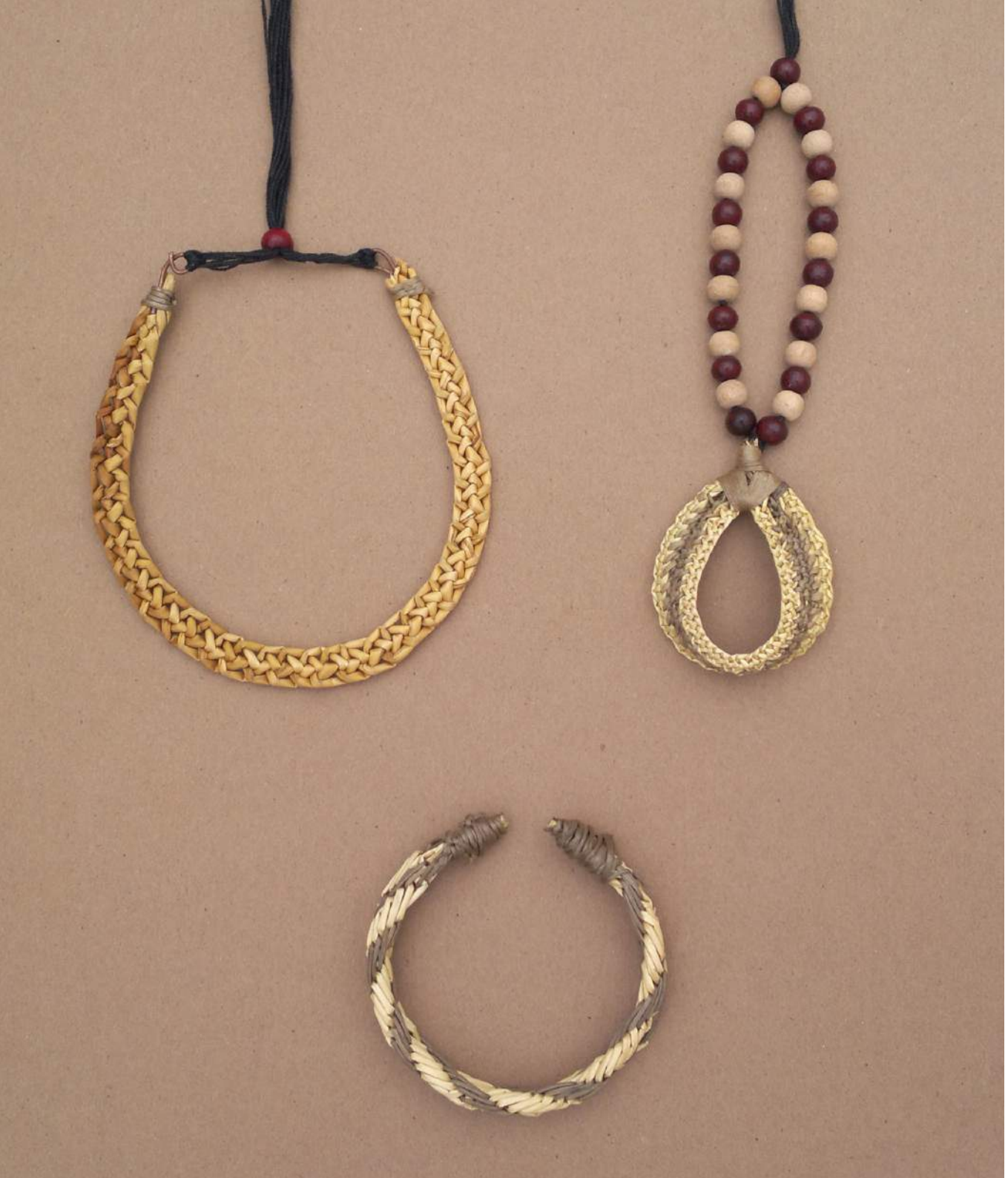
The process involved in weaving :

1. Tie required number of strands to the copper wire
2. Distribute the equal stands on both sides of central copper wire.
3. Start weaving acoording to the images shown for each metod.

The unique feature of this jewellery is that except central copper wire, it is totally made from naturally availble material. Also it is very light weight and does not spoil in water.

