

**ENHANCING LIVELIHOOD POSSIBILITIES OF
DOKRA CRAFTSMEN THROUGH THEIR CRAFT
: REDESIGN OF DOKRA DOOR HANDLES**

**INDUSTRIAL DESIGN PROJECT II
MPR - 426**

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**INDUSTRIAL DESIGN CENTRE
INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
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Enhancing
Livelihood Possibilities of
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Redesign of Dokra Door Handles

Design Project II Report
July 2015 to Nov 2015

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Guided by : Prof. B K Chakravarthy
Gaurav Vaidya | 146130002 | Product Design

Acknowledgements

I'd like to thank Mr. Hakim (metal casting artisan) and his son Mr. Nizam for appreciating my work and helping me during the process.

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Thanks to the institute for providing us a well equipped studios where anyone from the institute who is interested can enter and use the available resources but efficiently.

My batch mates at IDC and my parents who have been the greatest resource at the best and worst of times.

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My work during Project 1

1 Background of the Project

Dokra casting is a non-ferrous metal casting process followed by traditional metal craftsmen in eastern part of India. In my Design Project 1, I was fortunate to experience this ancient technique from experienced craftsmen community in Jharkhand.

During a short span of 8 days, I got an opportunity to follow the process as well as very closely observe craftsmen and their daily life and challenges faced by them.

Dokra is practiced mostly by tribal and backward section of society. The socio economical condition of these craftsmen, keeping this 4000 year old technique alive, is not

very encouraging. During my stay, I interacted with many craftsmen and their families. After my conversation with them it was very much clear to me that future of this craft is not very promising.

Question that came to my mind is, how can design intervention enhance the livelihood options of these extreme poverty section of society through their craft. This initial thought got further refined during a series of discussions with Prof. B K Chakravarthy and narrowed down to redesigning dokra door handles.

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Wood Handicrafts in Shantiniketan (W.B)

2 Importance of Handicrafts

Why Handicrafts? Are they important?

Though I chose to take project in the area of handicraft, I constantly asked myself and also to others the above questions. In my opinion, handicrafts are important for following reasons :

There are roughly 200 million people in India who depend on handicrafts for their livelihoods.
(Source : Stanford Business School Web. July 21, 2015)
And Handicrafts is one of the major option for livelihood after agriculture

But more than a third craftsmen have left the occupation in the past 30 years.
(Source : Dasra-Indian philanthropy foundation)

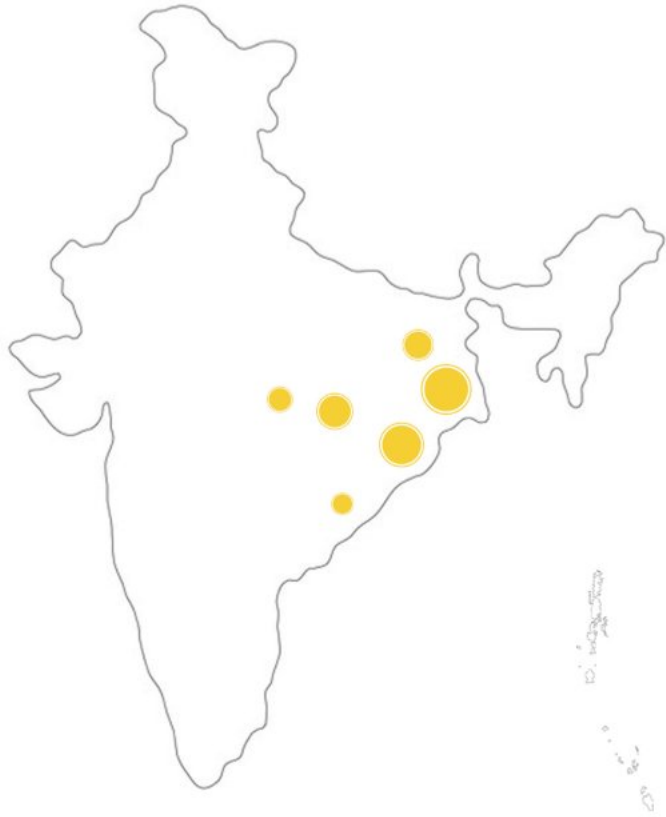
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Cultural Importance

- Handicrafts represent the culture and traditions &
- Preserve traditional skills and talents associated with people's lifestyle and history

Economic Importance

- Help in Economic development
- Employment with low capital investments
- Medium for foreign earnings



● Regions in India where Dokra casting is being practiced

State	Districts
West Bengal	Bankura, Midnapore, Purulia, Birbhum and Burdwan
Orissa	Puri, Dhenkanal, Nayagarh, Khurda, Keonjhar, Sambalpur, Mayurbhanj, Phulbani and Ganjam
Chhattisgarh	Bastar, Raigarh, Sarguja
Jharkhand	Dumka, Jamtara, Pakur

Some parts of Madhya Pradesh and Andhra Pradesh

3 Problems Faced by Dokra Craftsmen

Dokra craft is being practiced mostly by tribal people in eastern parts of India. The tribe is spread across West Bengal, Jharkhand and Orissa. The artisans following dokra tradition are from socially and economically backward portion of the society. Most of them are illiterate. Apart from issues like health, sanitation, education etc. this community is facing several other problems which are directly affecting the traditional craft and their livelihood.

Lack of knowledge about the new designs that are being experimented all over the world, lack of inspiration to work with something new, lack of encouragement to work with innovative

ideas are great hindrance to adapting modernizations and keeping pace with contemporary demand.

There has been decline in the domestic demand for the dokra products with the change in people's tastes caused by globalization.

Increase in prices of raw materials forces artisans to use low quality material which results in bad quality final product and lower sales value.

The artisans could be taught to innovate and improvise, use better tools and better raw materials. Innovative techniques can be taught to the workers through government sponsored programmes.

A few steps have to be taken as measures to revive this exquisite practice. A constant effort to develop new designs and try out new innovations will be beneficial for the production catalogue of the artisans.

Due to various reasons this scheme has not been implemented for dokra craft since 2000.

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The Office of Development Commissioner (Handicrafts) Government of India implements various developmental schemes for handicrafts in India. One of the design and technology up gradation scheme focuses on up gradation of artisans through design and technology intervention in order to develop new designs and prototypes and giving practicing craftsmen exposure to developments taking place in the field of design & technology.

4 Dokra Casting - History & Features



Dancing Girl (Mohenjo-daro)

http://www.world-archaeology.com/wp-content/uploads/2014/10/ObjectLesson_CWA67.jpg

Dokra casting is Lost-Wax Casting or Investment Casting also known as 'cire perdue' which means lost wax in French.

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.

Dokra is the oldest form of metal casting which is prevailing in India over 4000 years. The earliest Dokra artifact known and found is the dancing girl at Mohenjodaro and Harappa civilization which specifies dominance and continuity of the art.

'Dokra' is believed to be named after the Dokra

tribesmen who are the traditional metal workers of the tribal communities in West Bengal.

Dokra is an essential part of the life of tribal people. Its products are used right from birth to death for all the rituals, events and social occasions.

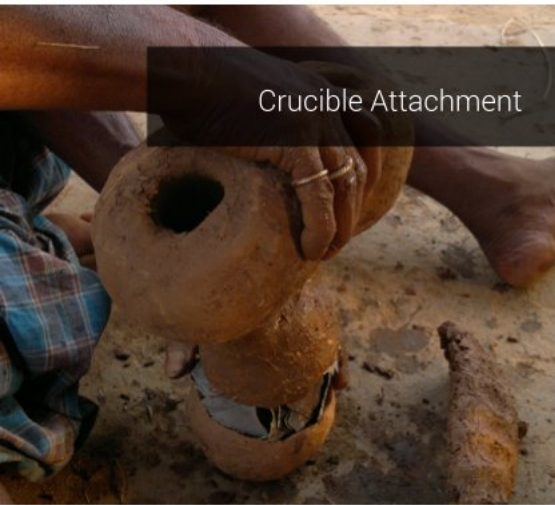
Ornaments, animals, birds, traditional figures, measuring bowls, idols are the most popular handicrafts made by this process.

The creative pieces made by this process have no joints and come in one piece, as a whole. Since, Dokra Art is handcrafted, the shapes are not perfect and the symmetries are not mirrored.

Hollow Casting



Crucible Attachment



Moulds in Fire Kiln



Solid Casting



These creative pieces are alluring, unique and graceful. However, making them is a long and tedious task.

There are two main processes of lost-wax casting: Solid Casting and Hollow Casting.

Solid casting does not use a clay core. It uses a solid piece of wax instead, to create the mould; whereas, hollow casting is the more traditional method and uses the clay core.

The whole process of melting metal & wax occurs in a single furnace within a single encasement. Crucible containing the metal is joined to the mould.

It is difficult to avoid casting defects such as gas

porosity, misrun, cold shut and inclusion. A misrun often occurs during dokra casting when the liquid metal does not completely fill the mold cavity, leaving an unfilled portion.

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5 Traditional Themes of Dokra Craft & User Experience

The traditional themes of these cast metal sculptures include Hindu or tribal gods and goddesses, bowls, figures of people or deities riding elephants, horse, musicians and other figures of people, animals and birds.

Most of the dokra objects are not day-to-day utility products or objects. They are decorative and novelty products.

