Athul Dinesh

DESIGN PORTFOLIO

I'm Athul Dinesh,
and I teach at the National Institute of Design, R & D campus in Bengaluru in the Universal Design Discipline of the Industrial Design Department.

I also work as a Design Consultant for projects of Service Design, Industrial Design and Design Research.

I partner with the artisans of Traditional Indian Handicrafts to make contemporary products.

My design focus is on Ergonomics, Design Thinking, Design for Elderly, Disabled and Children, Toy Design and Design Management.

My research focus is on Inclusivity through Design and Design for Play.

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ACADEMIC PROJECTS

Paletteballet

Children play with things all the time. What if this play can be transformed into a beautiful painting? This is what Paletteballet does. It is a tool that allows children to let out their inner artist.

KOKUYO DESIGN AWARD 2018

 # PALETTEBALLET

A free- form painting kit which nurtures creativity in children through play.

BRIEF AND IMPACT

Paletteballet was started as a project to improve the way in which children make their artwork. A workshop was conducted to understand how they paint. The activity was closely observed and recorded. Thoughts were put into improving this experience into a better one and Paletteballet was born. The skill of traditional Channapatna artisans was an essential part of this project. The project won the merit award In January 2019 for the best Industrial Design at Tokyo, Japan in a competition held by Kokuyo International. The product was chosen from around 1289 world-wide entries.

YEAR

2018

DISCIPLINE

Industrial Design
Craft Design
Accessible Design

SECTOR

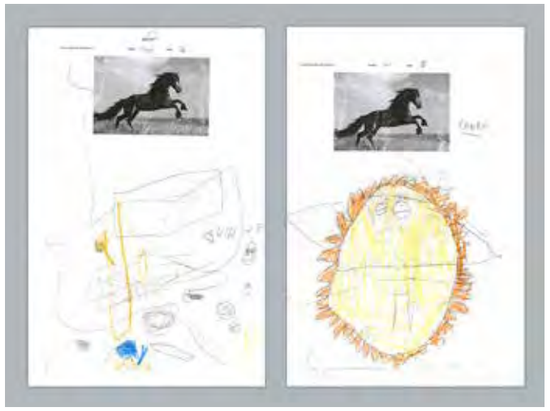
Toy
Consumer goods
Stationary

COLLABORATORS

Bharat Arts and Crafts, Channapatna
Pranav Bidwe (Content creation)
Ghufran Ahmed (Title and Video creation)

https://www.kokuyo.com/en/award/archive/prizepast/2018.html

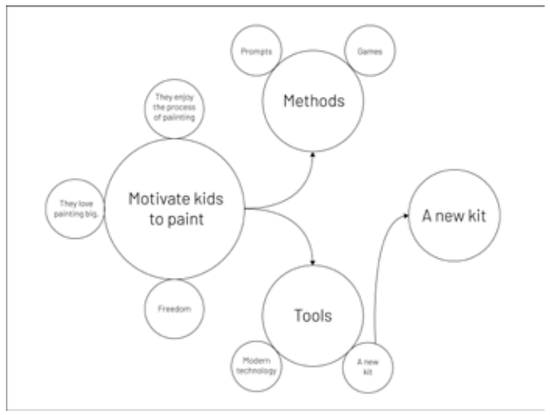
#1 WORKSHOP
To understand how children paint.



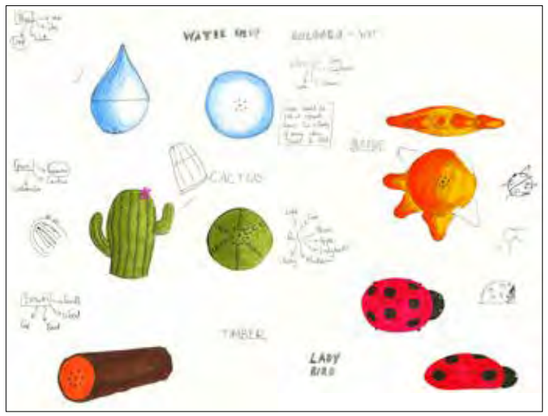
#2 FINDINGS
Children enjoyed the process of painting.

#7 COLOUR STORAGE
Containers inspired from elements of Nature.

#8 MIXING
Shake to drop the colour pigment.



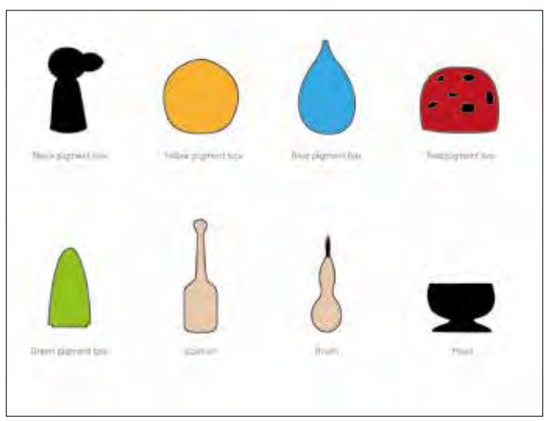
#3 IDEA MAPPING
How to make a painting kit.



#4 IDEATION
Words to sketches.

#9 TESTING
A girl mixing the colour.

#10 SPINNER
A girl using the spinner to paint.



#5 FINAL PRODUCT FORMS
Dimensional drawing of the product.

#6 MANUFACTURE
With traditional toy making technique.

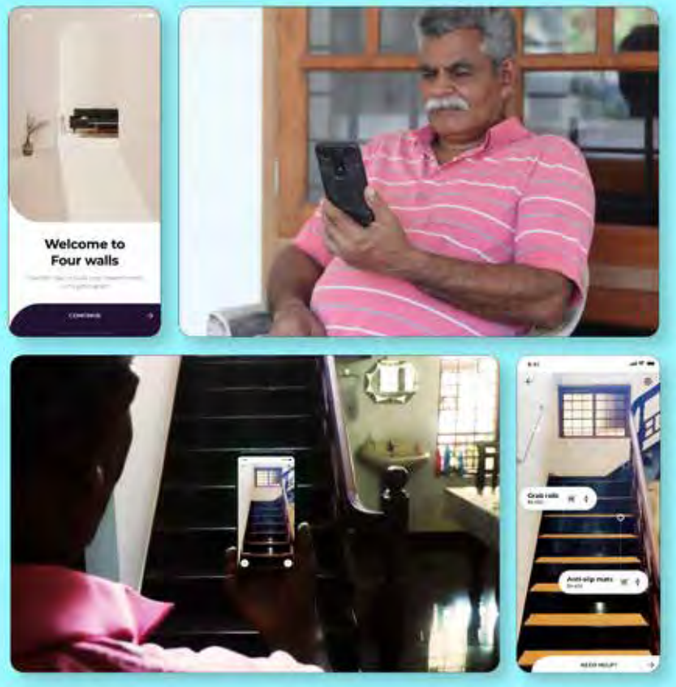
#11 INTERNATIONAL APPRECIATION.
The project won the Kokuyo Design Award.

#12 INTERNATIONAL WORKSHOPS.
Children at an exhibition in Malaysia.

Four Walls

How might we harness age-friendly design to ‘future-proof’ homes so they are sustainable, safe and inclusive places to live and enjoy?

RSA Student Design Awards Winner 2021



 # FOUR WALLS

A design solution to solve the accessibility issues of homes across the globe.

BRIEF

In India only three percent of buildings are accessible according to the Department of Empowerment of People with Disabilities (DEPwD). This is despite a significant number of people with physical disabilities and a population of over-60’s expected to increase from 8 to 20 percent by 2050. Four Walls is a platform and service design concept which helps users to learn about accessibility upgrades and products that can be applied to their homes. The platform provides advice and solutions while also showcasing existing ready-made products on the market. A small network of local experts and labourers is also available to consult with and source for bespoke products..

YEAR

2021

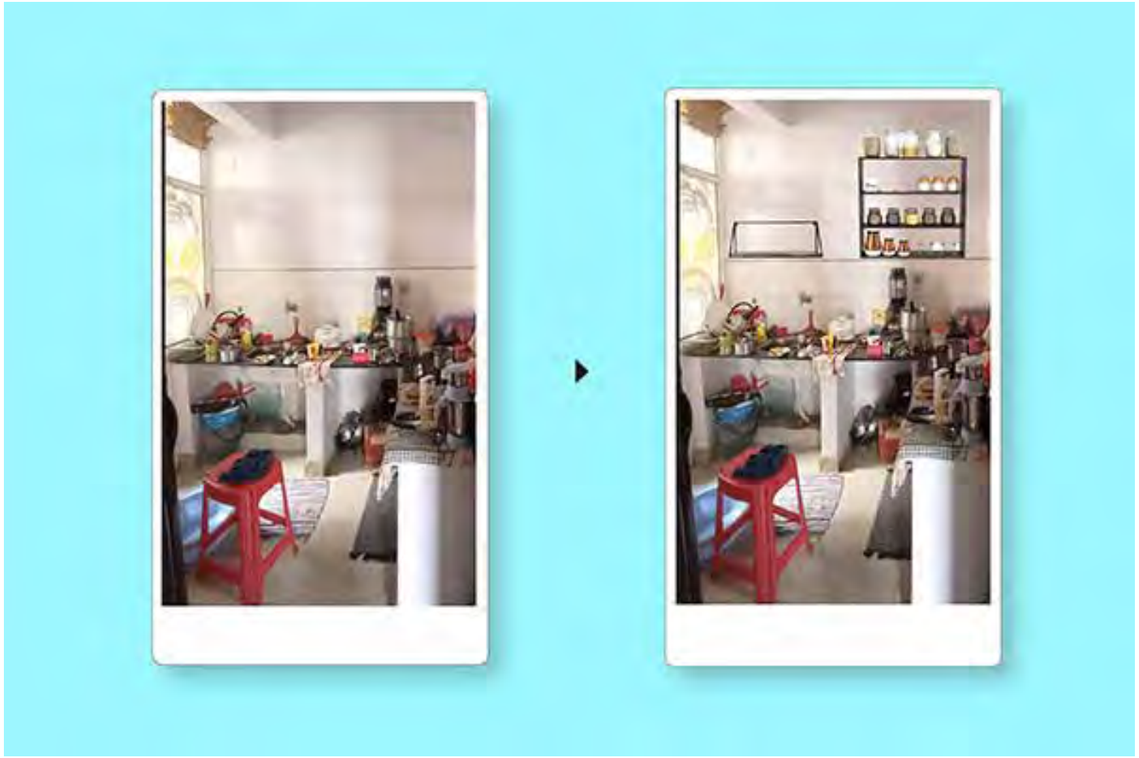
DISCIPLINE

Human- Centered Design
Accessible Design
UI/UX Design

SECTOR

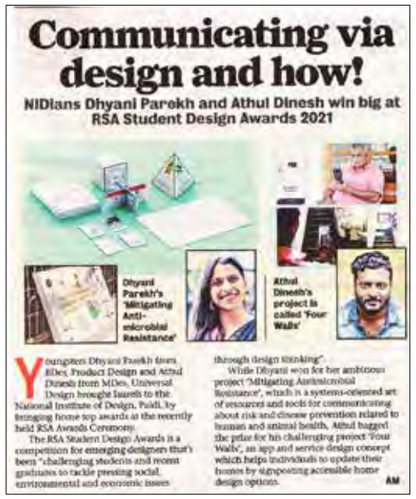
Service Design

https://www.thersa.org/student-design-awards/winners/2020-21/home-sweet-home



#1 FOUR WALLS APPLICATION
The app searches for accessibility issues in the house and suggests bespoke solutions.

#2 FOUR WALLS SYSTEM DESIGN
The diagram of the product-service-system.



Communicating via design and how!

NIDians Dhyani Parekh and Athul Dinesh win big at RSA Student Design Awards 2021

Dhyani Parekh's 'Mitigating Anti-microbial Resistance'

Athul Dinesh's project is called 'Four Walls'

Youngsters Dhyani Parekh (BDes, Product Design) and Athul Dinesh (MDes, Universal Design) brought laurels to the National Institute of Design, Paldi, by bringing home top awards at the recently held RSA Awards Ceremony.

The RSA Student Design Awards is a competition for emerging designers that's been "challenging students and recent graduates to tackle pressing social, environmental and economic issues through design thinking".

While Dhyani won for her ambitious project 'Mitigating Antimicrobial Resistance', which is a systems-oriented set of resources and tools for communicating about risk and disease prevention related to human and animal health, Athul bagged the prize for his challenging project 'Four Walls', an app and service design concept which helps individuals to update their homes by signposting accessible home design options.

AM

NEWS DIGEST

NID students win RSA awards

Two students of the National Institute of Design, Dhyani Parekh (BDes in product design) and Athul Dinesh (MDes in universal design), won the top honours at RSA Student Design Awards 2021. The awards recognize fresh graduates' works focused on social, environmental, and economic issues through design thinking. Dhyani won for her project 'Mitigating Antimicrobial Resistance', a systems-oriented set of resources and tools for communicating risks and disease prevention related to human and animal health. Athul's project 'Four Walls' won for his concept to help individuals to update their homes by marking accessible home-design options.