I learnt this weaving method from one of the tribal craftsman Lala who lives in village Boner Pukur Danga. The final weaved products are very similar to the products made by tribals.

Weaved Jewellery



MIT Journals

Date: 4th May, 2015

Objective

1. Micro grid electrification for rural India, electrification planning and energy system optimization
2. Visit to MIT library
3. Projects on Mechanical Design for Water Engineering in India

Place

1. E19-319
2. MIT libraries 14N-132

Contacts

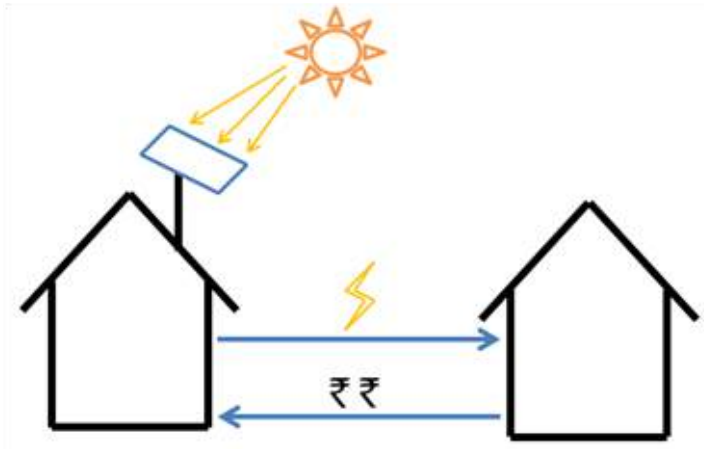
1. Reja Amatya
2. Ms. Jennifer Greenleaf and Ms. Anne Graham
3. Dr. Roger Wang

Summary

(Write briefly about learnings/ points of discussion/ observations made / need finding activities)

After food, clothing and shelter, electricity has become forth

Reja Amatya discussing about Micro grid electrification



Peer-to-peer electricity distribution

need of a human being. Around 1.3 billion people in the world are facing the problem of lack of electricity. Unavailabilty of electricity affects many aspects of human life, like education, health, agriculture, economic development. Reja Amatya, a research scientist at MITEI department is working on this problem of lack of electricity. She also considers electricity as a need and believes in universal access of energy. She gives three solutions to the existing problem

1. Microgrid
2. Planning tool
3. Energy system optimization

The conceptual model proposed by her is peer-to-peer electricity distribution. In this model a single household in rural area may start generating electricity with the help of solar pannel and diesel power generator. Now this household can start distributing electricity to its neighbouring houses and can charge money for that. For this, she is developing Power Management Unit (PMU) which provides the conversions necessary to power specific loads and also helps establish and control the grid. They have successfully demonstrated their model at Jamshedpur. They have used 250W solar pannels in this demonstration.

For better planning and to achieve universal access to

electricity another solution being developed which is a software model known as the Reference Electrification Model (REM). REM will help in planning electricity networks for India and other developing countries. It utilizes Census of India, the National Sample Survey, and satellite imagery to decide best electrification mode for particular region.

Dr. Roger Wang explaining Bio-Inspired Drip Irrigation

In afternoon session, there was presentations and discussions on projects for water engineering in India. Tata fellows are working on water purification using bark of trees. There are plant tissues which can filter the water when it is passed through them at high pressure. This process involves building pressure of 5psi using Nitrogen gas and passing water through tree barks of sizes 2.5" x 2.5". The process removes many harmful bacteria and protozoa. This low cost water filter solution will provide safe drinking water to large rural population. They are also working on improving efficiency of Tata Swach by developing a mathematical model to understand the resistances for the flow of water. The project also involves understanding the user perspective of using a purifier and why people do not prefer to use water purifiers. It utilizes Fishbein Multi-Attribute Attitude Model to compre between various aspects like cost, ease of maintenance,

performance etc. Tata fellows are also working on building bio-inspired pressure compensating drip irrigation which will drastically reduce down the power consumption of water pupms used in agricultural sector in India. This not only saves the energy cost but also saves water.