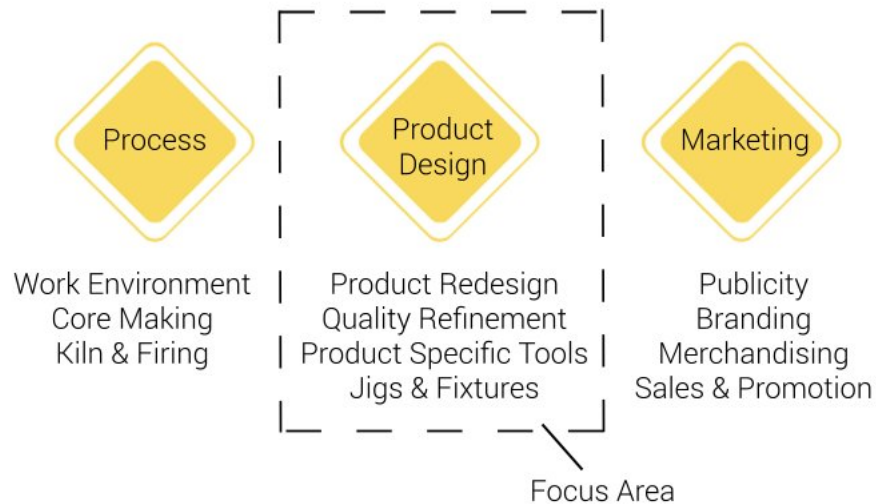
These objects are mostly purchased by craft lovers and they are kept in their living rooms or elsewhere on shelves in house where one can enjoy the intricate aesthetics of the carefully crafted objects by looking at them and sometimes touching them.

Here out of five only one sense i.e. sight is coming into picture and a little bit of touch. Hence sight dominates the whole user experience in such kind of products.

One of the objective is how can dokra products be designed in such a way that the user will not only love the way they look but also love the way they feel when user caress them. In doing so, how can I take advantage of peculiar surface texture of dokra objects.

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6 Project Focus & Design Brief



Opportunities for Design Intervention

Project Focus

Based on the research and observations, my main area of focus in this project is to design utility products using dokra technique and try making those products standardize to an extent by designing product specific tools, jigs and fixtures.

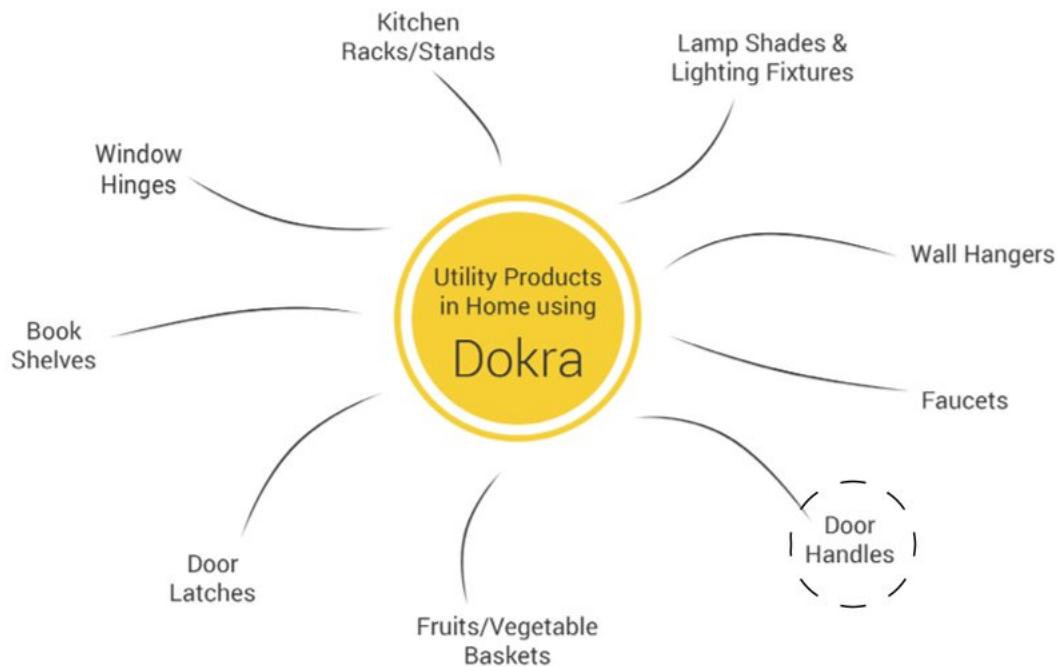
Design Brief

To design a range of everyday utility products which one can see, touch & feel to enjoy the beauty of it.

Design Considerations

- Products of intimate identification and appreciation
- Products imparting joy and a tasteful & memorable experience
- Easy to make & without any complex mechanism involved
- Can be made using Dokra Casting

Based on initial design brief, mind map is created to enlist everyday used products which can be made using dokra casting technique.



Mind Map for everyday utility products using Dokra

Out of several other products, Door Handle is chosen for this project due various reasons as follows :

1. Artisans in the village are currently making door handles right now but the design is very primitive and there is an opportunity to redesign & refine the product.
2. Handle is the interactive zone where visual as well as tactile interaction of the user and the product takes place.
3. Door handles they make are only for residential houses . Can it be redesigned to suit for other user environments also?
4. It is a lifestyle product which can also be sold as a gift item.

Different aspects explored are

- Form Explorations
 - Modern, Contemporary
 - Traditional
 - Forms in nature (animals, birds, plants)
- New motifs and alternative use of original/traditional motifs
- Designing Jigs and Fixtures – to make clay core making easy

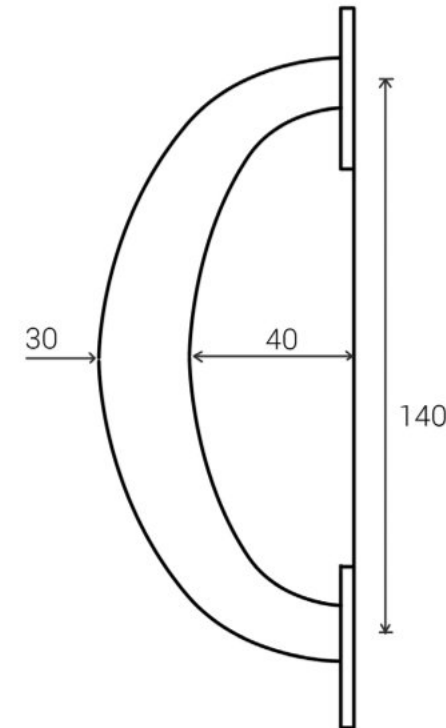
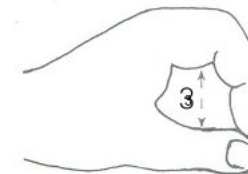
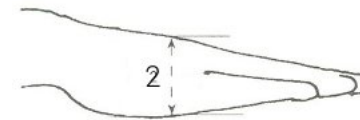
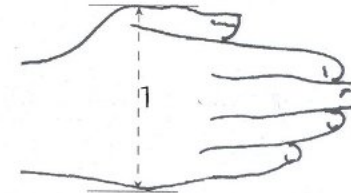
Why a Dokra Handle is different from other handles?

- Unique texture of dokra handle will give a different feeling in terms of seeing and touching to the user
- Distinctive appearance due to its antique and stark finish
- Unique motifs and patterns, rustic beauty, ethnic look
- Each piece is unique.

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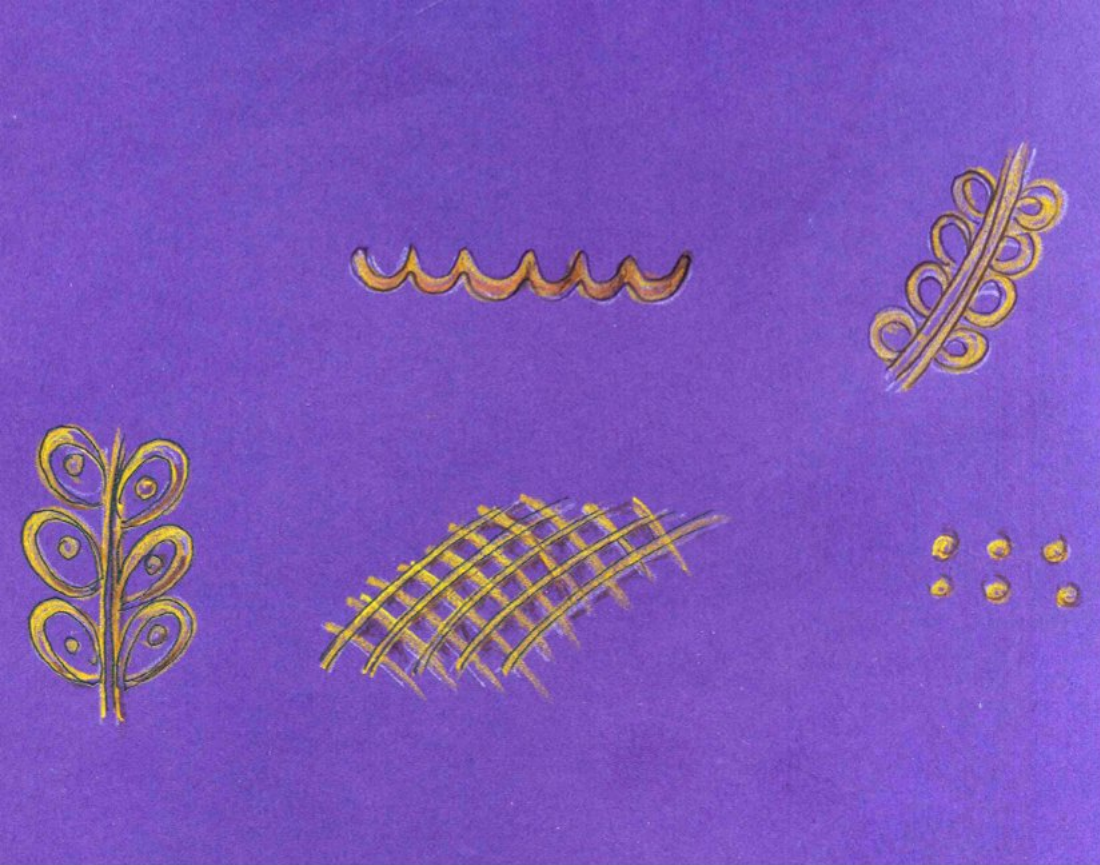
7 Anthropometric Dimensions