#3 STUDENT DESIGN AWARDS
Newspaper cutting from dailies on winning the awards, June 2021.

#4 WINNERS ONLINE CEREMONY
The ceremony was held online due to the COVID-19, pandemic.

#5 THE TROPHY
The Royal Society of Arts, Student Design Awards, Pebble.

Tree of life

We are all part of a whole. A family, a neighbourhood, a state, a province, a country or a planet. But what holds us together? It is a heritage. But how can we make people understand the importance of heritage? Through interactive storytelling.

HERITAGE
International Open Electives
22 Jan-2 Feb'2018

 # LEAVES OF HERITAGE
The leaves containing the essence of the heritage of Ahmedabad, scattered on the floor.

BRIEF
The tree of life structure and 'jaalis', seen at various parts of Ahmedabad was the inspiration for our installation. It represents a tree that provides good health and wealth eternally to the people. Here, in our installation we put in both the traditional and the modern ways of design and fabrication. In the interactive installation, there is a lifeless tree to which the visitors are ushered to connect the leaves, and give life to it. The tree represents the culture of Ahmedabad. The people and architecture give life to it. The gesture of picking up the leaf with photographs of the people and architecture of Ahmedabad, and connecting the leaf to the tree represents giving life to an inert object.

YEAR
2018

DISCIPLINE
New Media Design
Universal Design

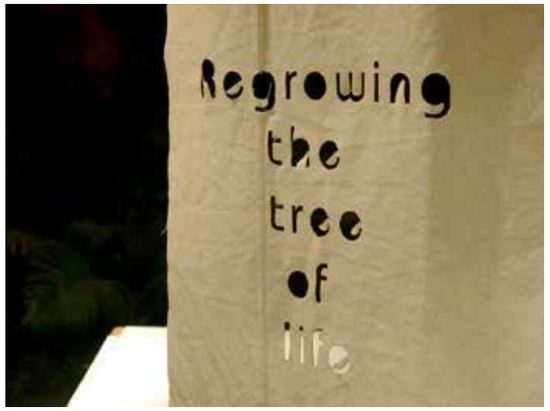
SECTOR
Manufacturing
Narrative Installation

COLLABORATORS
Evy Design Studio, Paris
Ravi Deepres, Birmingham City University
International Open Elective, NID Paldi
Ananth Krishnan, Igin Shaji, Namita Verma,
Ronit Pandya, Suhas Sourav

#1 FIELD STUDY
The crowded market in old Ahmedabad.

#2 FIELD STUDY
Two boys in Sunday market.

#7 PAINTING
The elements were spray painted.



#8 PROPS AND DISPLAY
Hangings were made from cloth.

#3 SKETCH
A very rough sketch of the installation.

#4 MAKING THE TREE FRAME
The tree was made with wires of different gauge.

#9 EXHIBITION
Initially all the leaves were on the floor.

#10 THE GROWTH OF THE TREE
People started connecting the leaves to the tree.

#5 LEAVES
The leaves were laser cut from photographs.

#6 FLOWER
Some elements were made by 3D printing.

#11 MORE LEAVES.
In the end all the leaves were tied on to the tree.

#12 THE END.
At the end of the day the tree was in ‘alive’.

CLIENT PROJECTS

Design of Playthings

I started designing for children as an independent practice after my graduation. I created playthings for many international clients. Most of the designs were manufactured out of wood and sustainable materials. The world of Play has attracted me so much because it is challenging and satisfying. I focus on the co-creation of toys with the children. I exhibited my toys at Spring fair 2022 in Birmingham, UK and Kuala Lumpur, Malaysia.

YEAR
Since 2020

DISCIPLINE
Design for Play
Industrial Design

SECTOR
Toy and Game

COLLABORATORS
Fusion De Nova, Chennai.
Bharat Art and Craft.
Midhun Muraly.

 # TOY DESIGN
Discussion with co- designer.

#1 SPINNING TOP
Plain wood spinning top.

#2 SPINNING TOP
Lacquer finished spinning top.

#3 DOLL
Lacquer finished doll.

#4 FARMERS
Abstract farmer models created by artisans.

#5 DARTH WADER
Star wars characters made by artisans.

#6 CHICKEN
Lacquer finished dolls.

#7 FIDGET TOYS
Fidget toy prototypes made in Channapatna.

#8 SPINNING TOP
Spinning top made in red and orange lacquer.

Bharat Art and Crafts

COMPANY PROFILE
The company has its roots all the way back in 1700, when its primary function was the manufacture of wooden dipping pens. At present Mr. P Mohamed Ilyas carries on the legacy with his sons. This company and its innovations have been part of people's lives for 5 generations and is continuing to move forward. One of our newest developments is the inauguration of a new unit in the Channapatna Craft Village.

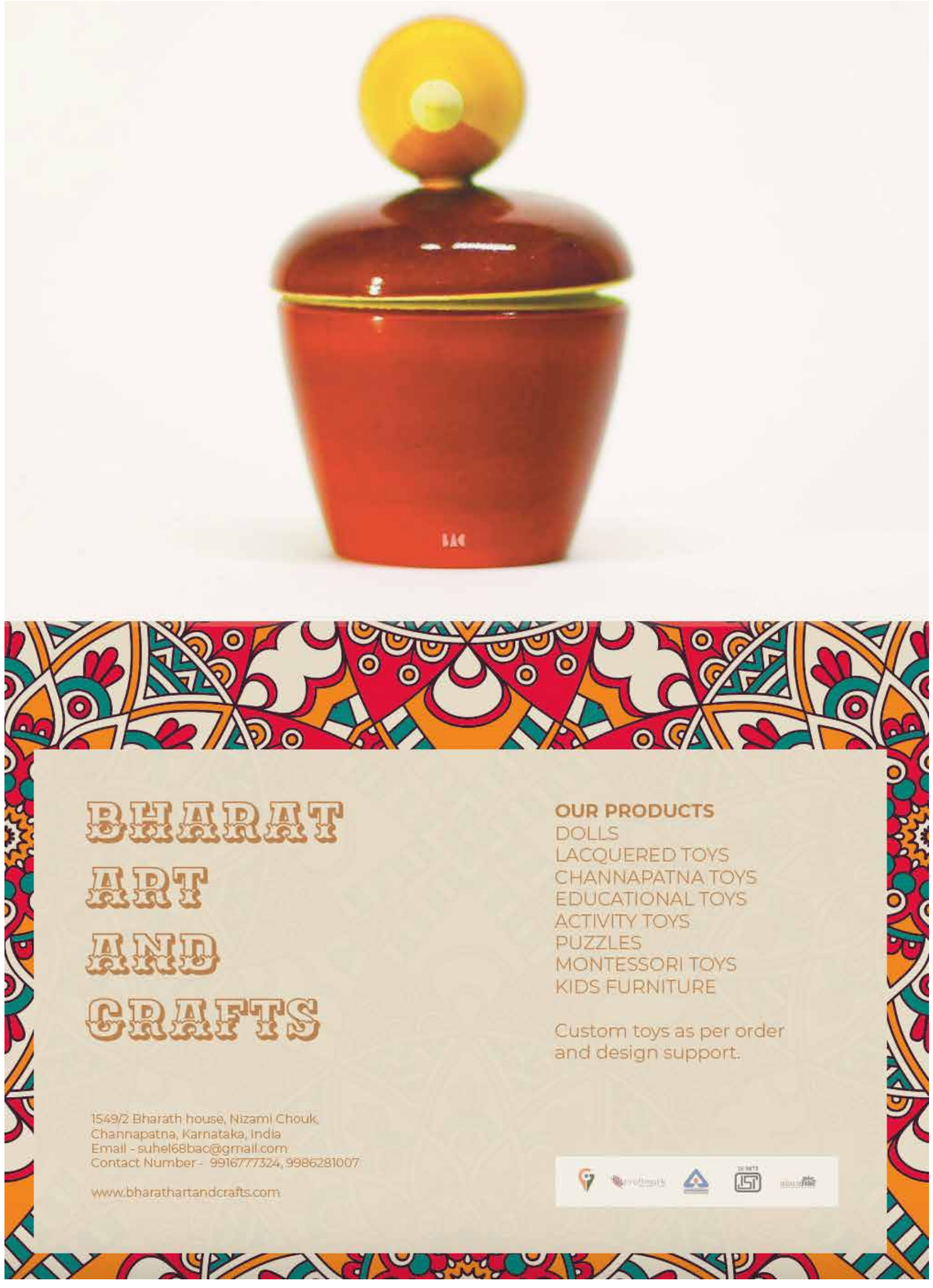
BRIEF
The company with such long tradition and legacy wanted a new brand identity to match with the modern world. I created a new logo, brand guidelines and a new website for Bharat Art and Crafts.

YEAR
2022

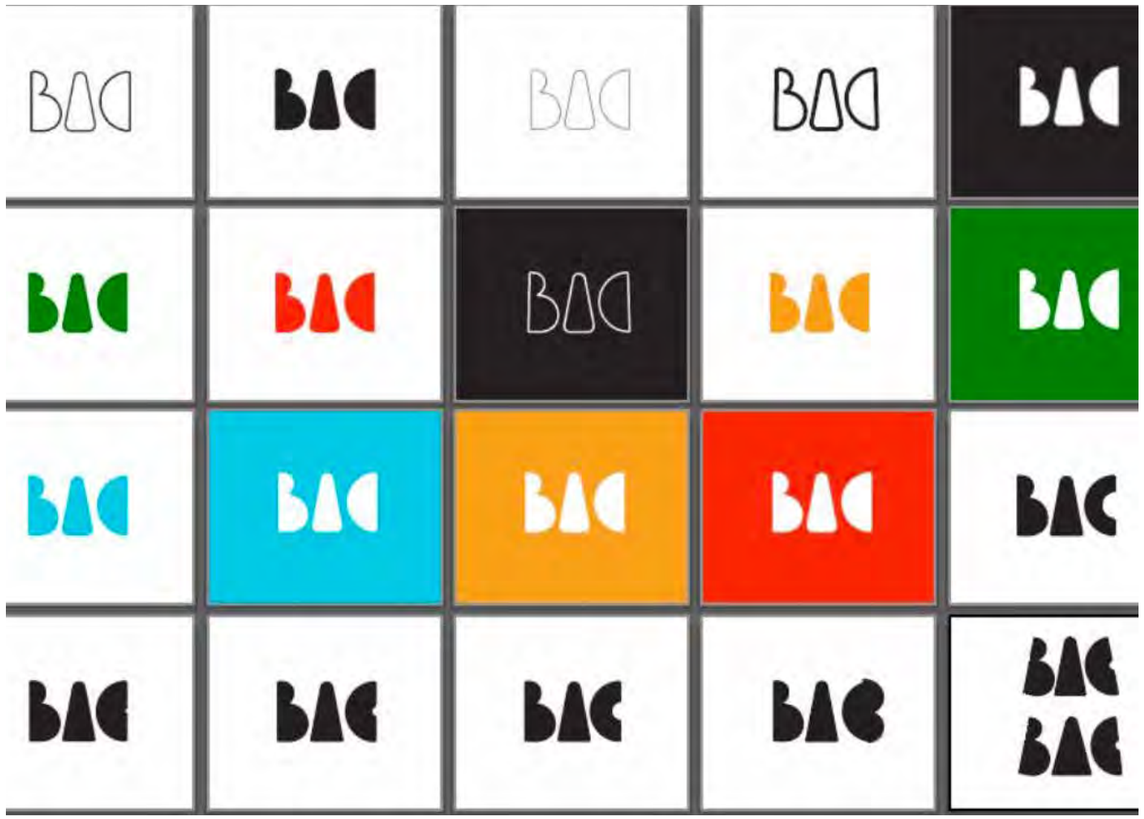
DISCIPLINE
Brand Identity
UI/UX Design

SECTOR
Social Work
Craft

COLLABORATORS
Farhan Ibnee Abid
Roshan Rajendrababu



 # BAC Brochure
The brochure was made for the publicity of the brand.



#1 LOGO ITERATIONS
Logo designs were inspired by Channapatna manufacturing process.

#3 PRINTED LOGO
Logo printed on the packaging.

#2 LOGO ON A TOY
New logo etched on a toy .

#4 BAC WEBSITE
Newly designed website of Bharat Art and Crafts.

Yarnit

COMPANY PROFILE
Yarnit is an early-stage start-up with a SaaS product, in the space of digital storytelling.

At Yarnit, the goal is to reduce the time, cost, and complexity of digital storytelling, with an AI based intelligent guided service, which leverages best practices from storytelling and multi-media communication.