Link to online media

http://tatacenter.mit.edu/portfolio/peer-to-peer-electricity-distribution/
http://tatacenter.mit.edu/portfolio/rem-a-planning-model-for-rural-electrification/
http://tatacenter.mit.edu/portfolio/development-of-low-cost-water-filters-using-plant-xylem/
http://tatacenter.mit.edu/portfolio/bio-inspired-pressure-compensating-drip-irrigation-emitter/

Date: 5th May, 2015

Objective

1. Housing as Infrastructure for Urbanization
2. Health Discussion
3. Interactive session with Walter Bender

Place

1. E19-319

Contacts

1. Aditya Barve and Thomas Point
2. Miho Mazereeuw
3. Jesse Austin
4. Walter Bender

Summary

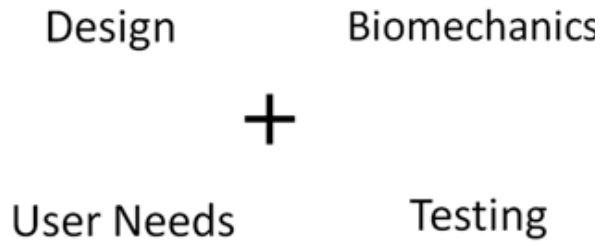
(Write briefly about learnings/ points of discussion/ observations made / need finding activities)

According to the Times of India, “a majority of Indians have per capita space equivalent to or less than a 10 feet x 10 feet room for their living, sleeping, cooking, washing and toilet needs.”

The problem of housing is severe in cities like Mumbai where majority of population is living in slums where basic hosing infrastructure like water supply, sanitation, drainage system is in substandard state. India's housing shortage was estimated to be 18.78 million units in 2012. Aditya Barve, an architect and post docs fellow at MIT, is working on several projects which deal with creating housing for new demand and for current deficit. Among the world's 100 fatest growing cities 24 are the Indian cities. There are many tier II cities like Ghaziabad, Faridabad, Asansol etc in that list which are not in focus for proper urban planning particularly by the government. The unplanned growth of these cities leads to more loss of lives in case of risk events like floods and earthquakes. The material commonly used for housing construction is cement and fire bricks. These materials have their own disadvantages like

1. Rising cost
2. Environmental issues
3. High energy requirements
4. Deplition of natural resources
5. Emission of pollutants
6. Labour availavilty and
7. Labour skills

For the design of thermally autonomous hosing project Tata



Process followed for redesigning Jaipur foot

centre at MIT and Hunnarshala foundation in Gujarat are working together to build and innovate upon existing building traditional crafts in housing. This project tries to understand that can we learn and improve local methods of construction. In particular, they are trying to improve thermal performance of a house by designing roofing with locally available material and testing it with different arrangements. Another discussion on housing was on low cost, earthquake resilient housing using confined masonry. Confined masonry uses less steel and concrete than a proper RCC frame and hence costs less.

One of the projects in health sector was to design a low cost, high performance, mass manufacturable prosthetic foot. Tata fellows are working with Bhagwan Mahaveer Viklang Sahayata Samiti (BMVSS) to design mass manifacturable version of Jaipur foot. The design process they are following is to understand the needs of the user, find out the problem areas with the current design, design keeping biomechanics of human body in mind, prepare prototypes and test it with actul users to understand the shortcomings of the design. Detailed analysis of daily activities performed by the user and their importance as well as the difficulty involved while performing those tasks has been studied.

In discussions with Walter Bender, former director of MIT

Media Labs and current executive director of sugar labs, he explained how he developed $100 laptop for school kids. He says, while executing a project, 90% of the learneings happen in last 10% of the work. He belives in the pholosophy that let people be the designer and bring design tool to them.

Link to online media

http://tatacenter.mit.edu/housing-infrastructure/
http://tatacenter.mit.edu/portfolio/low-cost-earthquake-resilient-housing-confined-masonry/
http://tatacenter.mit.edu/portfolio/design-and-evaluation-of-a-low-cost-high-performance-mass-manufacturable-prosthetic-foot/
https://en.wikipedia.org/wiki/Walter_Bender

Amshuman Das explaining Computational Photography

Date: 6th May, 2015

Objective

1. Health Diagnostics at the Tata Center
2. Social Science Research on India-Relevant Topics
3. Interactive Pro-seminar session.