R. No.	Parameter	Defination	Dimension (mm)	Selection	Final Dimension (mm)	Reasons / Remarks
1	Hand Breadth with thumb	Maximum breadth across the palm with the thumb at the right angle to the long axis hand	111	Door handle grip length (95 th percentile)	140	15 mm clearance on both sides of palm
2	Hand depth metacarpal	Max. Thickness between the dorsal and palmer surfaces of the palm, across the knuckle of middle finger, where it joins the palm	31	Gap between handle grip and door surface (95 th percentile)	40	9 mm extra clearance as hand depth will increase when gripped around handle
3	Grip inside diameter, maximum	Measured by sliding the hand down a graduated cone until the tips of thumb and middle finger remain touched to each other	39	Handle bar diameter	30	Data pack is for adults. Chosen reduced diameter by considering children user group



Critical Dimensions

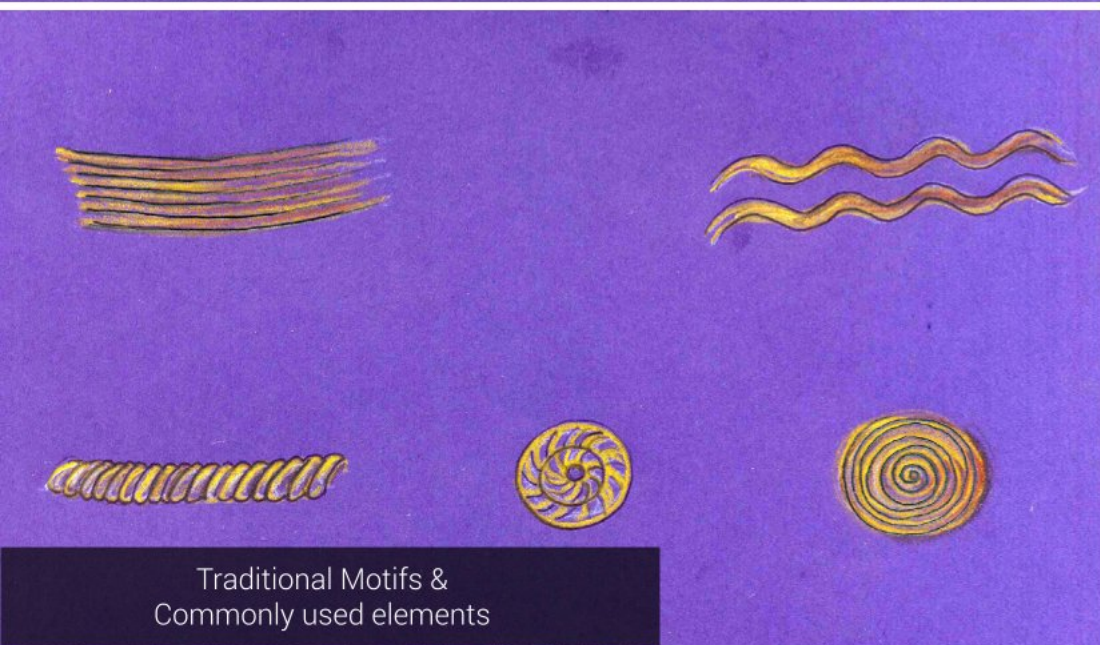
Indian Anthropometric dimensions for ergonomic design practice;
by Debkumar Chakrabarti, ISBN No: 81-86199-15-0 , 1997 NID



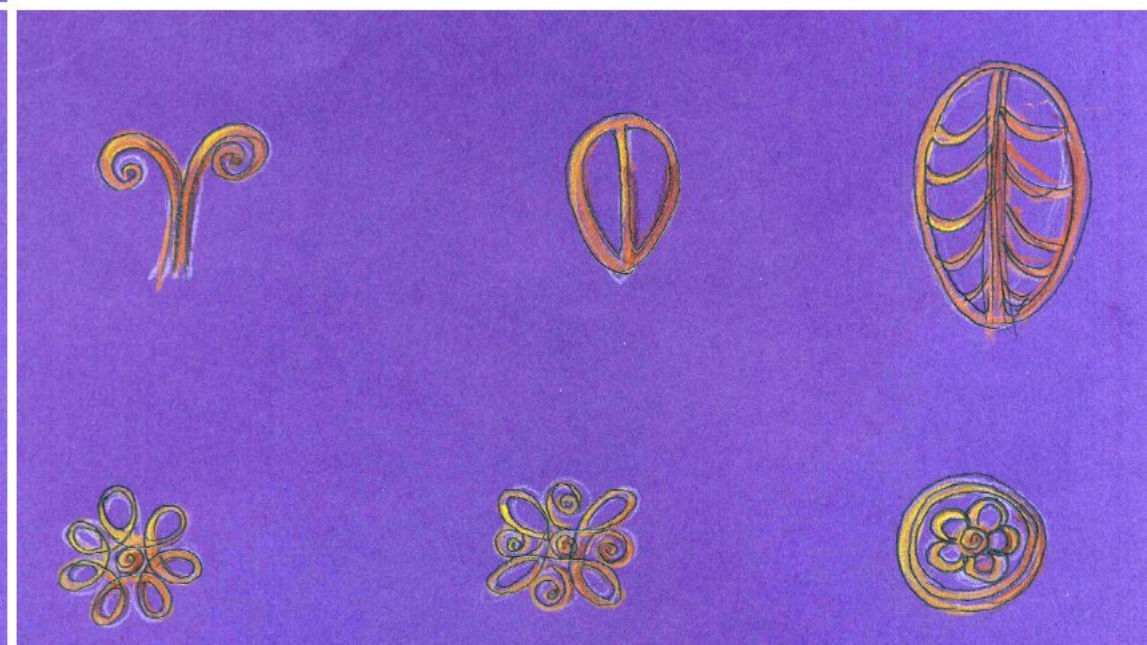
8 Motifs

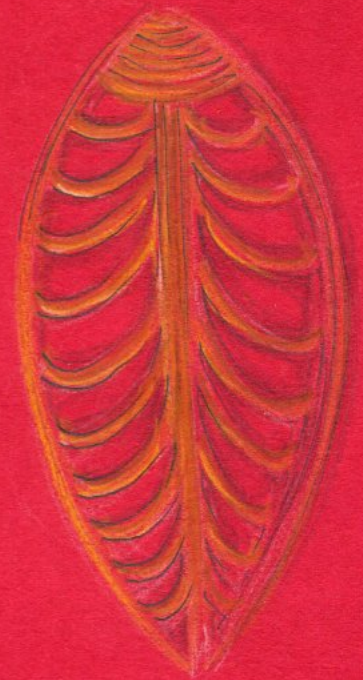
Dokra artisans decorate the objects with different folk motifs which are carefully made by sticking wax threads on clay cores. These motifs are inspired from the things in nature like flower, leaf, water etc.

New motifs are developed considering what will be possible to make using wax threads. In some of them, elements of traditional motifs are used to keep essence of tribal craft intact.

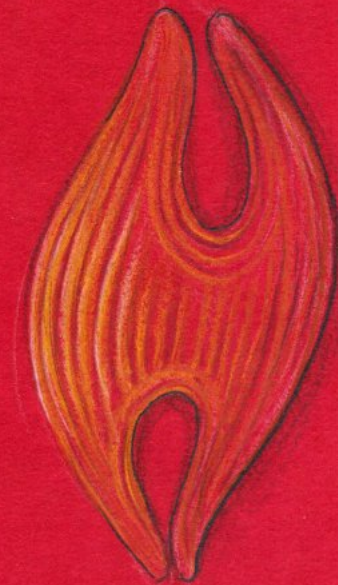


Traditional Motifs & Commonly used elements

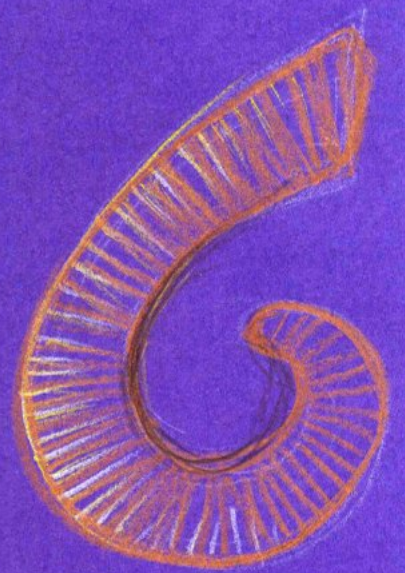
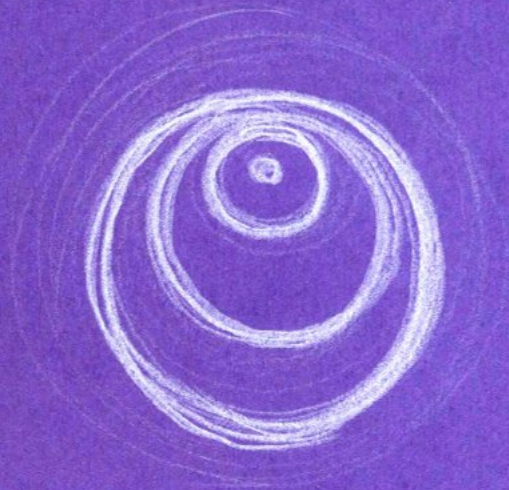




New Motifs



New Motifs



New Motifs

9 Ideation

Two main categories of door handles are made

1. Complete Handle in Dokra
2. A component of handle is made of dokra

The first category is further sub-divided into several other categories as follows