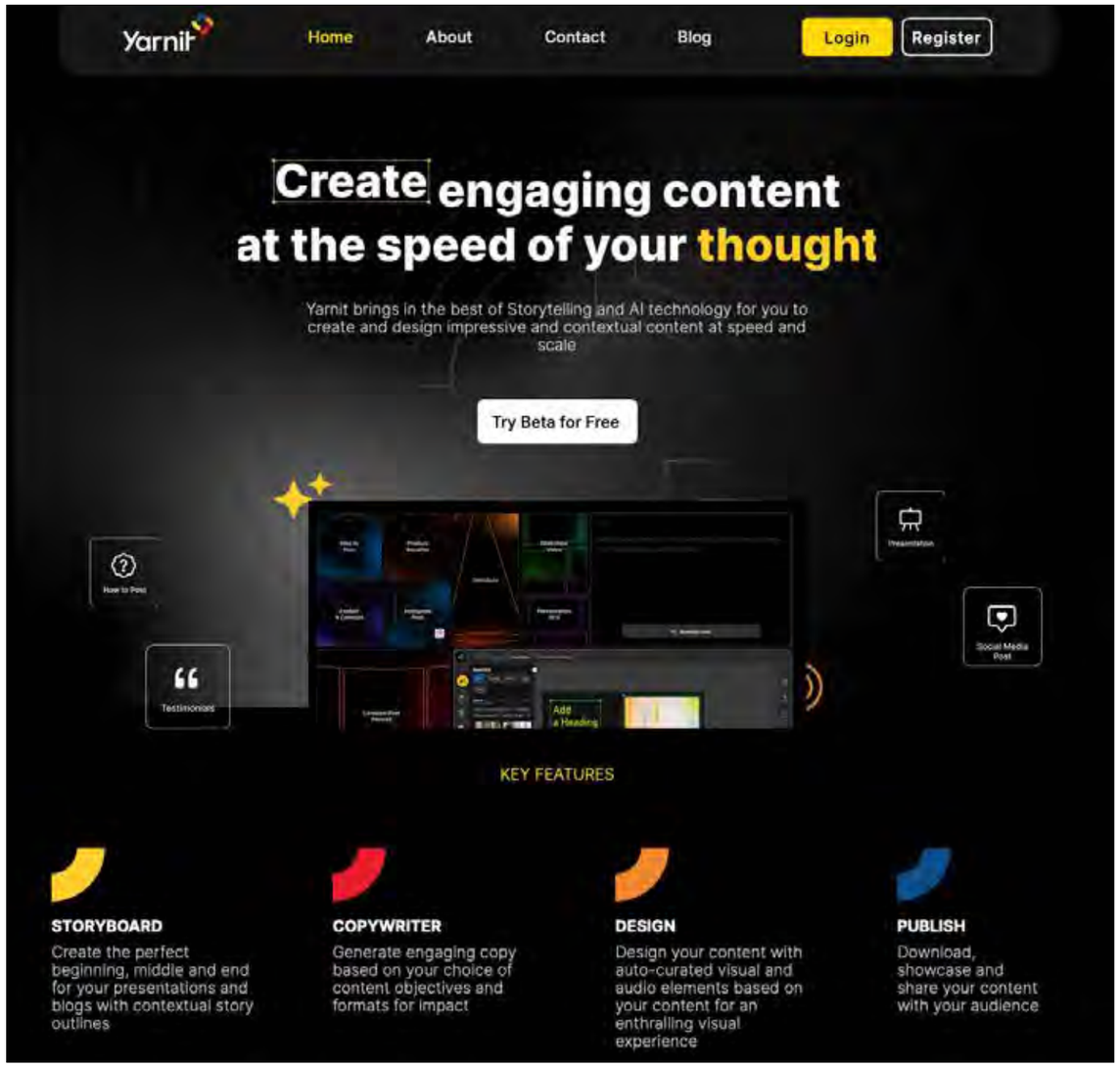
BRIEF
The company wanted a service design blueprint for their platform that would help in content creation and multi-media communication. My team and I developed the design over a span of one year.

YEAR
2020 - 2021

DISCIPLINE
Service Design
UI/UX Design

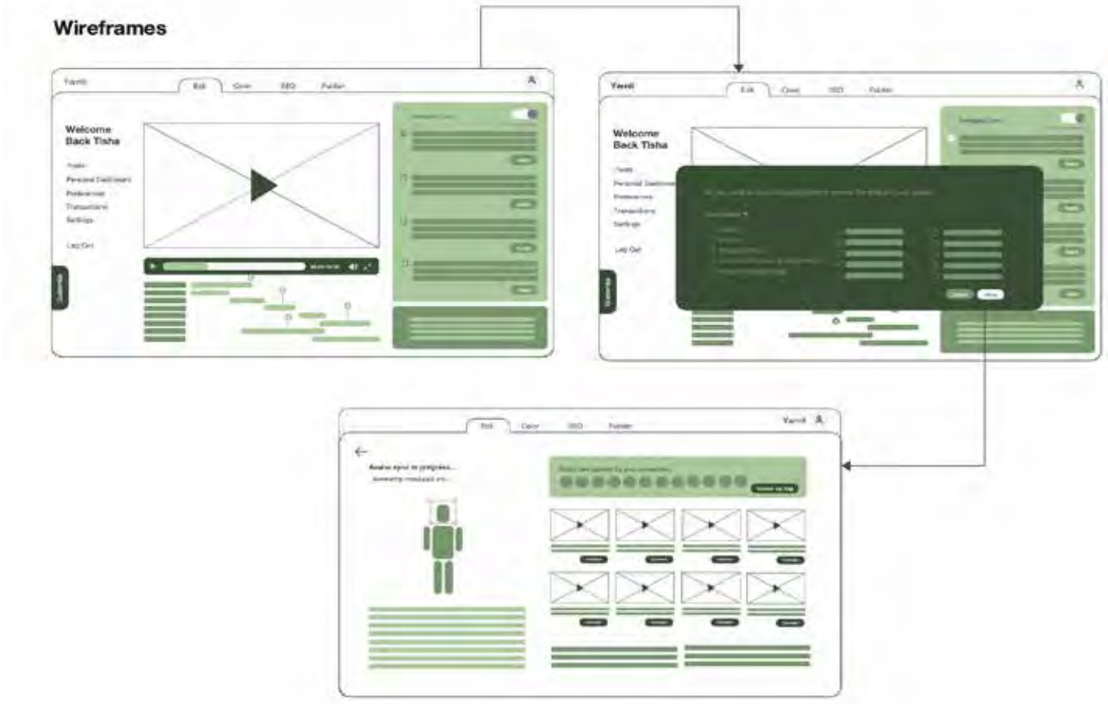
SECTOR
Service Platform
Content creation

COLLABORATORS
Akanksha Bhatt
Roshan Rajendrababu
Jyotirmoy Dutta
Yarnit app

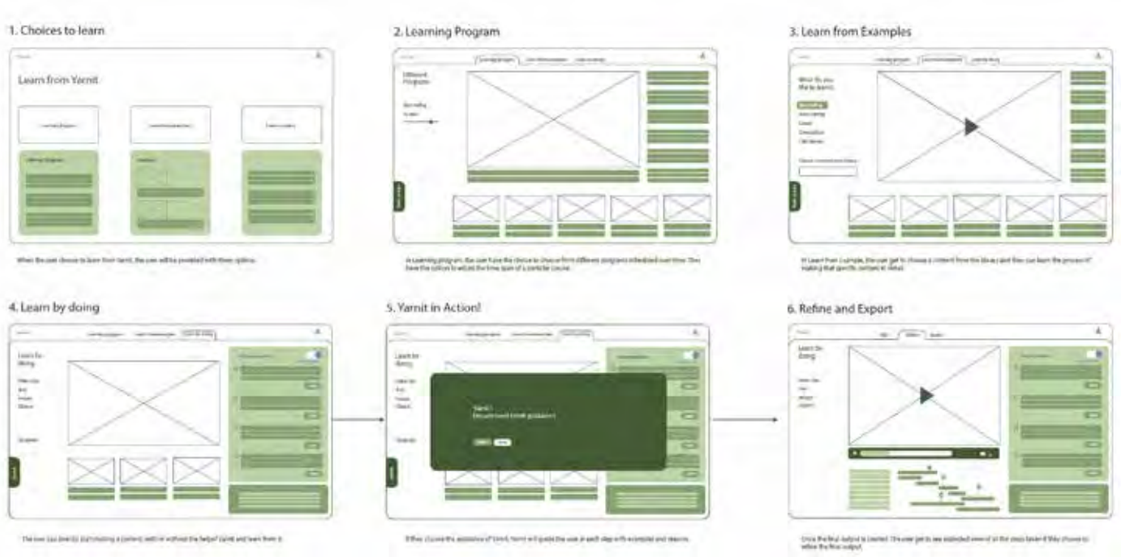


 # Yarnit website
The newly launched Yarnit Beta Website.

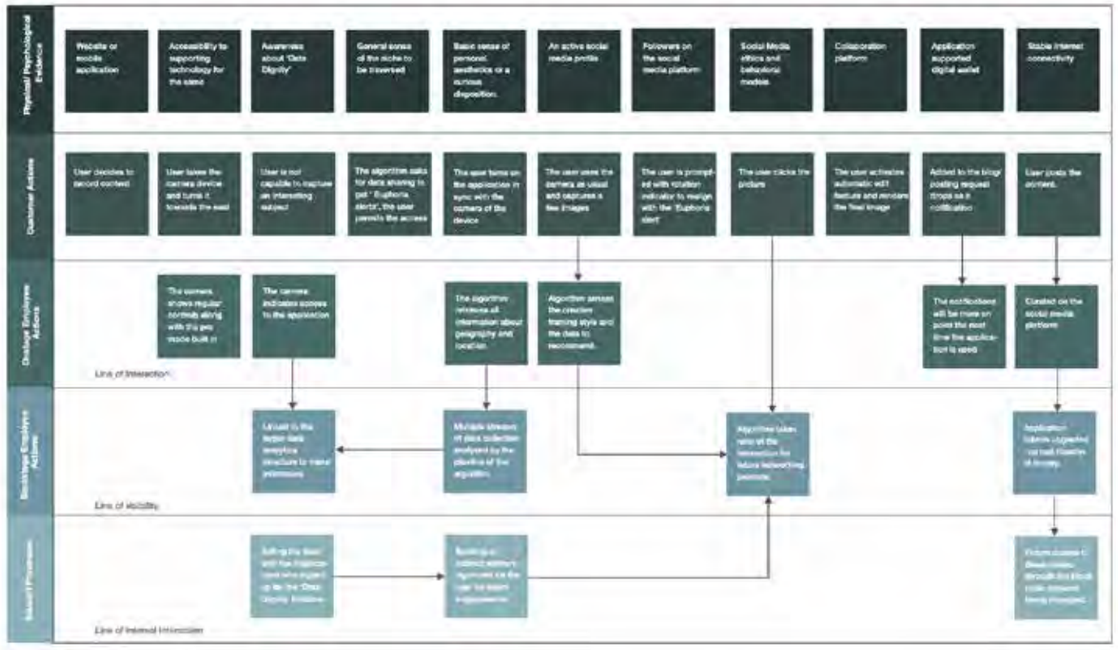
https://www.yarnit.app



#1 UI
Design of Low fidelity wire frames for Yarnit app.



#2 UX
Design of User Journey in Yarnit app .



#3 SERVICE DESIGN BLUEPRINT
Detailed service design blueprint of Yarnit App.

Design Management

COMPANY PROFILE
MIPL Global is a global design company working towards "Connecting brand environment to workplaces". MIPL has established a reputation as a versatile integrator combining ideas, design, innovation in materials, and forethought in planning with nonpareil execution effectiveness. We have delivered to top industry segments such as corporate work spaces, hospitality spaces, healthcare environments, educational campuses, transportation systems & transit hubs, sports complexes, recreational arenas and residential communities.

ROLE
I was inducted to the design team to set up a proper design process and channelize the process for the benefit of the company and client. Initially, I had to observe all the events; from acquiring a client to delivering the required products. At the end of the contract I had the experience of working with several clients under a corporate setup.

YEAR
2019

DISCIPLINE
Space Design
Graphic Design

SECTOR
Environmental Graphic Design
Signages and Wayfinding

CLIENTS

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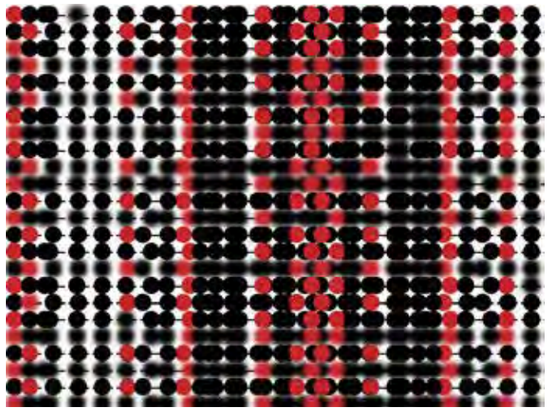
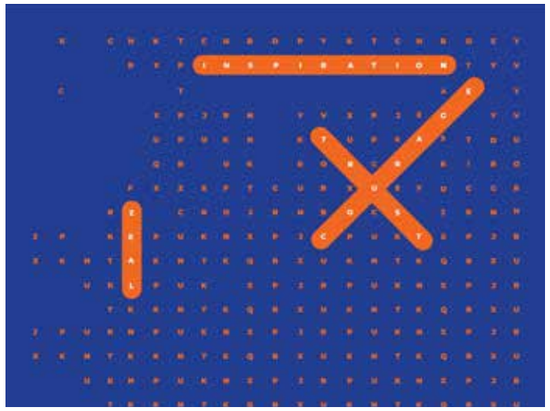
 # QUICK BOOK
A design guide custom- made for the employees of MIPL Global.