Place

1. E19-319
2. MIT media labs

Contacts

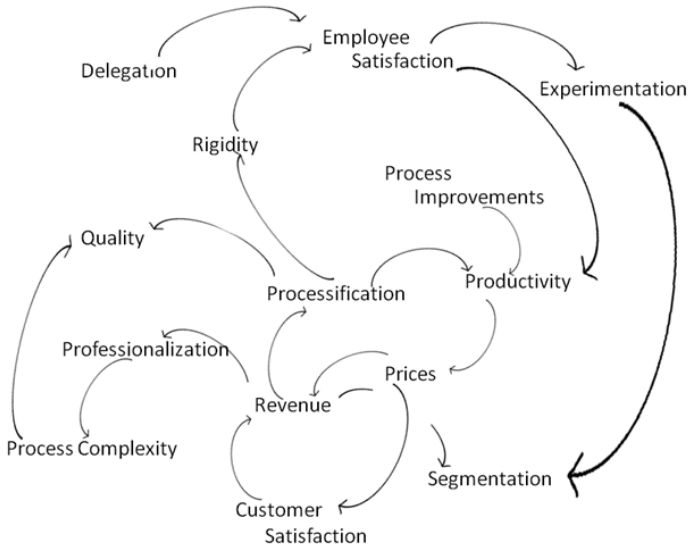
1. Anshuman Das
2. Aruna Ranganathan

Summary

(Write briefly about learnings/ points of discussion/ observations made / need finding activities)

Anshuman Das, a post docs fellow at MIT Media Labs explained how they are using computational photography to do subskin imaging for health diagnostics. By recording multiple images, they compute the direct scattering of laser

Tata Fellows at Camera Culture Lab, MIT Media Labs



light from the skin and eliminate unwanted scattering from the underlying tissue. He also explained how modern camera technology helps to find healthcare solutions. The discussion also included introduction to various modern developments in camera and photography like 5000 frames per second phantom camera, femtosecond laser, streak camera etc. An interactive session with Aruna Ranganathan gave insights of social issues in India. The day ended with pro-seminar session on engineering the end-to-end value chain.

Various types of company strategies and philosophies that were discussed like

Google - Give product to users, let them find out the problem and then solve it.

Apple – Do not release half done product in the market. Test it completely and then give it to the user.

Startups- Speed is very important. As they have limited number of resources and they have to show success before running out of money to generate more money from the customers.

The session also helped to keep balance between creativity and discipline.

Link to online media

http://tatacenter.mit.edu/portfolio/health-diagnostics-skin-perfusion-photography/

https://www.youtube.com/watch?v=taJOV-YCieI

Mike Laracy presenting his work on Innovative Housing

Date: 7th May, 2015

Objective

1. Innovative Housing : Bricks from industrial waste
2. Prototype to shipping in 3 months : understanding entrepreneurship challenges and possibilities

Place

1. E19-319
2. Student Activity Center (Amos Winter's class)

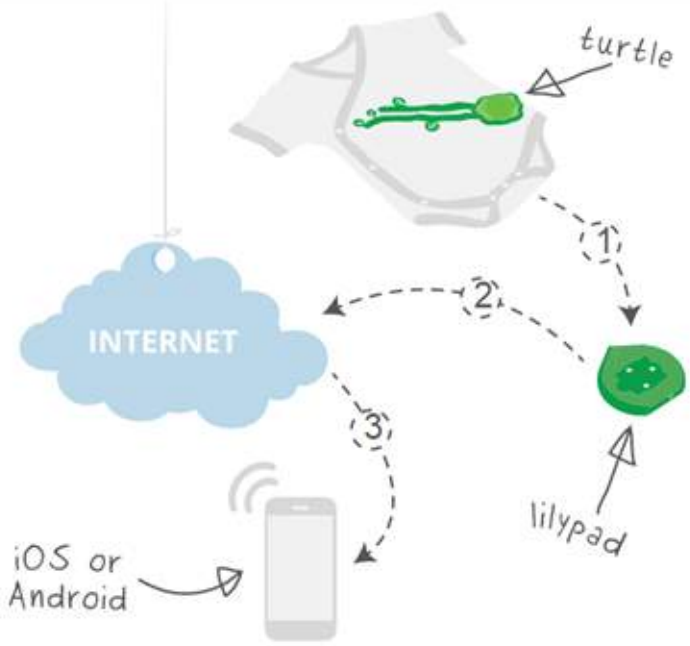
Contacts

1. John Ochsendorf, Chris Porst, Mike Laracy
2. Thomas Limpoa

Summary

(Write briefly about learnings/ points of discussion/ observations made / need finding activities)