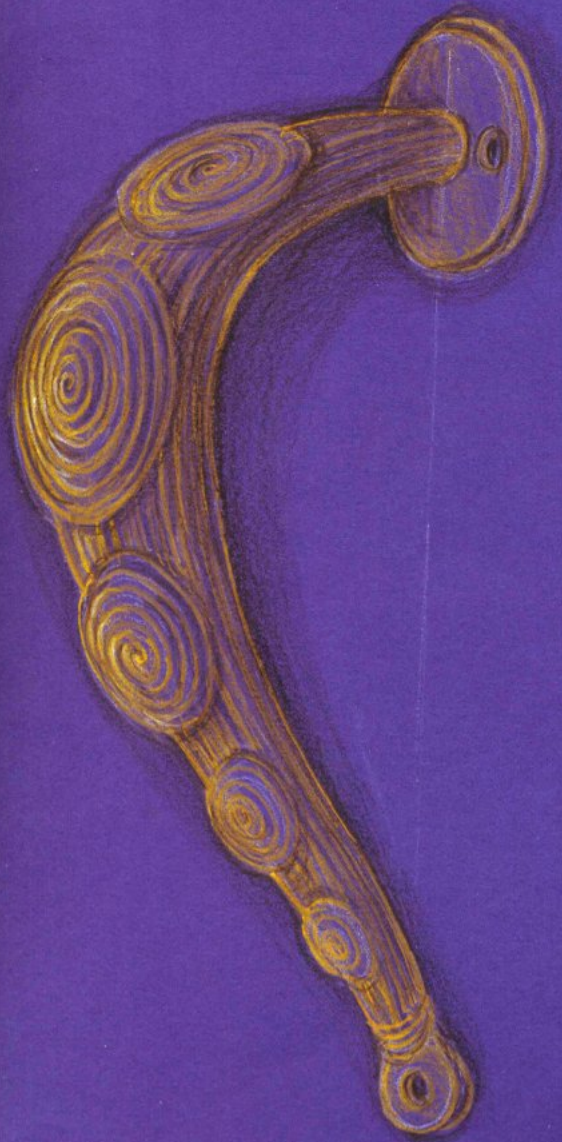
- a. Pattern of Motifs
- b. Animal/Bird Form
- c. Offset
- d. Minimum Material
- e. Use of Back plate
- f. Push-Pull