#1 ABACUS
Vinyl print design idea for Standard Chartered.

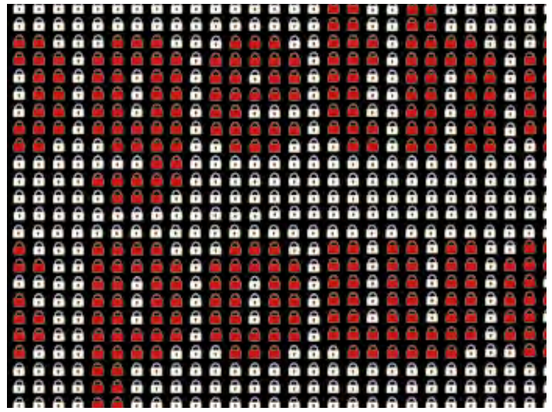
#2 CHEMICAL REVOLUTION
Vinyl print design idea for Eastman.



#7 CROSSWORD
Vinyl print design idea for Solv.

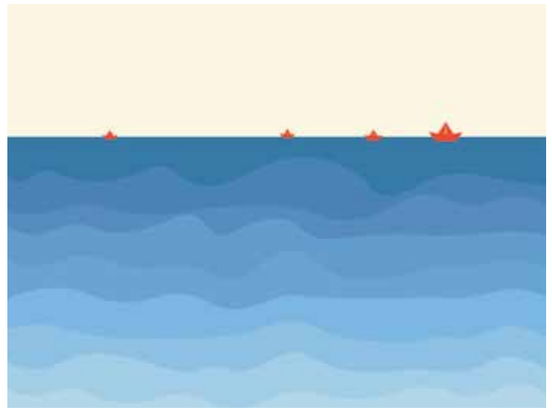
#8 TECHNOLOGY
Illuminated wall design idea for Northern Trust.

#3 RUGBY INFOGRAPHIC
Wall installation plan for Societe Generale.



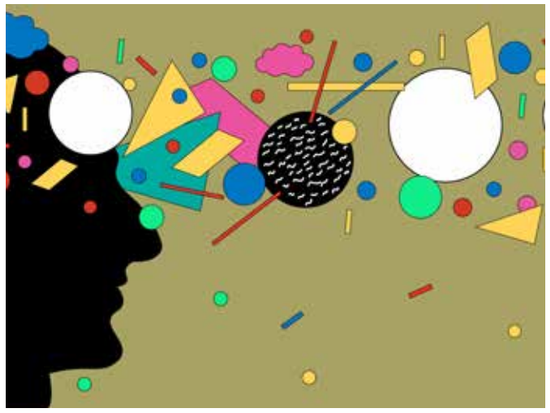
#4 TOGETHER IS POWER
Wall installation plan for McAfee.

#9 WORLI
Worli art inspired vinyl print design for Globant.

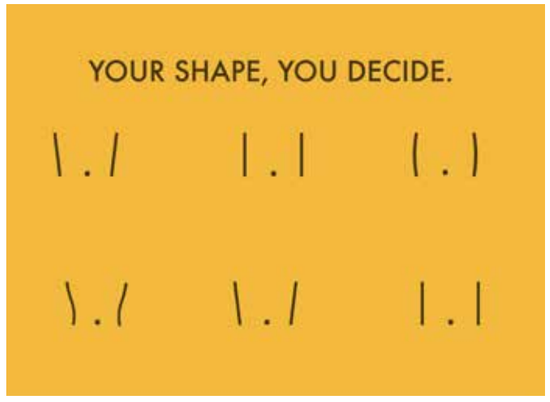


#10 PAPERBOATS
Vinyl print design idea for Standard Chartered.

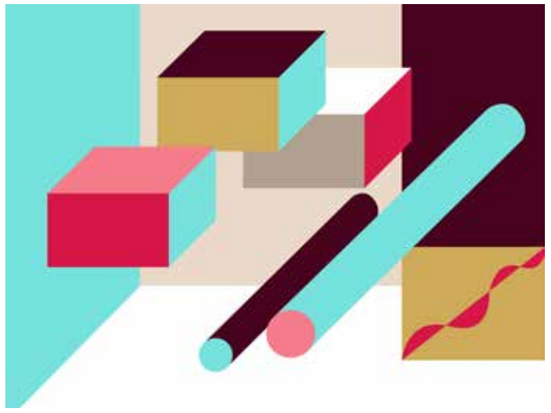
#5 LET US COLLABORATE
Writeable wall design idea for Rubrik.



#6 THINK IN SHAPES
Writeable wall design idea for VMware.



#11 MOTIVATION
Gym wall vinyl print design for Societe Generale.



#12 SHAPES
Wall frosting design idea for Northern Trust.

Brand assets design

STOKR

COMPANY PROFILE
STOKR is a digital marketplace built on the blockchain to create independent access to a new age of capital markets. Through programmable digital shares (transferable securities) offerings compliant with EU capital market rules, everyday investors can directly fund forward-thinking start-ups and SMEs in return for a share of the ventures' future profits or revenues.

BRIEF
The company wanted a special logo for the 2019 Christmas season. Several Christmas cups were also created with its logo. All the employees got custom made cups with their names on it. Another brief was to create a flyer for Dubai international expo. Two types of flyers were created for investors and ventures. The flyers had different design characteristics as per the brand guidelines.

 # COFFEE CUP PRINT GRAPHIC
The print design as per brand guidelines.

YEAR
2020 - 2021

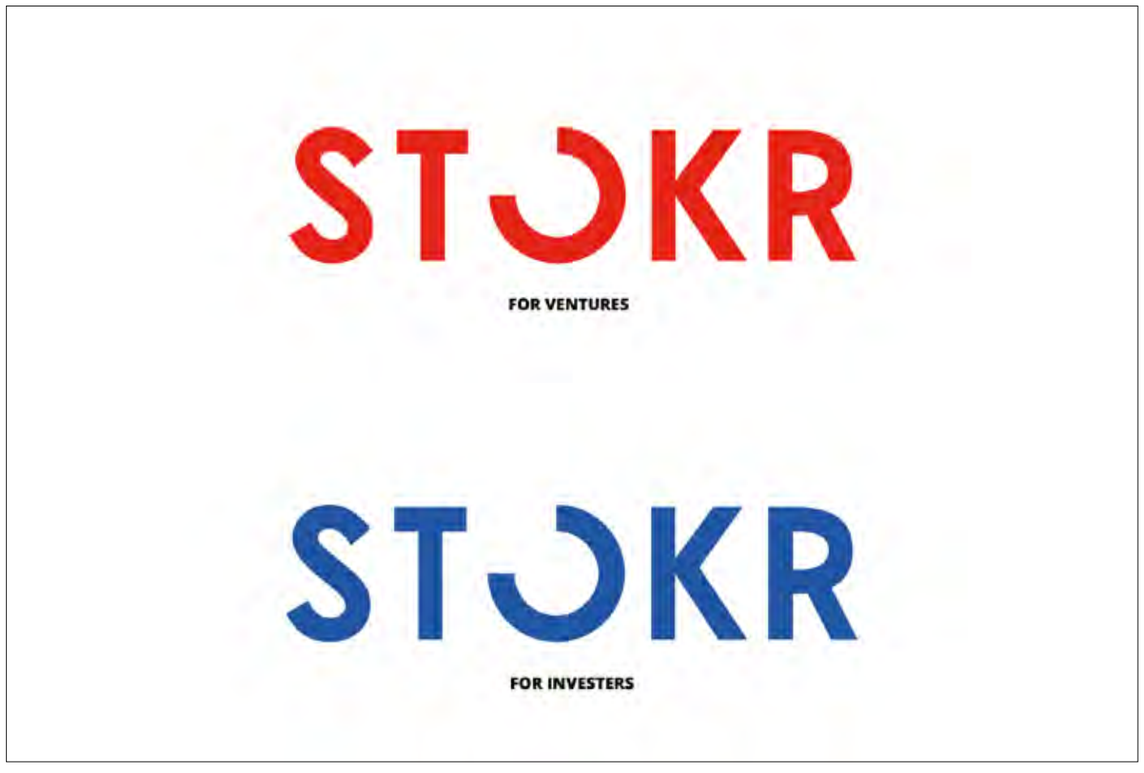
DISCIPLINE
Graphic Design
Product Design

SECTOR
Brand Assets Design

#2 VISUALISATION
The cup in an office environment.

#3 SPECIAL CHRISTMAS BRANDING
The cup with the special logo on it.

#5 SPECIAL LOGO
Logo designed for Stokr, Luxembourg during Christmas 2019.



#4 ORIGINAL LOGOS
The original Stokr logos created by AKQA Amsterdam.

#6 FLYER DESIGN
The flyer for ventures.

#7 FLYER DESIGN
The flyer for investors.

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For the love of Nature

The right to a safe, healthy and ecologically-balanced environment as a human right in itself, but entails the duty to protection. Accordingly, existing environmental laws set out that everyone must contribute to living in an environment adequate to his or her health and well-being.

BRIEF

A new park was built to improve the tourism at certain areas of Sirsi forest range. There were several rocks to be beautified by painting on them. All the concepts were based on the concept of protecting the environment for the sake of human beings and animals. All the paintings were concept based. " Girl and Tiger", "Ant hill", "Southern Bird Wing butterfly and "Psychedelic ant" were the subjects. The "Southern Bird Wing butterfly" painting was done in the butterfly park. Most of the paintings were done with enamel paint and brush. Quick realistic touches were done with spray paint. The project took a week to complete. It was a wonderful experience at the forest in the midst of Nature itself.

YEAR

2020

DISCIPLINE

Wall Painting and Design.

SECTOR

Social Work
Applied Art

COLLABORATORS

Ashish Kumar
Midhun Muraly
Pranav Kishore Bidwe

 # GIRL AND TIGER

The 10 x 2 metre, mural done on a natural rock in Sirsi forest.

#1 SOUTHERN BIRD WING
The state butterfly of Karnataka in the park.

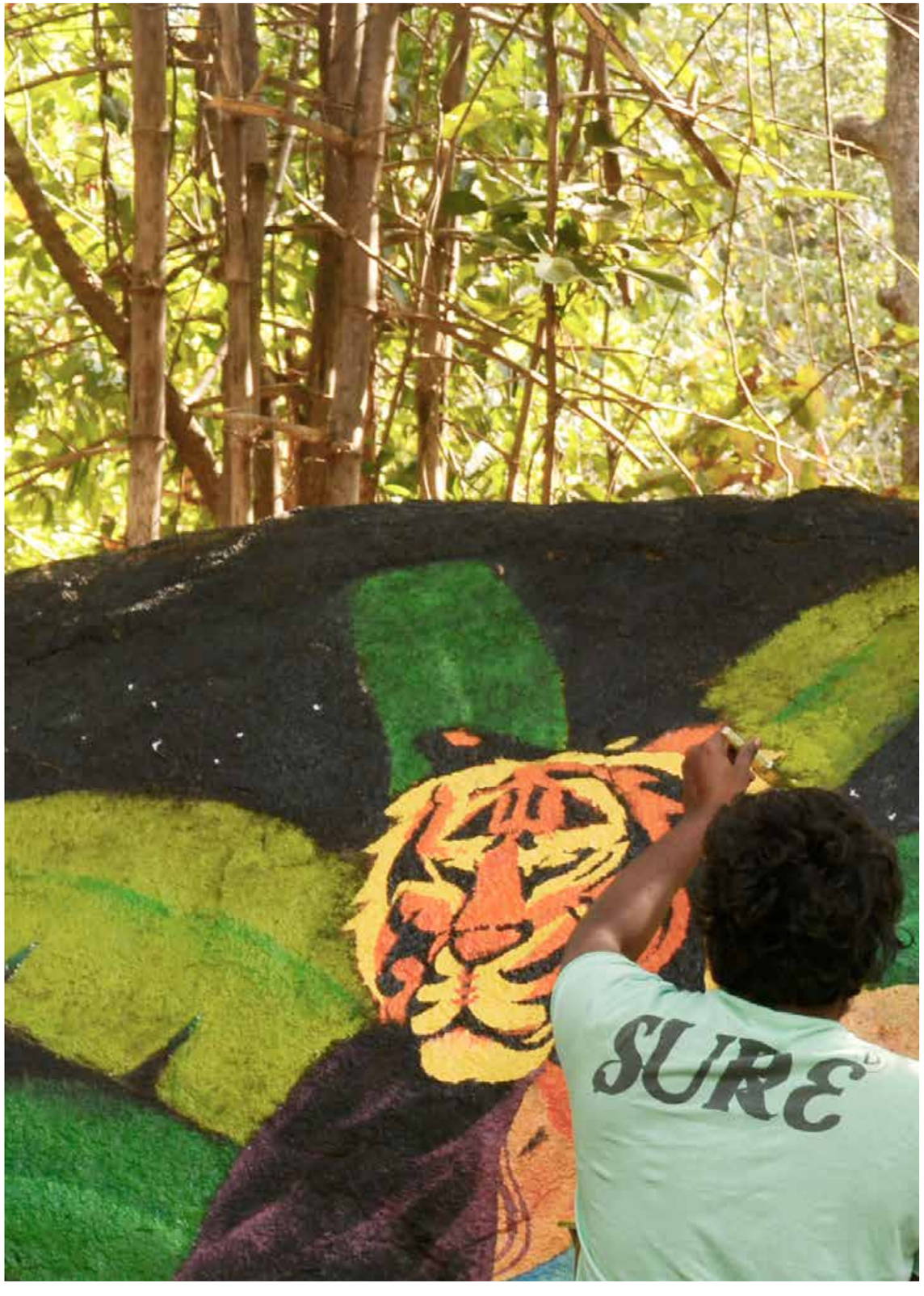
#2 ANT HILL
A narrative painting of an anthill.