There was discussion on urbanization, population growth in India and its implication on housing. The shortage of raw material for construction of housing is a major issue faced by many developing countries. Prof. John Ochsendrof and



Working of kimono

Tata fellows ate working on a project to use industrial waste of paper industries to manufacture low cost bricks which is both economically and environmentally sustainable. There are many industries in India which produce boiler ash as their waste product. This project is scalable to all the regions in India where such industrial waste is available. Our concern was that there are many industries in India which make fly ash bricks. There was no significant comparison between these two kinds of bricks on the basis on cost, thermal properties and mechanical properties like tensile and compressive strengths.

In another discussion with Thomas Limpoa, an entrepreneur, we understood various aspects of new product development and whole product design process right from the concept generation to shipping the final product. Mr. Thomas has developed a smart baby monitor called as kimono. The Mimo kimono is made of soft cotton with respiration sensors pressed to the top of the kimono, keeping anything from touching your baby's skin. Information from the sensor is sent by the Turtle via Bluetooth to the Lilypad, which then relays that data and live audio through the cloud connected smart device.

Link to online media

http://tatacenter.mit.edu/portfolio/masonry-from-industrial-waste-urbanization-and-environment/

http://tatacenter.mit.edu/portfolio/low-cost-earthquake-resilient-housing-confined-masonry/

http://mimobaby.com/

Date: 8th May, 2015

Objective

1. To comprehend the working process of Deer Island waste water treatment plant.
2. Feedback

Place

1. E19-319
2. Deer Island

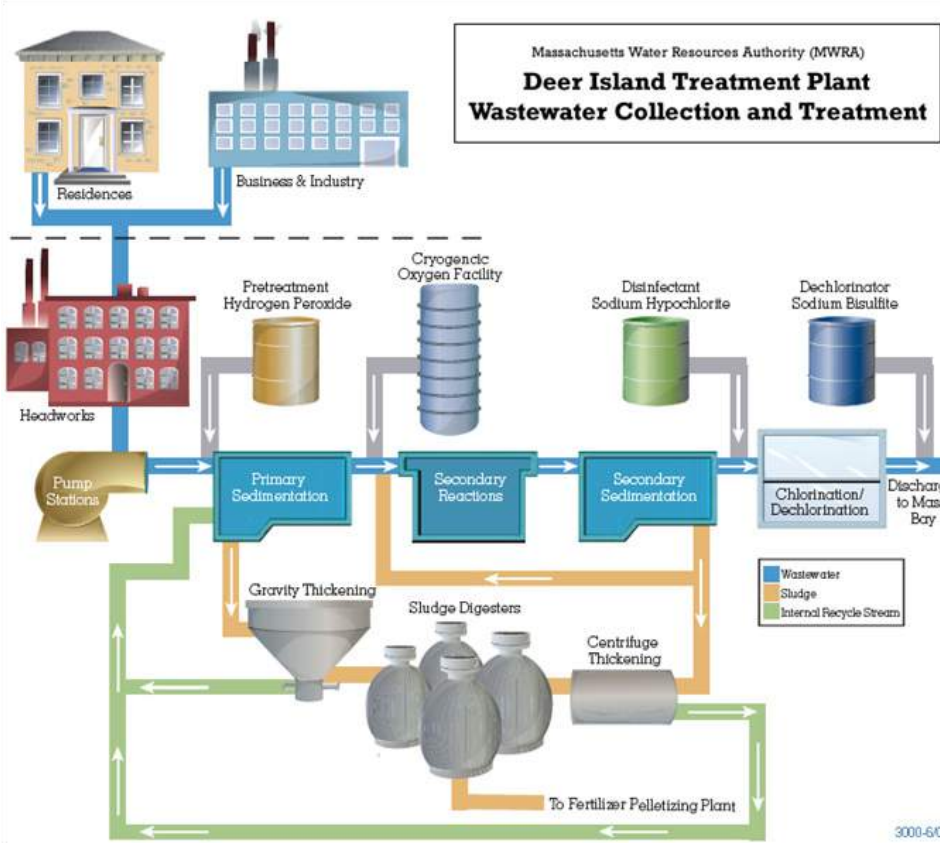
Contacts

1. Rob Stoner
2. Shawn Bamforth and Andy Campanella

Summary

(Write briefly about learnings/ points of discussion/ observations made / need finding activities)