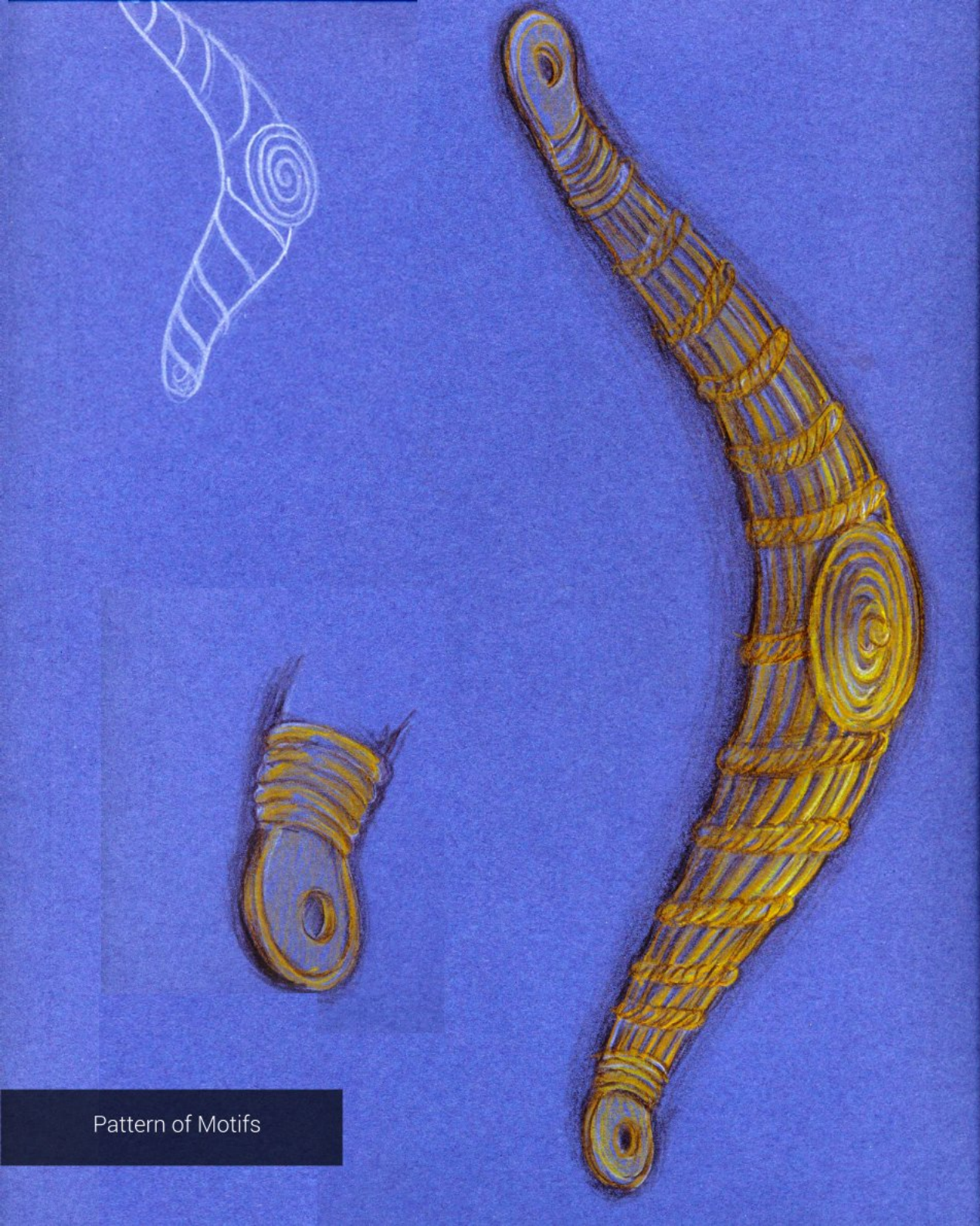


Category 1 : Complete Handle in Dokra



Pattern of Motifs





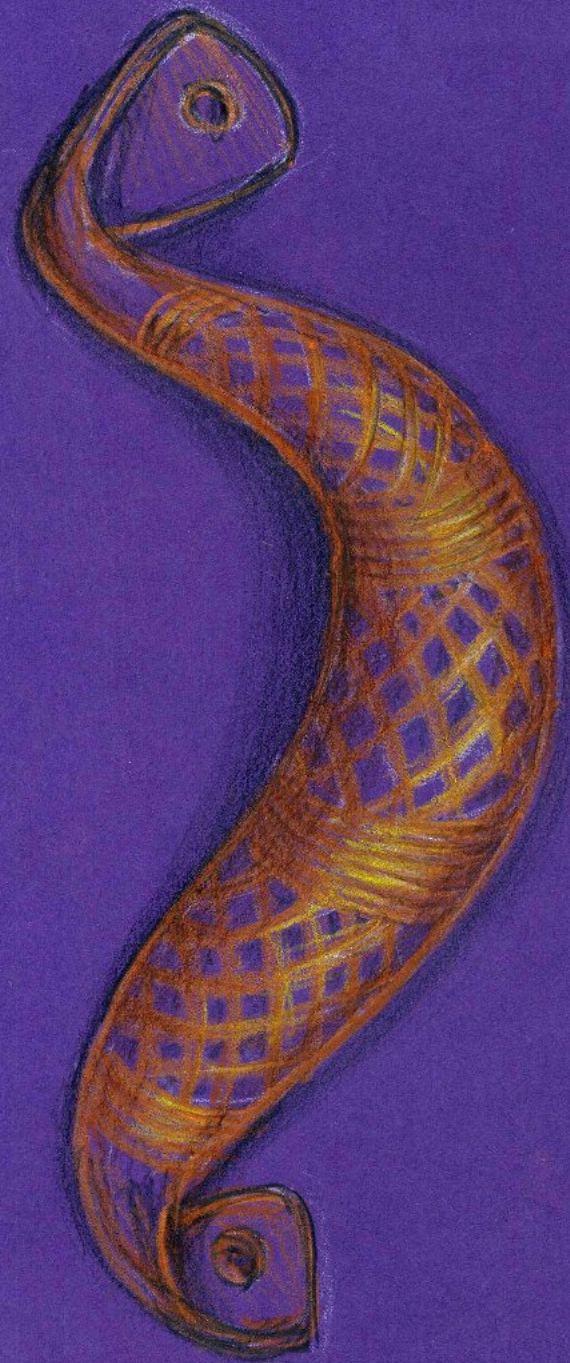
Pattern of Motifs



Animal/Bird Forms



Animal/Bird Forms



Offset



Offset



Minimum Material



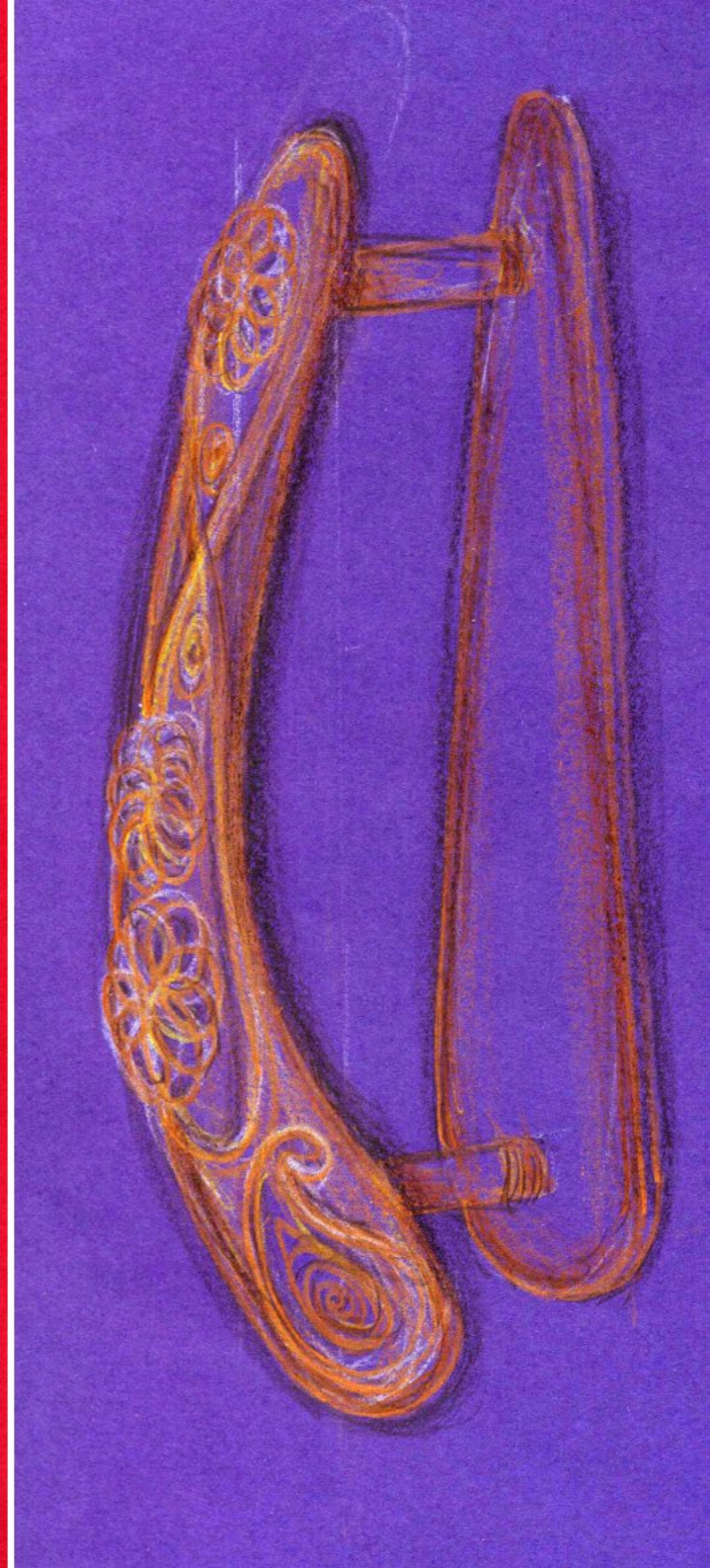
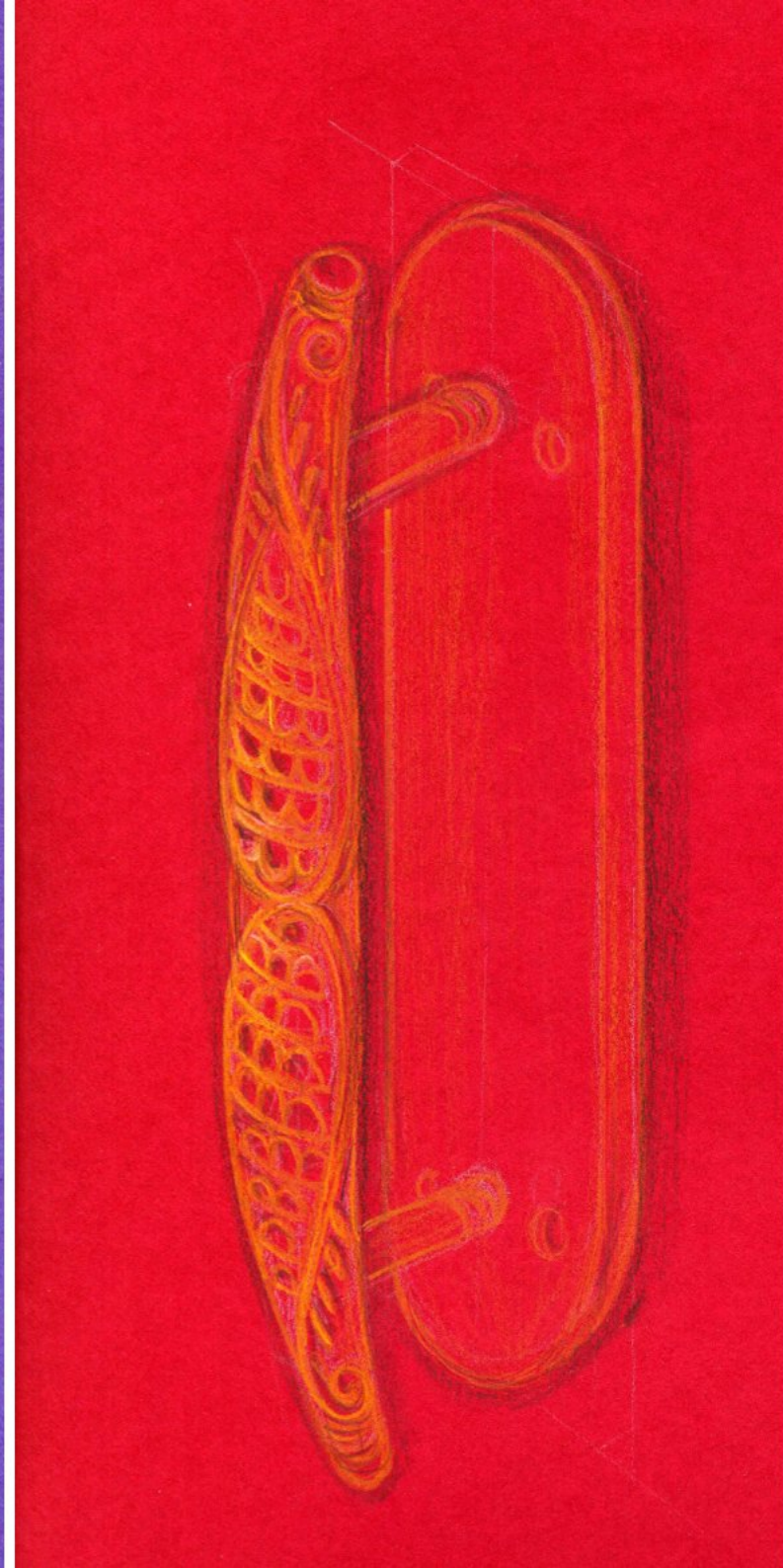


Minimum Material



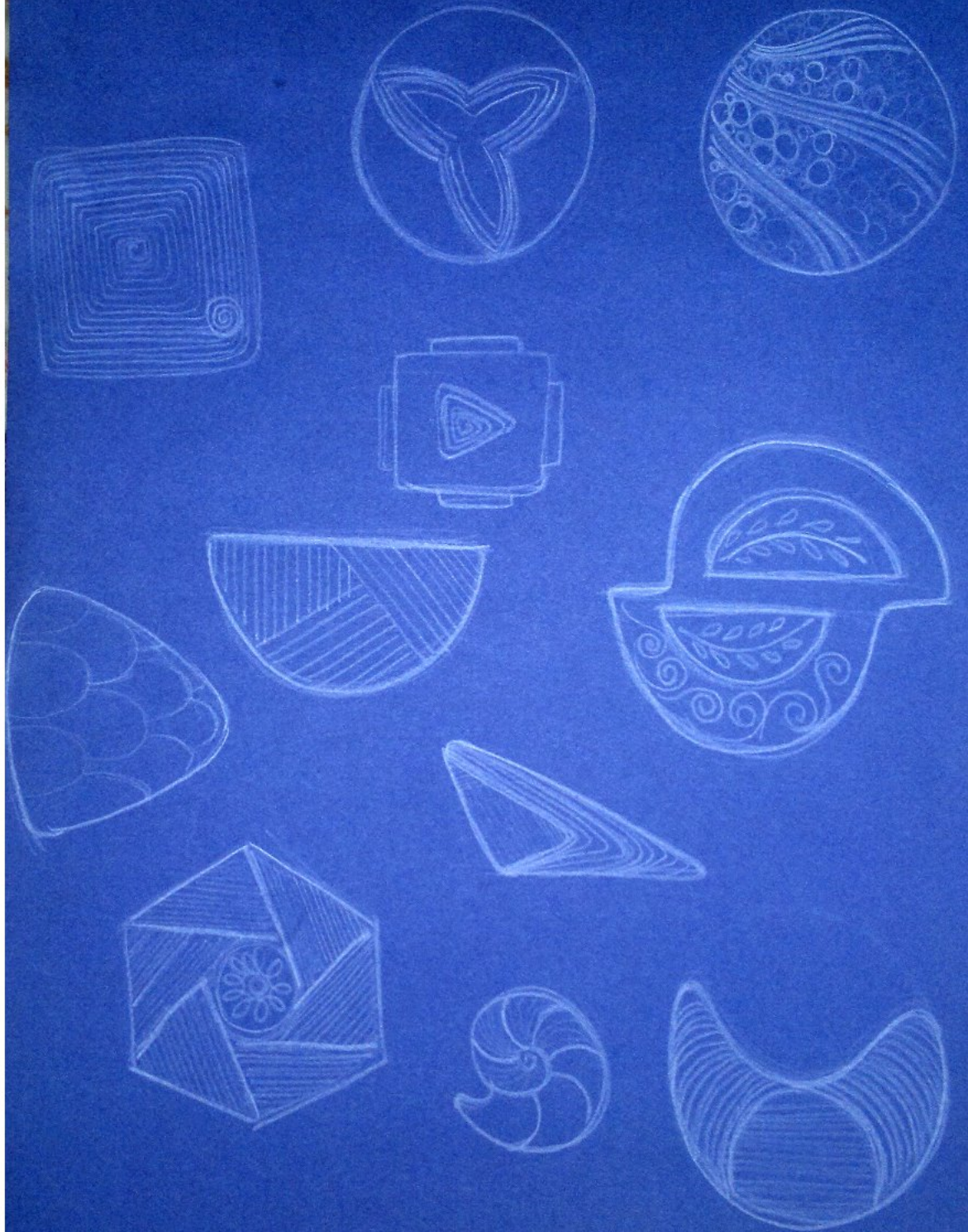
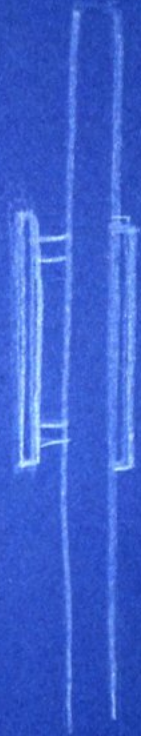