#3 PSYCHEDELIC ANT
An ant shaped rock before painting.

#4 PSYCHEDELIC ANT
After painting with sprays.

#5 ANTS
An area in the children's park for ant stories.

#6 GIRL AND TIGER
The painting that portrays love for Nature.



#7 FINAL TOUCHES
Adding stars to the night sky.

TEACHING & RESEARCH

Subject

DESIGN PROCESS

Design process is a course for the first year Master of Design students of all disciplines at the National Institute of Design, India.

Relevance

This course gives students an overview of the process of design which is essential for them to appreciate the learning through various courses.

Objective

To introduce students to the different stages in the design process – from perception of a problem to generating a solution to the problem through investigation, analysis and synthesis. To understand the methodology of the problem solving process.

Course Contents

- Analysis and mapping of the design process.
- The morphology of the problem solving process.
- Role of creativity in design.
- Methodologies and strategies related to the different stages of the design problem.
- Case studies.

Methodology

Lectures.
Assignments.
Individual design projects.
Discussions and feedback.

YEAR

2022

FOR THE M.DES STUDENTS OF

Industrial Design
Interaction Design
Information Design
Digital Game Design
Design for Retail Experience

INSTITUTE

National Institute of Design

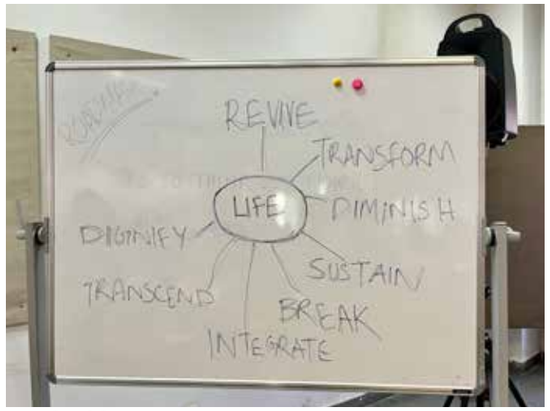
CO- TEACHERS

Nijoo Dubey
Tulip Sinha Neel
Balaji Rengarajan

राष्ट्रीय डिज़ाइन संस्थान
NATIONAL INSTITUTE OF DESIGN

DESIGN PROCESS LECTURE

A session where different types of design processes were introduced to the students.



#1 TOPICS
Broad topics for students to start thinking.

#2 BRAINSTORM
Keywords and their interconnection.

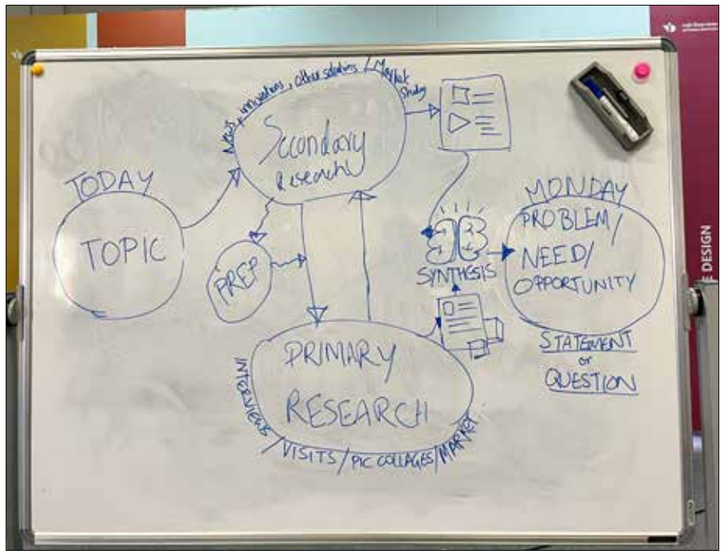
#3 ACTIVITY MAPPING
Students presenting their activity mapping.

#4 GROUP WORK
Students working in groups.

#5 AFFINITY MAPPING
Sorting keywords

#6 SORTING
Students sorting the keywords.

#7 ANALYSIS AND SYNTHESIS
Problem statement and brief



#8 DIFFERENT STAGES
Different stages in design process

#9 CONCEPT PRESENTATION
Students presenting their concepts.

Subject

UNIVERSAL DESIGN THINKING

Universal Design Thinking is a course for the first year Master of Design students of Universal Design Discipline at the National Institute of Design, India.

Relevance

Universal design is a philosophy, a way of thinking at an intellectual level and at an actionable level an integral part of design process in achieving 'Good Design'. It is the shift in thinking of designing 'for us all' rather than 'for them'. It is design for Future, it is design for Diversity.

Objective

To introduce the concept of the universal design, Global and India view, the thinking, approaches, the concepts, policies and advocacies. To familiarize students to the 5 UD India Principles and the 7 Universal design principles. To sensitize the students to issues faced by intragenerational users and people with disabilities and identify areas of impactful design interventions.

Course Contents

- Discourses and Discussion on concept of Universal Design
- Case Studies in UD & models
- Mapping broad areas of need & impact for UD intervention
- Field Visits

Methodology

Discourses, Discussions & Discovery
Group exercises & collaborative study
Field study

YEAR
2022

FOR THE M.DES STUDENTS OF
Universal Design

INSTITUTE
National Institute of Design

CO- TEACHER
Nijoo Dubey

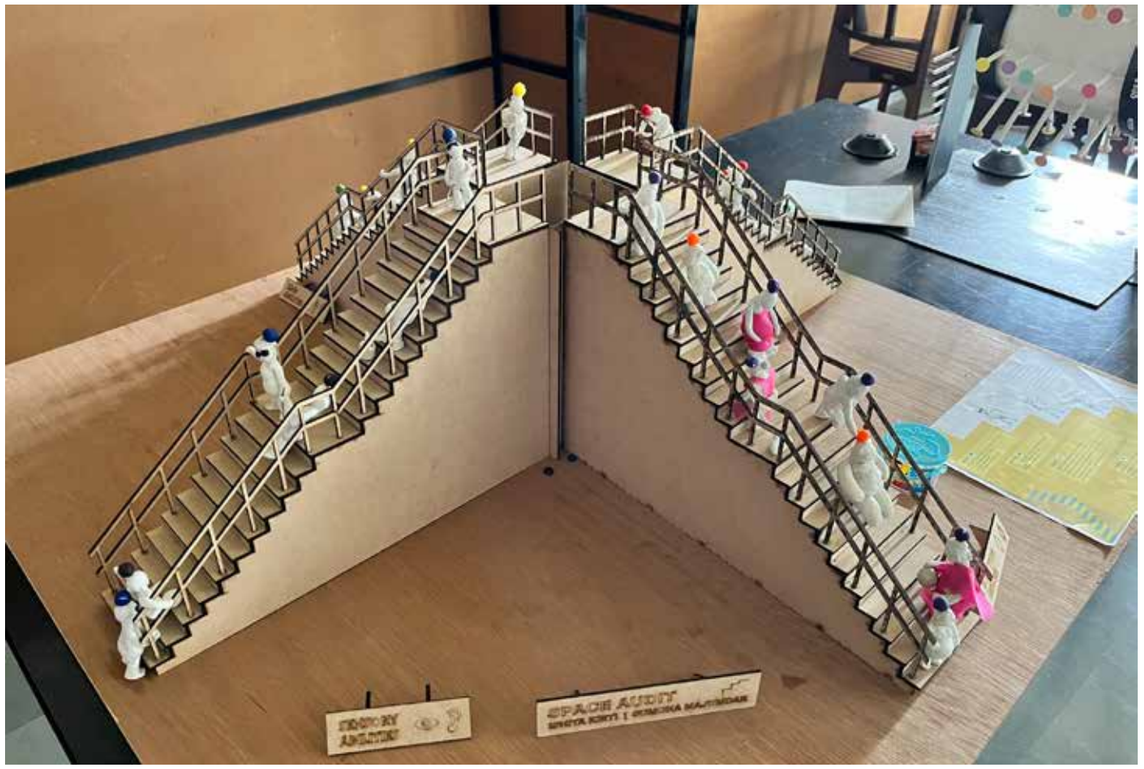
राष्ट्रीय डिज़ाइन संस्थान
NATIONAL INSTITUTE OF DESIGN

 # FIELD VISIT

Student visit Mobility India to understand the problems faced by people with disability.

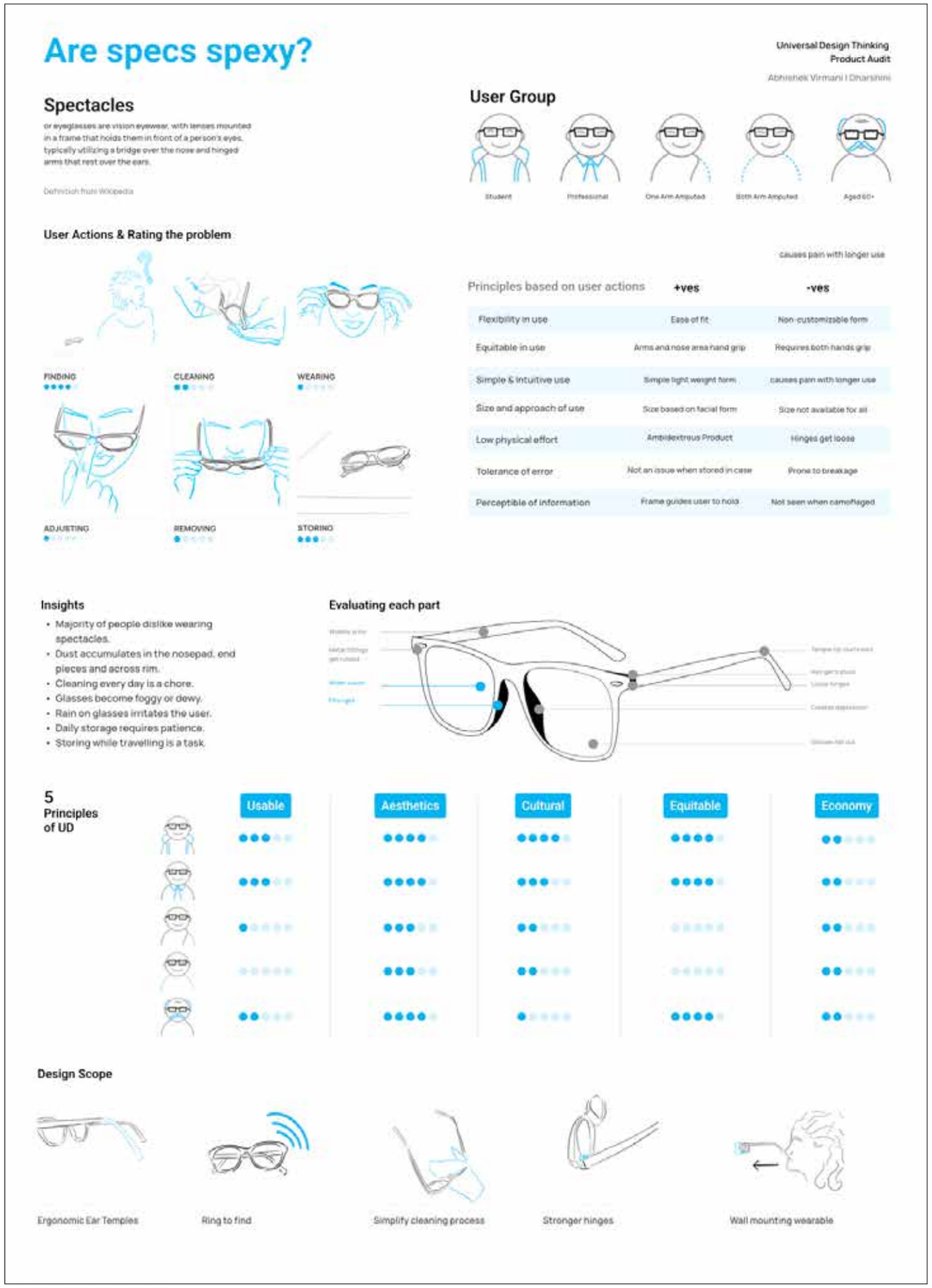
#1 SPACE AUDIT

A students attempt to understand the inclusivity problems of NID studio spaces.