The Deer Island wastewater treatment plant is the $3.8 billion program to remove the pollution from Metropolitan Boston's sewer systems. It is able to treat nearly half of the state's population and also collects water from rain water



runoff from sewers. It removes water from human, household, business and industrial pollutants that creates in homes and businesses in Boston. From people using water in kitchens and bathrooms in their homes and from commercial and industrial use. Nearly half the state's population, over 2 million people in 43 communities, sends sewage to MWRA's treatment plants on the shores of Boston Harbor. Over 5,500 businesses and industries contribute wastewater as well. In addition, nearly half of the total flow in MWRA sewers is from rainy-weather street runoff and from below-ground cracks and faulty connections that allow groundwater into the system. The communities are connected with the sewage through pipe network where bricks, logs and other large objects are screened out. Then Primary settling tank treats about 60% of the total solids by sedimentation, hence removes 50% of the pathogens and the toxic contaminants. In this step, gravity is used to separate the sludge and scum from the wastewater. In the secondary treatment, the mixers, reactors and clarifiers remove the non-settleable solids through gravity and biological treatment. The growth of micro-organisms speeds up by the use of added oxygen. Over 85% of the pollution removal occur in this step. Centrifuges are used to thicken the sludge and scum. The digestion process is taken out in the big egg

Reflection session with Prof. Sanjay Mahajani

shaped anaerobic digesters which mimics the stomach's natural digestion process. Disinfection is done by the use of sodium hypochlorite in order to kill bacteria and then sodium bisulfate is used to dechlorinate the water. This stream of treated wastewater, known as effluent, travels through a 9.5-mile Outfall Tunnel bored through solid rock more than 100 foot below the ocean floor, through more than 50 individual diffuser pipes, each with eight small ports for rapid mixing. The remaining sludge is processed and converted into fertilizer pellets.

The educational trip was ended with the reflection session with Prof. Sanjay Mahajani.

Link to online media

http://www.mwra.com/

References

1. Prof. Kochhar, Rajesh, The Traditional Art of Metal Casting, Chitrolekha International Magazine on Art and Design, (ISSN 2231—4822), Vol. 1, No. 2, August, 2011
2. http://www.dsource.in/resource/dhokra-shilp/process/lost-wax-tech/lost-wax-tech.html
3. https://en.wikipedia.org/wiki/Santiniketan

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IIT BOMBAY

Ref.:- TCTD/Interns/2015-16/10 **Date**: - 13/07/2015

To Whomsoever It May Concern

Tata Centre for Technology and Design (TCTD) at IIT Bombay focuses on developing technologies, products and systems to deal with the challenges facing India's bottom sector.

This is to confirm that Mr. Gaurav Vaidya was part of the study tour to MIT USA from 2nd to 9th May 2015.

We wish him success for all his future endeavours.

Kind Regards,

13/7/2015

Sanjay Mahajani
Professor-in-Charge
Tata Centre for Technology and Design
IIT Bombay

To Whomsoever It May Concern

This is to certify that Mr. Gaurav Vaidya, M.Des Product Design, Industrial Design Centre IIT Bombay, has done his Summer Internship for a period from 21st of May, 2015 to 13th of June, 2015 and has worked in following fields:

1. Dhokra Casting
2. Wood Carving
3. Pottery – Hand Pinching Technique
4. Tribal Weaving Technique

Mr. Gaurav Vaidya has been found to be keen in exploring different crafts in Shantiniketan region and working with various materials. His conduct has been good throughout the internship period. I wish him all the success for his future endeavours.

Place: SANTINIKETAN

Date: 15.06.2015

Bidyut Kumar Roy

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