Use of Backplate



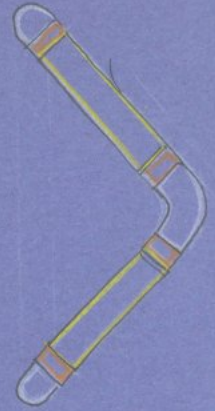
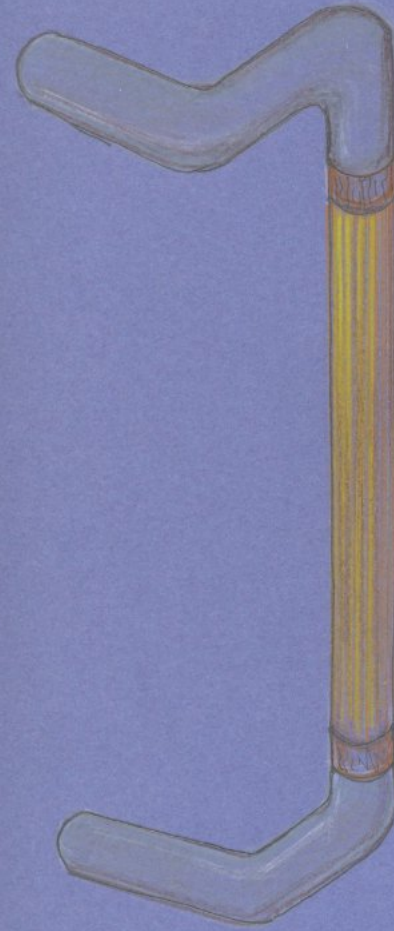
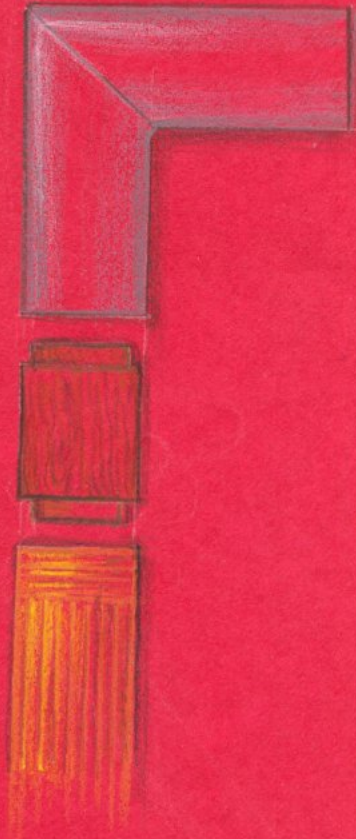


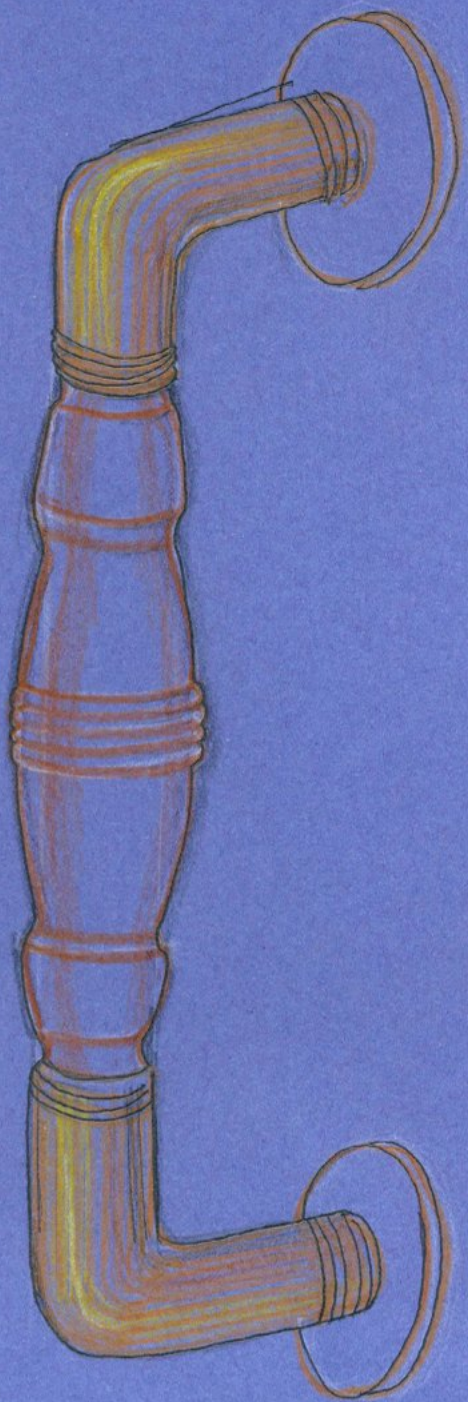
Backplate Forms

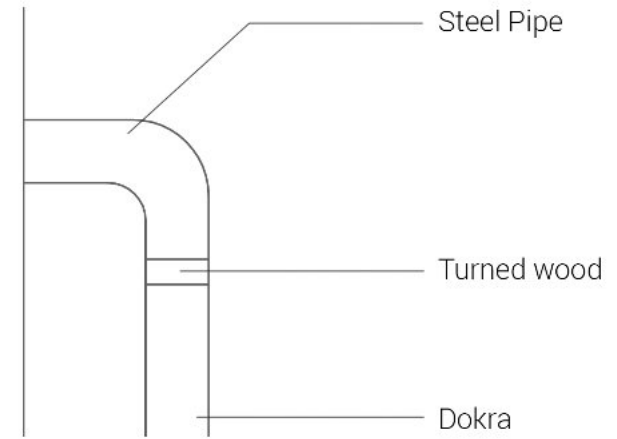
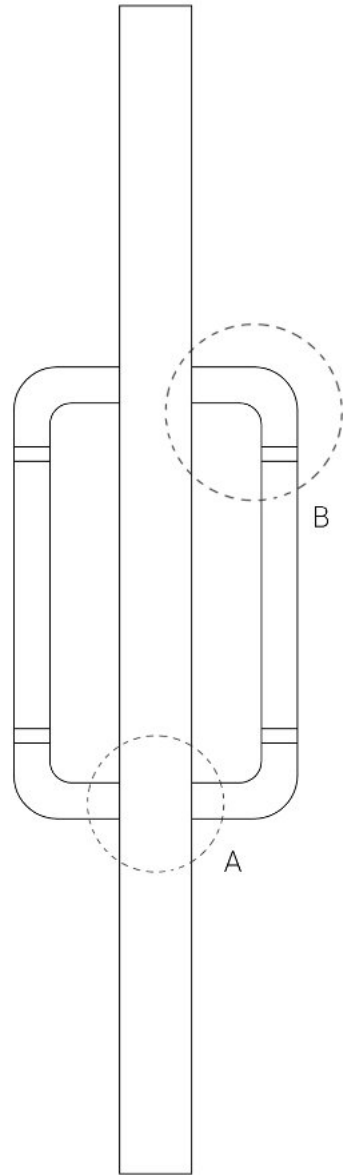


Push-Pull

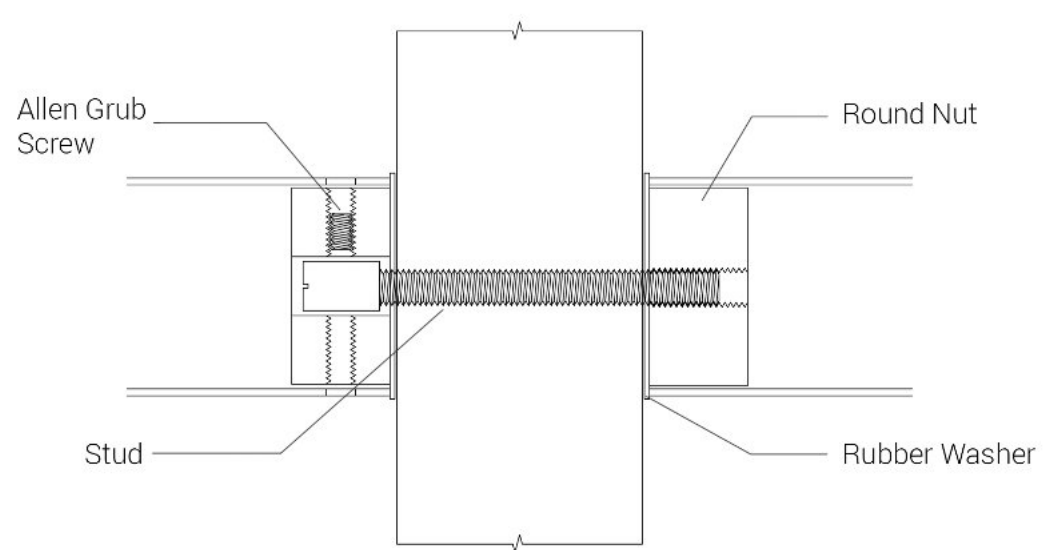
Category 2 : Component of Handle in Dokra