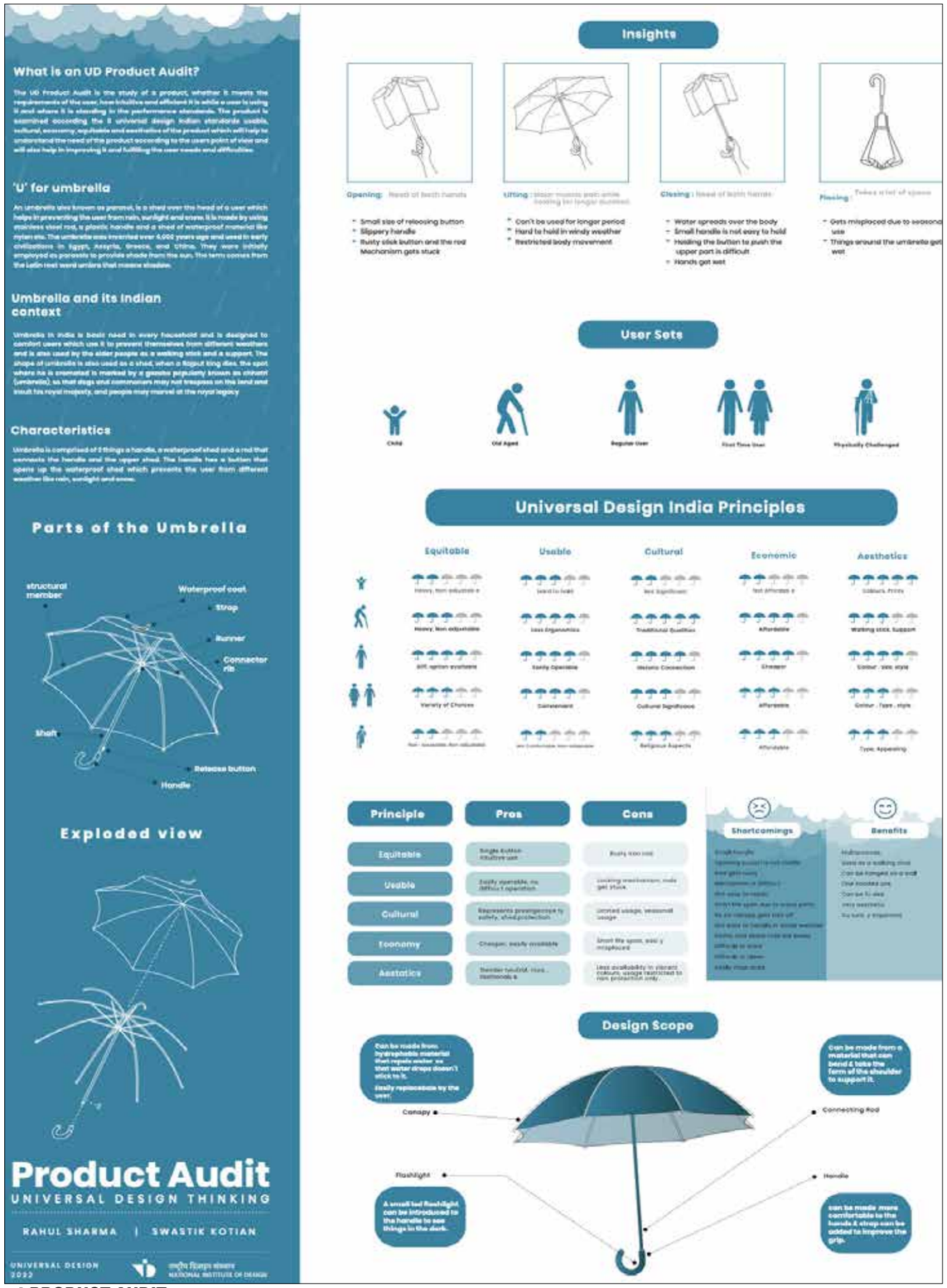
#2 PHYSICAL MODEL

Representation of Inclusivity problems of diverse user while using a staircase .

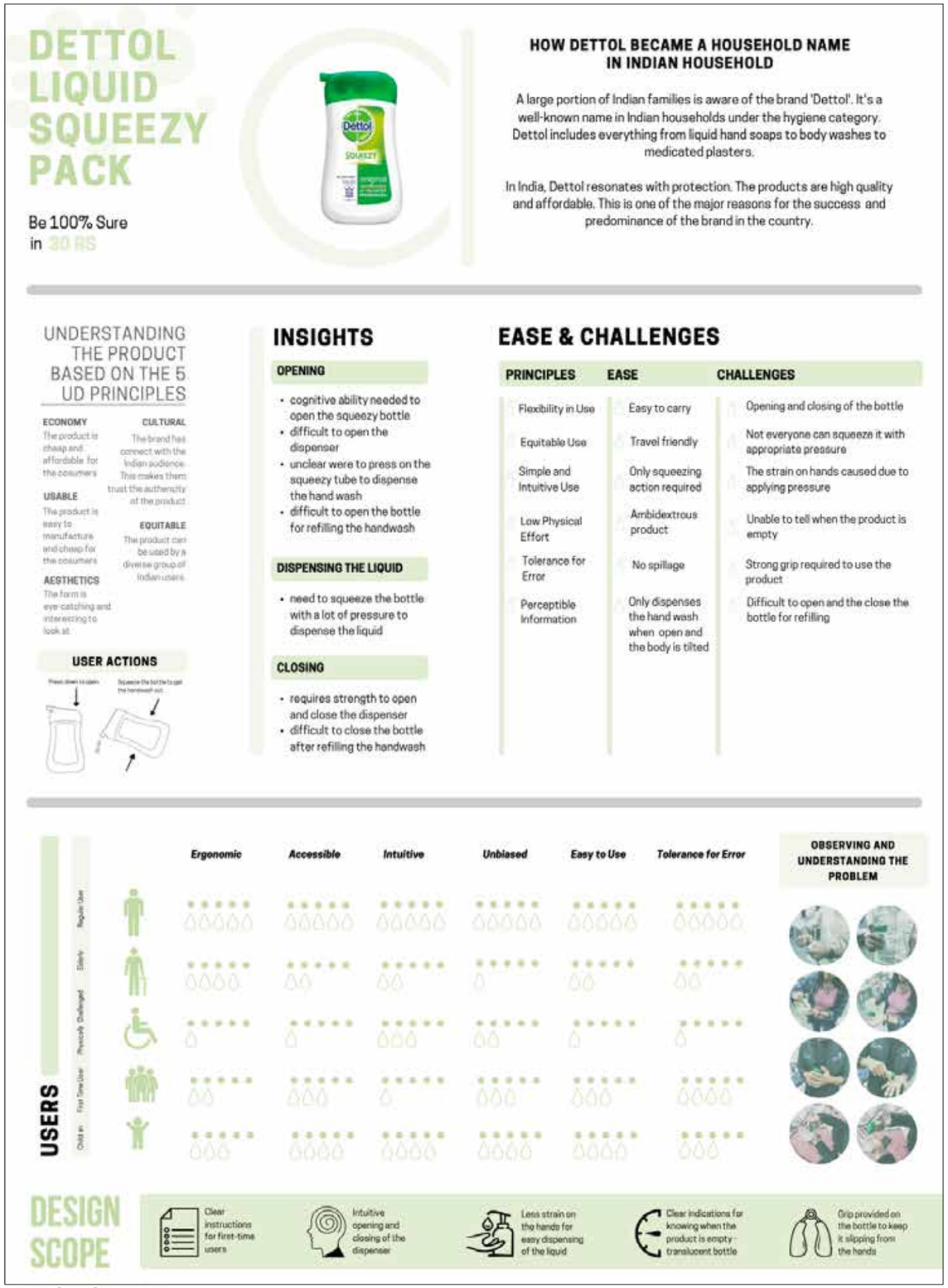


#3 PRODUCT AUDIT

Audit of eye glasses base on UD principles.



#4 PRODUCT AUDIT
Audit of an umbrella based on UD principles.



#5 PRODUCT AUDIT
Audit of Dettol packaging based on UD principles.

Subject

FORM STUDIES

This course is for the first year Universal Design students to sensitise the importance of 'form' in their practice. The course will consist of activities that will help students to think and manipulate forms in 2D and 3D. It will also provoke them to look at forms around them in the natural and built environment and understand and observe more.

By the end of the course the students will have developed skills in model making, sketching, translating sketches into models.

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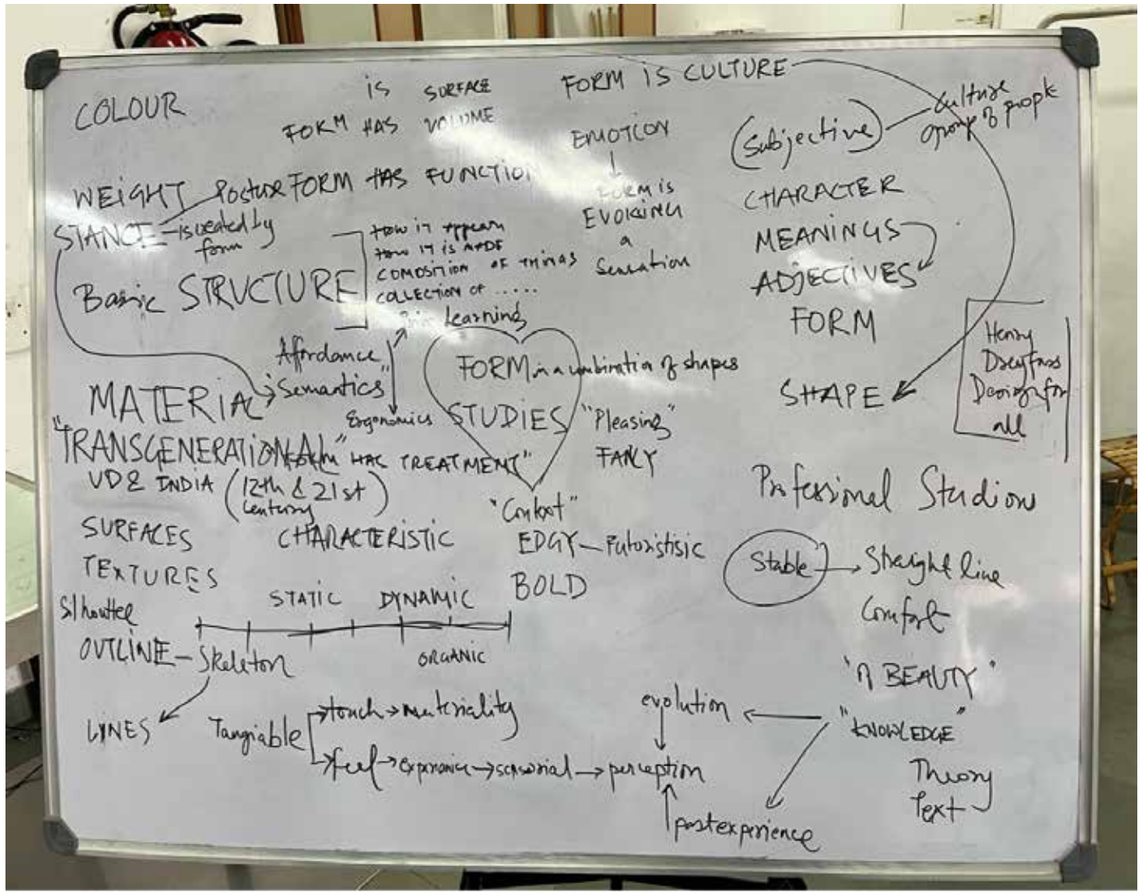


 # WHAT IS A 'FORM'
An introduction to form.

YEAR
2021

FOR THE M.DES STUDENTS OF
Industrial Design
Interaction Design
Information Design
Digital Game Design
Design for Retail Experience

INSTITUTE
National Institute of Design

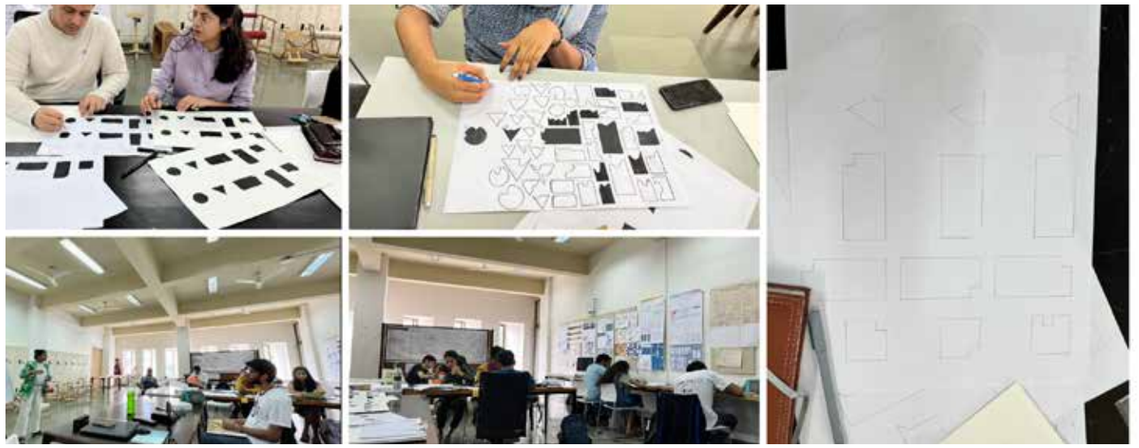
CO- TEACHERS
Nijoo Dubey
Balaji Rengarajan
Tulip Sinha

#1 AT WORKSHOP
Cutting MS rod to make 'lines in space'.