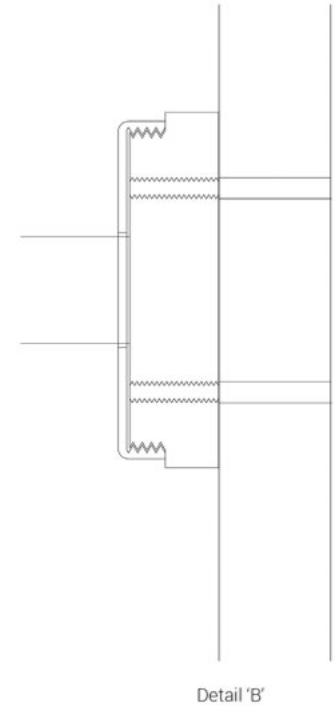
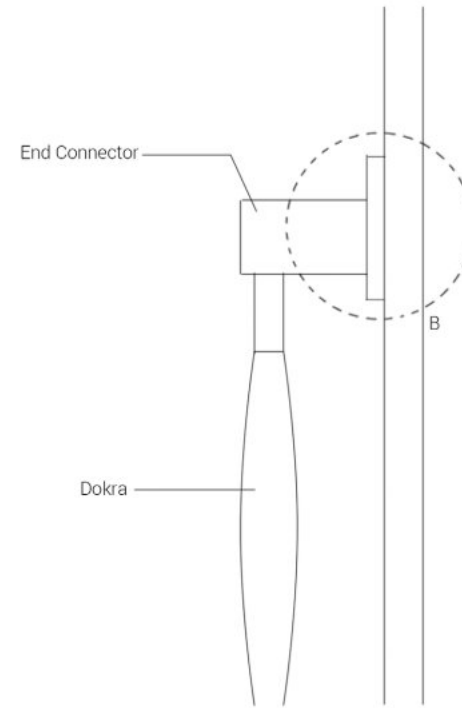
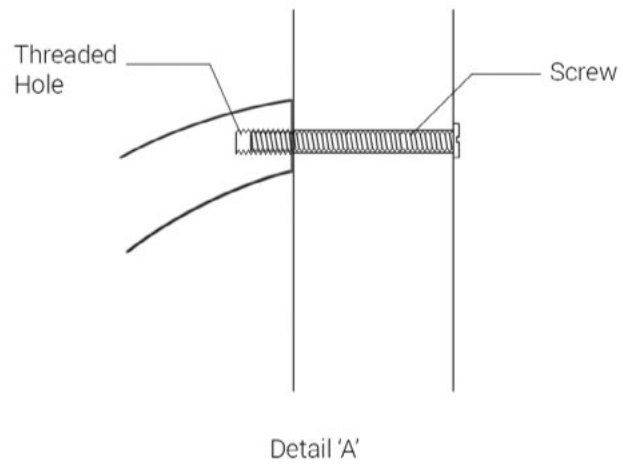
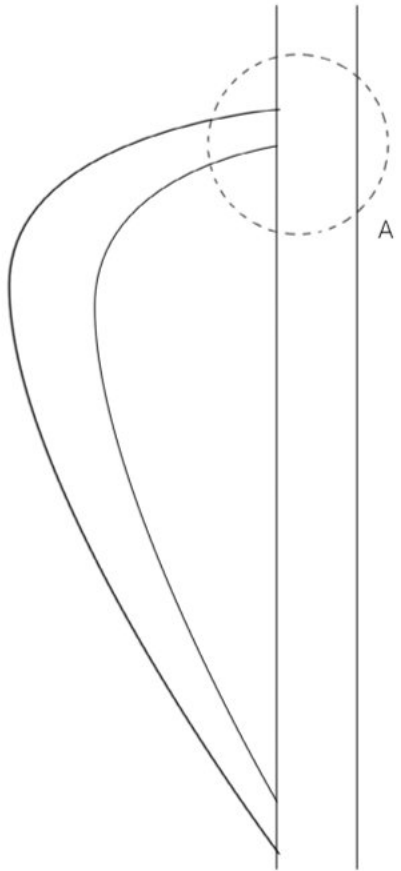


Detail 'B'

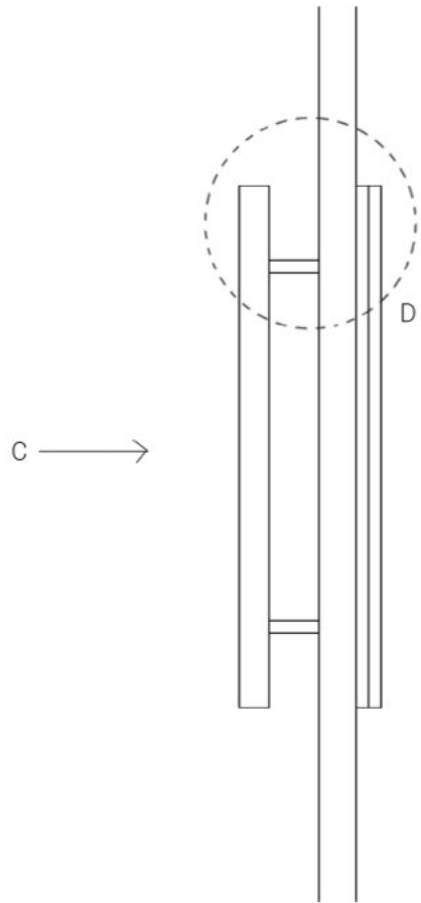


Detail 'A'

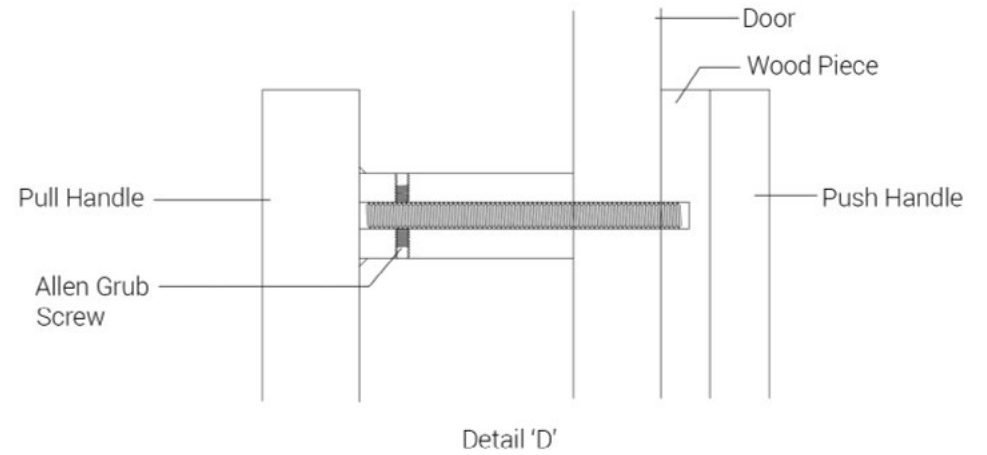
Connection Details for Category 2



Connection Details for Category 2



View - C



Connection Details for Push-Pull

10 Mock-ups

To get the feel of actual dokra handle, wire of aluminium/copper is wound over PU foam core. Using metal wire for mock-up has some limitations in bending it in different ways. Hence all design details and motifs can not be shown in them.

To get an idea about gripping on handle and how the form will look, rough and dirty mock-ups are made using thermocol. Motifs are drawn on them with black ink.



PU Foam Core for Mock-ups



Mock-up 1





Mock-up 2





Mock-up 3





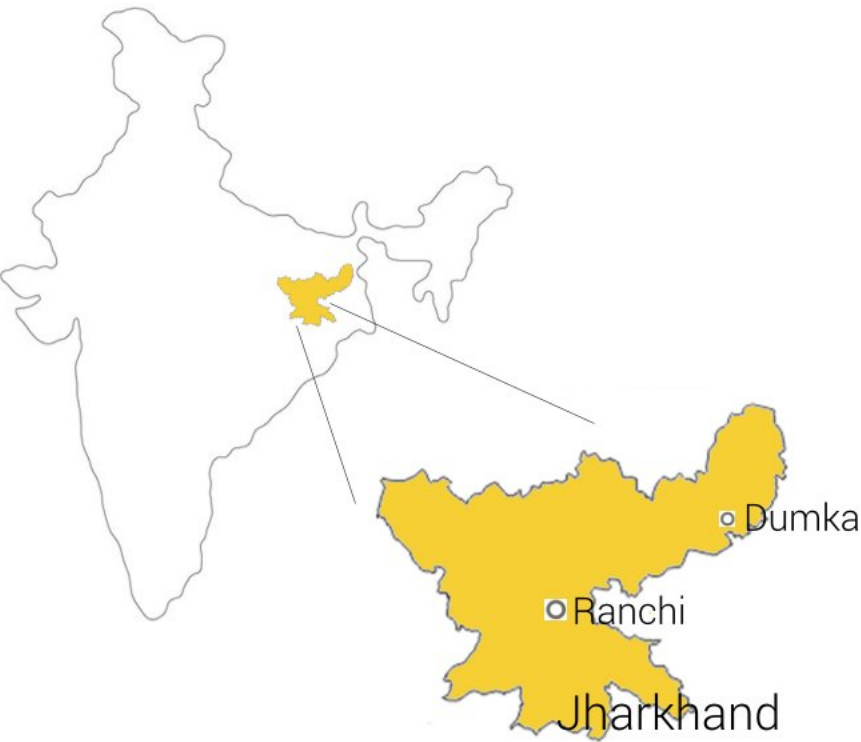
Mock-up 4





Thermocol Mock-ups





11 Casting Process

Traditional Dokra castings of Jharkhand

The unique feature of traditional casting is that the crucible 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. Hakimda lives in Jagudi village. Jagudi is a very small village in Dumka district of Jharkhand.



Location of Craftsman's village





Metal Pieces



Red Clay



Rice Husk



Coal



Wax



Incense

He is one of the skilled craftsmen in the village and his crafts are very popular in around Shantiniketan. Hakimda is practising Dokra casting for last 30 years and earning his living. He casts anklets, measuring bowls, dancing bells, idols etc. I lived in his house while I was there in Jagudi. He made sure that I feel comfortable at his place.

Raw Materials

Metal

The primary raw material is brass or bronze metal which is purchased from district market metal shops.

Riverside Clay (Lal Mati)

The red colored riverside clay 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 Clay (Kali mati)

It is collected from the beds of fields.

Cow Dung

It is mixed with black clay.

Coal

Coal used in kiln is procured from local traders.

Wax, Incense and Edible Oil

These are mixed together and heated for making threads.



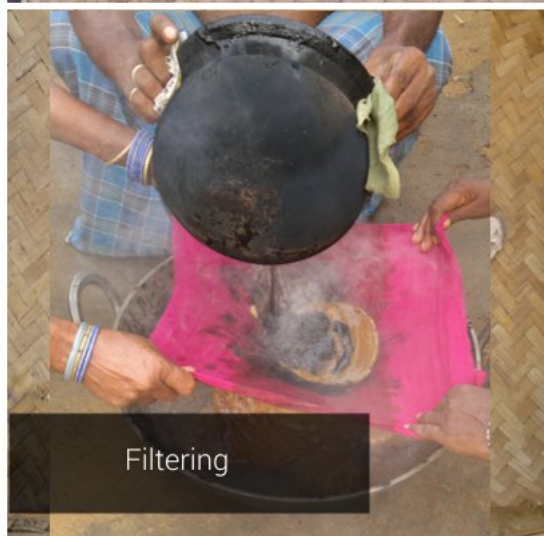
Wax & Incense
(1:1 proportion)



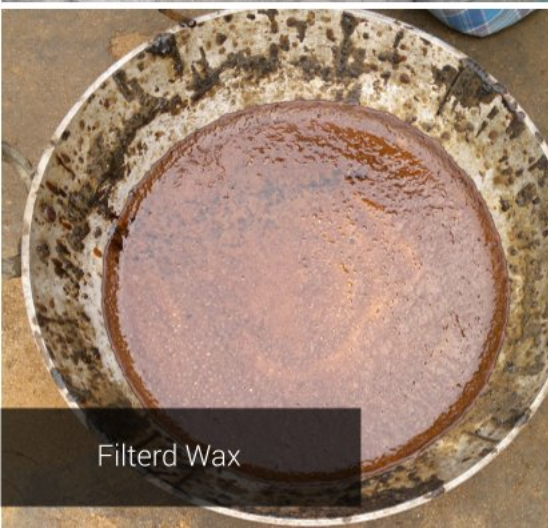
Powdered Mixture



Wax Heating



Filtering



Filtered Wax



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.



Wax Heating



Hand Press



Wax Threads



Wax Thread Bundles

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.



Clay Digging Place



Red Clay



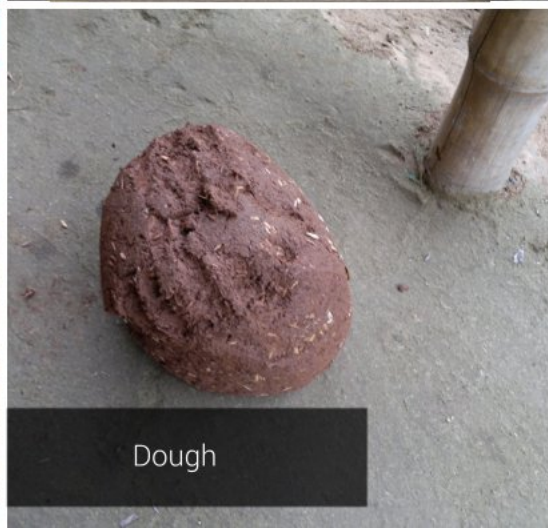
Rice Husk



Husk & Clay Proportion



Mixing



Dough

Clay Collection and Preparation

The good quality red clay for making moulds is available 1km inside forest. The clay 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 clay is mixed with cow dung and formed into a soft dough.



Clay Core forms kept on jigs

Clay Core Making

Basic clay cores are prepared of red clay by shaping it with hands. For maintaining critical anthropometric dimensions and desired forms, I used wooden jigs in clay core making. The cores are kept for sun drying. The dried cores are coated with

a layer of black clay and again kept to dry in the sun. The hard and dried cores are scrubbed with the help of rough stones to make surface smooth. They are then scrubbed with hands to remove dust.



Clay Core made using a Jig



Clay Core made using a Jig



Wax coiling on clay core



Motif



Set of handles with Wax wire coiling



Wax Channel Attachment



Handles with Wax Channels

Coiling of Wax Threads

Before winding wax threads on the cores, the cores are kept in sunlight to get heated slightly. Wax sticks easily on the heated cores.

Motifs are made 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.



Wax Strips

End Connections using Product Specific Tools

End connection is the part of door handle which is going to get fixed with the door. There should be some standards maintained such as screw hole positioning and hole diameter. As Dokra products are entirely made by hand, it

is very difficult to make end connections exactly same each time. Simple tools are made from materials which will be easily available to craftsmen and they can also develop new tools getting some idea out of it.



Sequence of End Connection making with the use of product specific tool



End Connection
Attached to Handle

Wax strip is made first and a PVC pipe of required diameter is kept on it. A press tool which has screw positioning marked is pushed through this pipe. The press tool marks the screw positions accurately. The extra wax around pipe is removed.

This wax cut-out end connection is then attached to the coiled door handle. Similarly other types of end connections are cut from wax strip and attached to handles and they are also decorated with various motifs to maintain overall design language of the object.



End connection attachment



Handle Completed
with wax work





Black Clay layer over the wax work

Covering Mould with clay layers

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



Red Clay layer



Multiple moulds attachment



Bowl at one end

Attaching multiple 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.



Metal utensils kept in fire



Breaking metal utensils and putting pieces in crucible



Crucible attachment



Metal

Metal shops in Dumka town sell scrap metal pots, utensils. Those pots are put into fire so that they become hard 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 clay.





Kiln

Kiln Preparation

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

The coal pieces are arranged in the kiln 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 kiln is then fired using dry rice husk. The wax coiled on the moulds melts and evaporates due to high temperature.



Moulds in Kiln



Mould taken out of kiln



Mould turning sequence



Breaking the mould



Mould Turning

The moulds are kept in kiln 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 clay 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 clay stuck in corners.

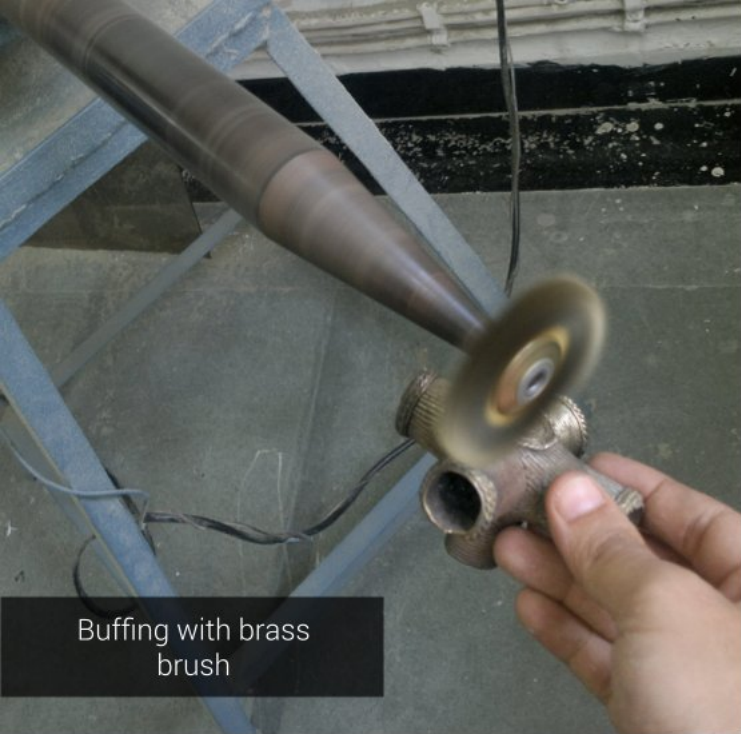


Casted Handles



Cleaning





Buffing with brass brush



Cleaning & Polishing

Handles are cleaned with wire brush and polished on buffing machine to get different surface finish and color. Some of the handles have got beautiful color patterns during casting, those are kept intact to achieve antique look.



Surface finish & Color change after cleaning





Turning of acrylic rod

Machining

Some of the components are fitted to dokra part after machining to exact required size. Here elements of different surface qualities are juxtaposed to create visual tension.



Final Products







12 Learning & Contribution

Working with artisans, understanding their daily life and facing the day-to-day problems encountered by them was itself a great learning experience for me during my stay in the village. It not only helped me to grow as a person but also allowed me develop my thinking process as a designer. Understanding the social and economical aspects of the craft and also closely observing the craftsmen's life was an exciting journey.

Working directly with artisan was a tough task initially. But as bond between a designer and an artisan grows stronger and better understanding of each others' strengths and weaknesses comes naturally. The relationship grows

with time and faith in each other leads to significant contribution from both the sides to give a balanced output.

One of the important learnings for me was while performing the design process with artisan, enough time should be given to them to understand and assimilate our perspective without rushing towards our own intended final outcome. Freedom given to artisan is necessary for inputs and suggestions from his end to make required adjustments and improvisation in the design. There must be a dialog and discussion between designer and artisan rather than one way instructional approach in the execution of plans.

The skills and knowledge acquired at IDC contributed to a great extent in each and every step of the project. Sketching and rendering skills learnt during media investigation module helped during ideation to communicate my ideas through detailed renderings. Understanding of material and processes was extremely useful for learning potential of metal casting as well as its limitations and to use those limitations wisely to creatively design a product. Mock-up modelling skills of PD1 and PD2 modules were applicable for making dokra alike mock-ups.

Well thought designs and plan of action resulted in better execution of ideas

while working on field. Use of product specific tools, jigs, creative forms contributed to add value to the final output product retaining aesthetics of traditional craft.

The idea of the project is to apply design aesthetics in such a way that handicraft products rightly fit into luxury product segment where they have more appeal to market where it can be appreciated. Apart from this, an approach is followed in which artisans are exposed to new possibilities with the craft which they can practice to earn better livelihood and to make the craft sustain even when it has a strong competition from mass manufactured products.

It was evident from the overall experience that the products must be designed so that artisans can perform permutations of various elements in the designs to create a variety of products by themselves and designs do not become repetitive. Regular participation of designer and artisan will result in quality products which will be extremely beneficial for the upliftment of craft.

Scope for future work

This project has helped to a bring a deeper understanding of a traditional craft, lives of practicing craftsmen and their social structure. Explorations in motifs, forms and technique in making it led to

development of a range of door handles.

Much more detailed study of tribal forms and motifs to enhance sophistication of form can be done to design other products. Market link establishment, branding, advertising of the craft would be a step taken further to encourage sales.

The more we embrace dokra craft products in our day to day life and activities the more we will understand the value of it. And a reminder of our need to promote, preserve and propagate it.

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