#2 CUBES
Result of a session on making 'accurate' models.

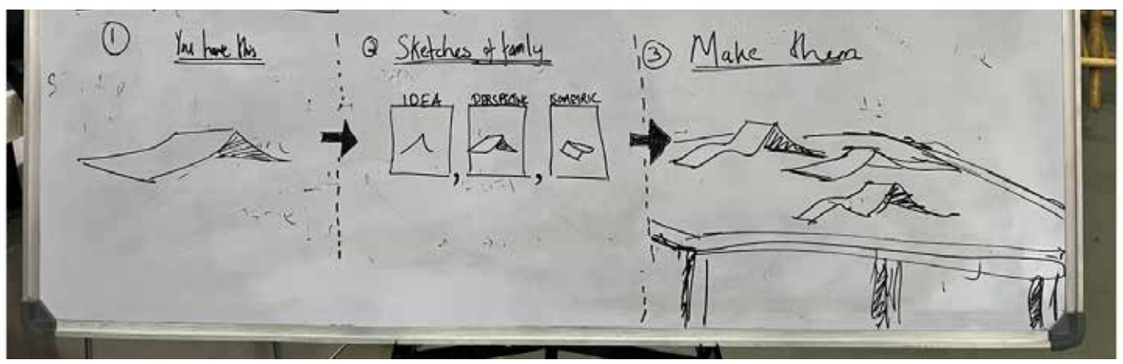
#3 LINES IN SPACE
A student attempt to make 'flow'.

#4 VOLUME INTERACTION
Dominant, Sub-ordinate and Sub-Dominant form.



#5 2D FORM STUDY
Students learning family of forms.

#6 PAPER MODELS
Students learning how to convert a lamina to a volume.



#7 FORMS AND SKETCHING
Step by step process of making 'family of forms'.

Design Workshop

TOY DESIGN THROUGH CRAFT

Relevance

The workshop will combine theoretical, practical lessons and field visits on “Play and its importance in education”. Play is an intrinsic act done by children. Certain factors affect child play. Children need an enriched environment which is the combination of toys and friends. They need a lot of colourful materials around them. It is relevant because of a playful attitude about life and not taking everything like popularity, competition, academics and adult criticism seriously and taking; necessities of growing up, avoiding addictions, staying within the boundaries of the law, staying playful in an age-appropriate way.

The students will experience the art of Toy Making from the Artisans of Channapatna. They will develop designs that would cater to the needs of preschool children and align the designs into the manufacturing technique of Channapatna.

Objective

- The workshop aims at making the students understand the importance of Play and its relevance in Early Child Education.
- The students will go through a complete design process of making a toy from an idea to a finished product.
- They will also understand how the toys can be refined and polished to make them marketable through prototyping and testing.

Methodology

Lectures.
Assignments.
Individual design projects.
Field visit.

YEAR

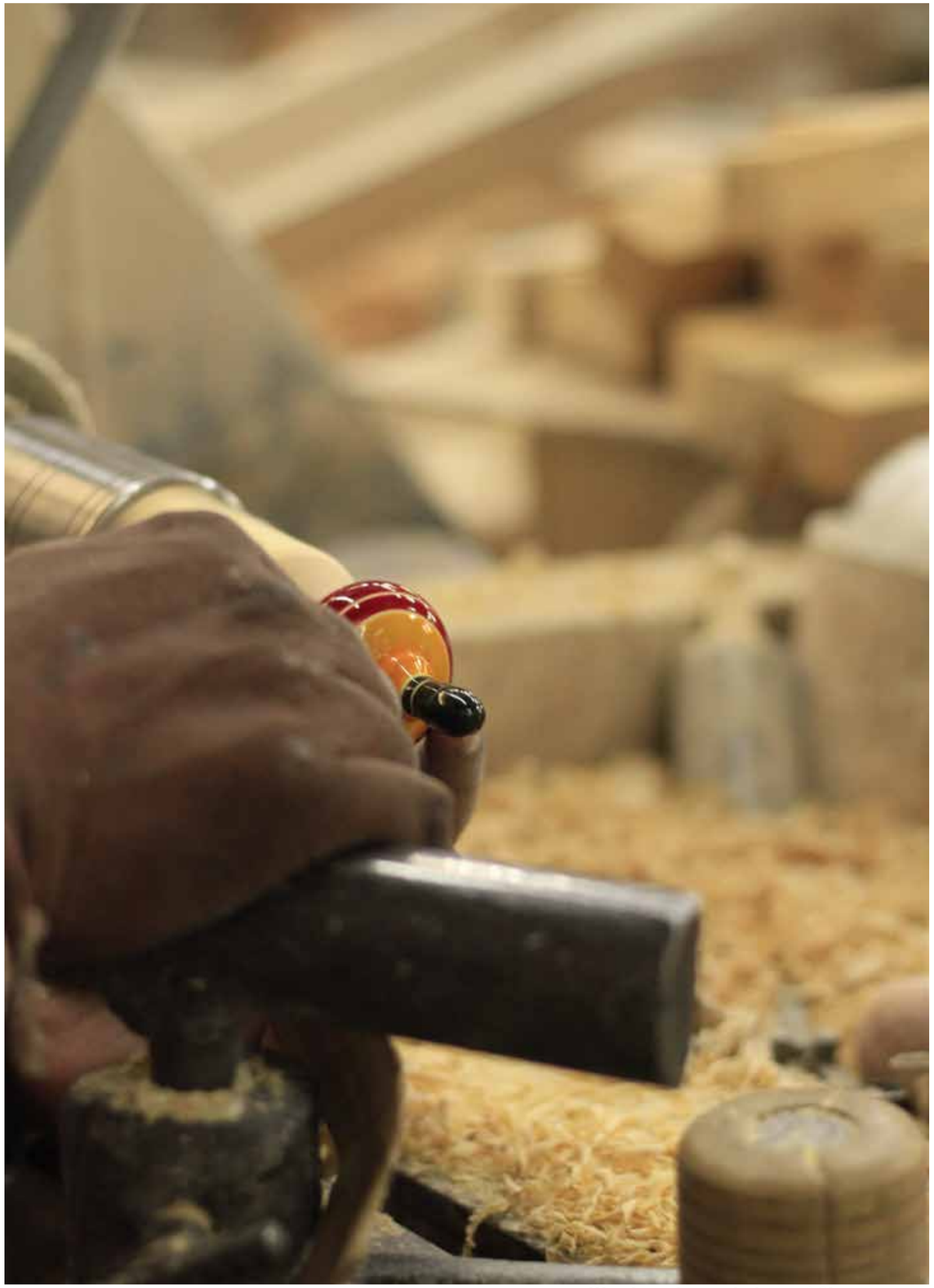
2022

FOR THE B.DES STUDENTS OF

Industrial Design
Furniture design
Communication design

INSTITUTE

School of Design, RV University.

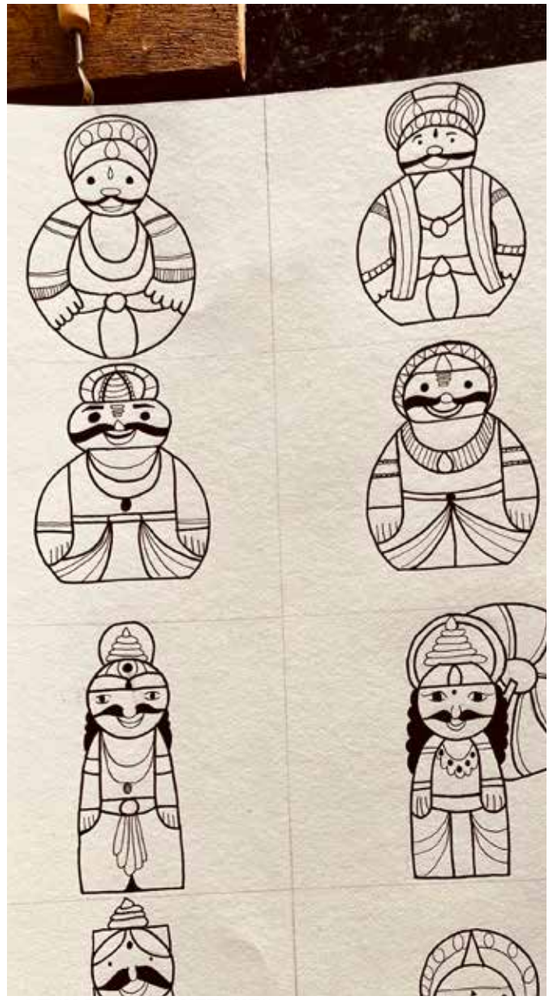


 # Wood turning technique of Channapatna

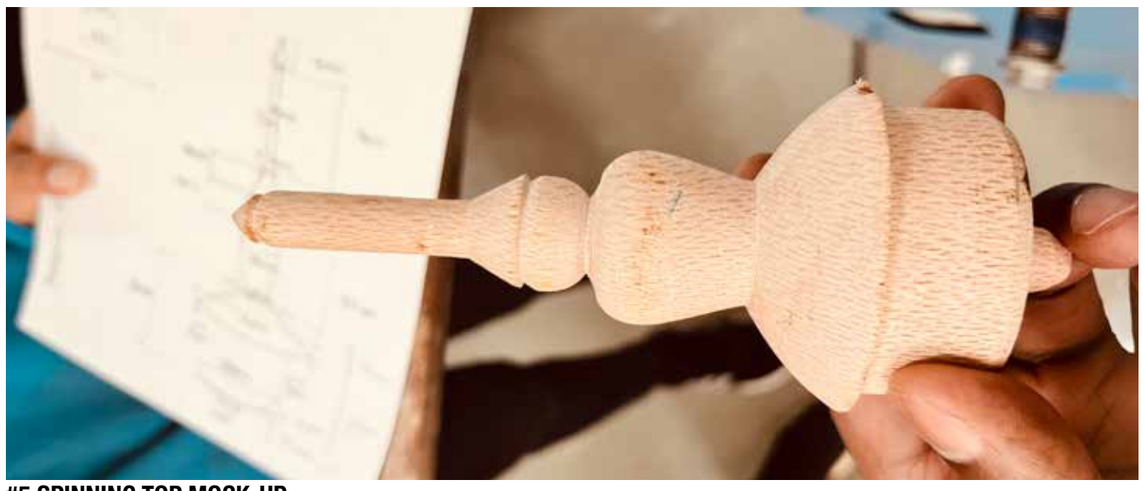
An artisan turning and colouring a spinner on a lathe.

#1 A CLAY MOCK-UP
A student's toy design exploration on clay.

#3 PAPER CUT OUTS
Radii manipulation and symmetry exercise.



#4 TOY DESIGN SKETCHES
Students exploration for toys.



#5 SPINNING TOP MOCK-UP
Mock up of spinning top made by the students.

#6 STUDENTS SKETCHING THEIR IDEAS AND MAKING PAPER MOCK-UPS
Ideas to sketches to mock-ups.

#7 HOW TO DESIGN TOYS
A lecture on 'designing for Play' and the design process.

#8 THE WORKSHOP
A student working on Lathe.

Engineering Research

AUGMENTATION OF HEAT TRANSFER COEFFICIENT IN POOL BOILING USING COMPOUND ENHANCEMENT TECHNIQUES

ABSTRACT

Modern compact electronic chip design demands more efficient and innovative cooling techniques in a limited space. One such method is the immersion cooling by pool boiling heat transfer, which is a highly efficient technique when compared with conventional cooling techniques. The boiling heat transfer coefficient can be enhanced using active and passive techniques. In the present investigation grooves as passive and surface vibration as active techniques were coupled to improve the boiling heat transfer coefficient. The forced vertical vibrations were induced on the copper grooved surface with a mechanical vibrator. The frequency of vibration was varied in the range 0–100 Hz and the amplitude of vibration was varied in the range 0–2.5 mm. The compound technique gave 62% improvement in heat transfer coefficient at 300 kW/m2 heat flux compared to the 29% enhancement due to grooves alone and 10% enhancement due to vibration alone. The experimental results were used to develop a modified Rohsenow correlation which predicts the experimental Nusselt number with an accuracy of ±25%. Boiling visualization was performed and the bubble parameters such as bubble departure diameter, bubble frequency and bubble growth were determined. The bubble departure diameter decreased by almost 36% and the bubble frequency increased by 221% for boiling on vibrated grooved surface.

Weblink
https://scholar.google.com/citations?view_op=list_works&hl=en&hl=en&user=V88K664AAAAJ

YEAR
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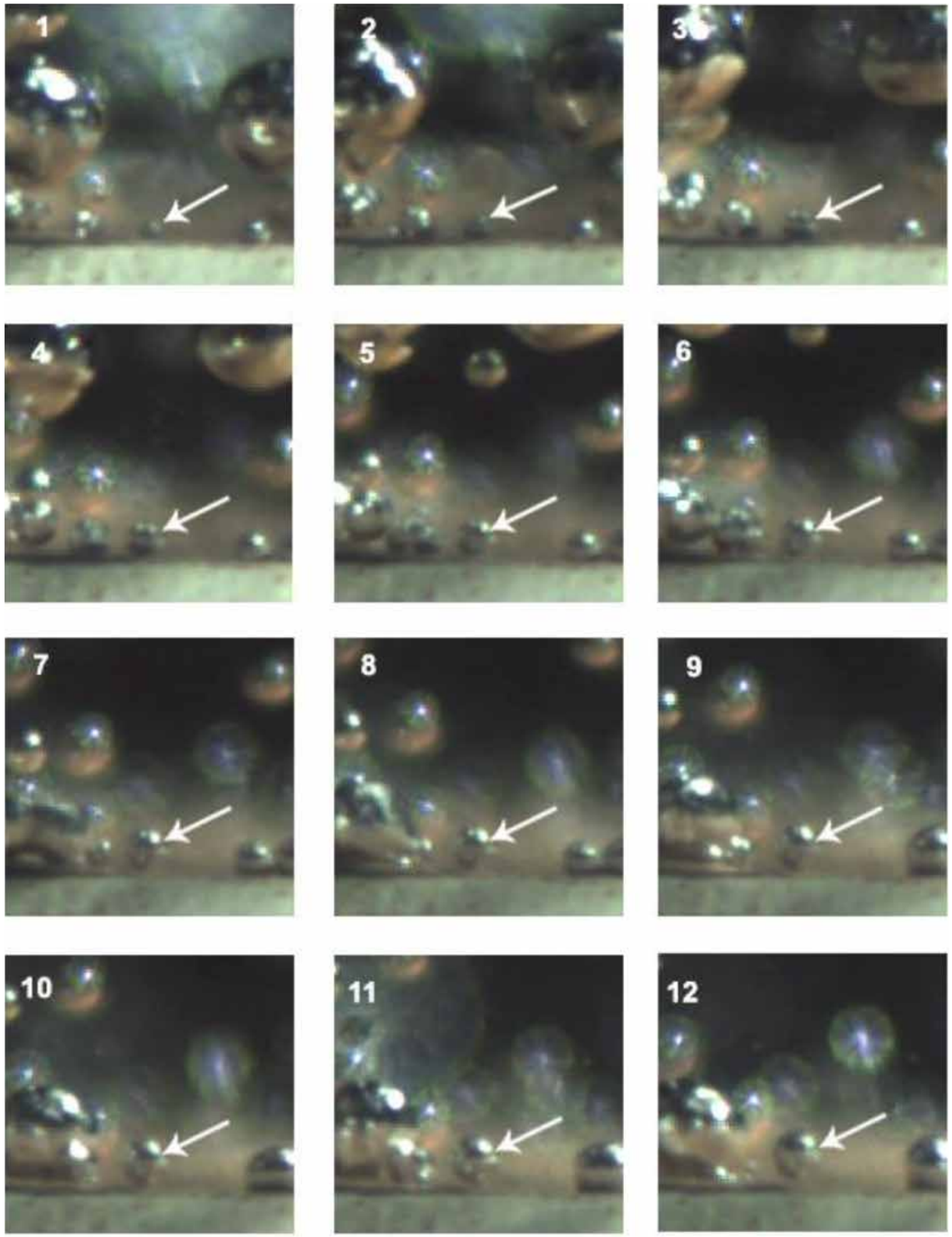
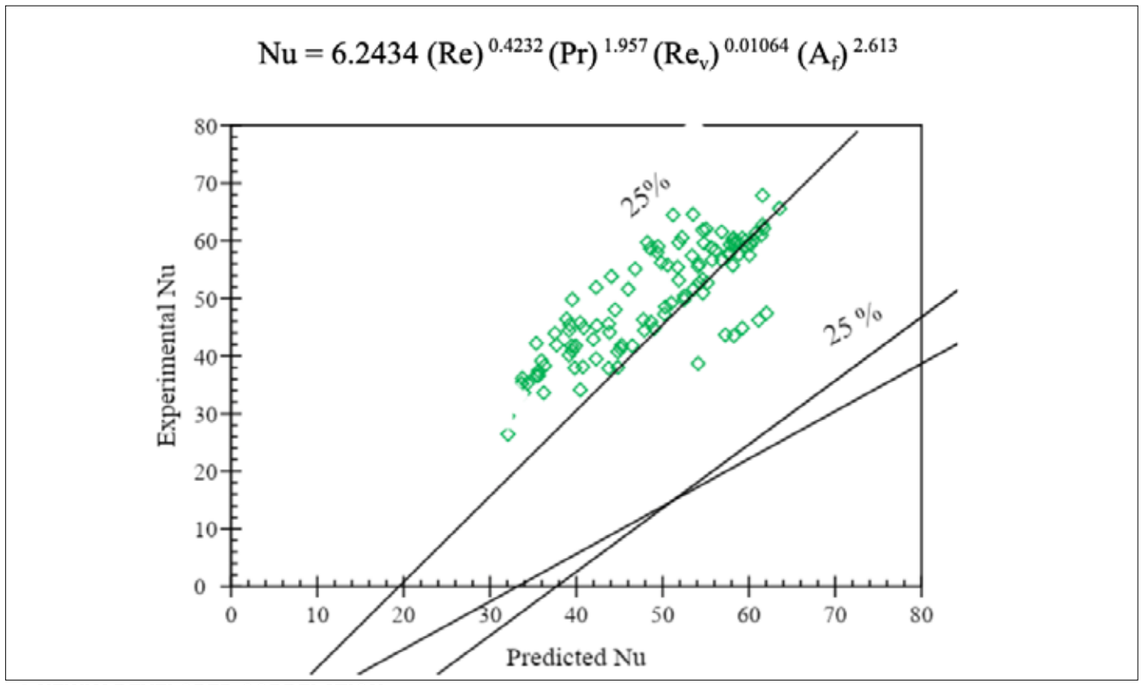


 # BUBBLE FORMATION
Images captured with high speed camera to observe the formation of bubbles.

#1 EXPERIMENTAL SETUP

Copper heating element which boils water.



#2 NEWLY DEVELOPED CORRELATION

The graph shows the difference between experimental and predicted Nusselt's number

Paper no.: IHMTC2015-236

AUGMENTATION OF HEAT TRANSFER COEFFICIENT IN POOL BOILING USING COMPOUND ENHANCEMENT TECHNIQUES

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Introduction

- The thermal management of electronic chips has become a challenge with rapidly increasing power dissipation in recent years. This trend has driven the electronic cooling community towards ebullient **cooling techniques**. This is to acquire heat input and to reject waste heat for the purpose of achieving higher power density and higher system efficiency.
- Faster cooling rates increase energy conversion system efficiency, enable higher power density and also boosts system functionality. Heat dissipation has become an increasingly important problem that will limit the performance, as advanced microelectronic and photonic device technologies have led to ever smaller structures.
- Due to the lack of a breakthrough in advanced cooling technology, most of the computer processor speed has reached its limit with traditional cooling techniques and the future of more advanced computers is now in doubt.
- Most of the advanced power devices and high-tech electronic systems ranging from heavy-vehicle engines, computer chips and advanced nuclear reactors depend on efficient thermal energy transport mechanisms.
- Modern compact chip design demands more efficient and innovative cooling techniques in a limited space. One such method is the **immersion cooling by pool boiling heat transfer**.
- The boiling heat transfer coefficient can be enhanced using **active and passive techniques**. While most of the previous researches were done using either one of these techniques, the present investigation aims at combining both these active and passive techniques to improve the **heat transfer coefficient**.
- **Grooved surface** is used as the surface modification which is **the passive technique** and the **heater is made to vibrate** using an exciter which is the **active technique** used.
- The **compound enhancement technique** used in this current research is found to enhance the heat transfer coefficient remarkably.

Materials and methods

The experimental setup consists of a square boiling chamber into which the Teflon insulated heating rod is placed vertically and it is coupled to an exciter by a shaft. The test surface is placed on top of this **heater rod**. An **auxiliary heater** is provided through the side walls to maintain the distilled water at constant saturation temperature throughout the experiment. **Three thermocouples** placed along the length of the rod close to the test surface are used to measure temperature gradient and heat flux. The **frequency and amplitude** of the exciter is controlled using a **power oscillator**. The pressure inside the boiling chamber is kept constant throughout the experiment by the help of cooling water pump, a pressure transducer and a proportional integral derivative (PID) pressure controller.

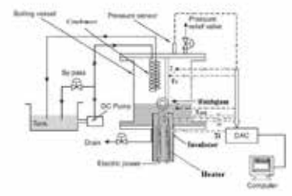

FIGURE 1. Schematic diagram of the experimental setup

First the experiment is conducted with **grooved surface** on the heater **without any vibration**. Then, the grooved surface on the heater **is made to vibrate** with **varying frequencies and amplitude**.

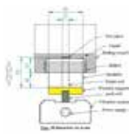

FIGURE 2. Vibration assembly

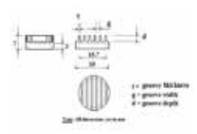

FIGURE 3. Rectangular grooved surface

Experimental results

The objective of this study was to evaluate the effects of surface enhancement and vibration excitement on the boiling heat transfer coefficient**. Data collected from the experiments are represented in the form of graphs** to provide a clear understanding of the **improvement in heat dissipation which the compound enhancement techniques** provides.

All the heat flux and the HTC (heat transfer coefficient) data gathered from the experiments conducted are plotted systematically. The **boiling curves** in which, the wall superheat is plotted as the function of the heat flux, represents the trends in boiling under different conditions. Initially the experiments were done **without test surface vibration.** The results obtained from these experiments were used as the base data for comparing with the data obtained from experiments with vibration.

It was observed that **HTC gets enhanced only till 2 mm amplitude when the vibrational frequency is 5 Hz**. The values dropped below the 'no vibration' curve when amplitudes were further increased above 3 mm. Improvement in heat dissipation was observed only for 1mm amplitude when the frequency was **10 Hz**. At high heat flux the HTC values were not improved.

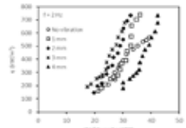

FIGURE 4. Effect of vibration on boiling curve at f = 2Hz

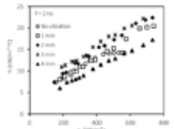

FIGURE 5. Effect of vibration on HTC at f = 2Hz

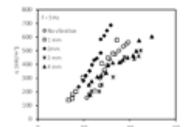

FIGURE 6. Effect of vibration on boiling curve at f = 5Hz

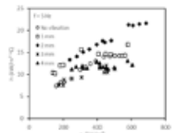

FIGURE 7. Effect of vibration on HTC at f = 5Hz

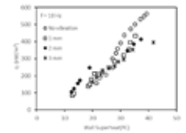

FIGURE 9. Effect of vibration on boiling curve at f = 10Hz

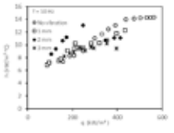

FIGURE 10. Effect of vibration on HTC at f = 10Hz

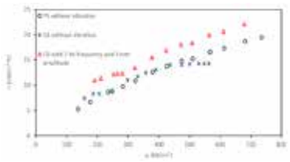

FIGURE 6. Effect of surface modification and compound enhancement on the boiling curve

Conclusions

From the current study on effects of compound enhancement technique on HTC, the following conclusions may be drawn.

- The compound technique gives more heat transfer enhancement than other techniques. This can be attributed to enhanced bubble nucleation from the grooved surface and better bubble departure from the test surface due to induced vibration.
- The experimental results showed that the heat transfer rate increased with low frequency vibrations.
- The enhancement of heat transfer was the highest at the vibrational frequency of 2 Hz and the amplitude of 3 mm.

References

- Nukiyama, S., 1934, "The Maximum and Minimum Values of Heat Transmitted from Metal to Boiling Water under Atmospheric Pressure," *J. Jpn. Soc. Mech. Eng.*, **37**, 367–374.
- P. J. Marto and Lt. V. J. Lepere, "Pool boiling heat transfer from enhanced surfaces to dielectric fluids," ASME J. Heat Transfer, vol.104, pp. 292-297, May 1982.
- V. F. Prisnyakov, and K. V. Prisnyakov. "Action of vibrations on heat and mass transfer in boiling." Journal of engineering physics and thermo physics 74, no. 4 (2001): 1015-1023.

#3 PAPER PRESENTED INTERNATIONAL HEAT TRANSFER CONFERENCE 2015

The paper was presented at Indian Space Research Organisation, Thiruvananthapuram.