Copper in *Tambat Ali*:

Design, Craft, and the Transformative Properties of a Material in Pune, India

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Declaration

I, Prasad Boradkar, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

April 15, 2022

Signature Date

Abstract

This research is an examination of the materiality of copper in the context of a design and craft community in a place called *tambat ali* (which in the local language Marathi translates to coppersmith alley) located in the heart of the city of Pune in Western India. For centuries, several generations of coppersmiths (*tambats*) have been shaping this malleable, sensorial material into a variety of objects for domestic use. Copper (*tamba*), in an expression of transformational materiality, has in turn, shaped the *tambats* into who they are as persons. In addition, the materiality of copper has engendered a unique set of skills and techniques, and it has moulded their bodies and gestures. The *tambats* make a variety of objects that are described as *vastu* in Marathi, a word that also refers to narratives that arc over the life of the material, the people, and the things themselves. For the past few years, the *tambats* have been collaborating with architects and industrial designers to create a variety of new copper products that are sold nationally and internationally. While industrial design practice typically tends to focus on form, user needs, or the market, in *tambat ali*, it starts with an emphasis on the properties of the material. Here, design unfolds in a new social context created by the presence of copper.

This thesis, with its focus on materiality, design, and craft, will attempt to show how copper has produced a materially inspired sociability, which has shaped the stories of objects, the nature of place, the practices of design and craft, and the lives of the people of *tambat ali.*

Impact Statement

This thesis can be situated in the anthropological subfields of ‘material culture studies’ and ‘design anthropology’, and it has the potential of leading to beneficial impact in both areas of study. And this impact is likely to be felt in academic scholarship as well as in practical application. The critical examination of copper, design, and craft, which form the fundamental core of my work, can: (a) help anthropologists and designers better understand the social import of materials; (b) inform new ways of conducting design and craft research; (c) guide designers in developing partnerships with crafts communities that are beneficial to the craftspersons, and (d) assist anthropologists in determining ways of critiquing the praxis and outcomes of design and craft activity.

Impact on Academic Scholarship

The study of copper adds to the body of literature in material culture studies, in which the critical, social examination of materials lacks sufficient attention and warrants more scholarship. Similarly, design anthropology, an emergent field of study, is likely to benefit from detailed examinations of the sociotechnical process of the making of objects that are included in these pages. As the field site for this research was the city of Pune in Western India, this thesis might also be useful to anthropologists engaged in the study of such topics as Indian personhood and caste.

Impact on Practice

While design anthropology is an academic endeavour which leads to publications as its primary form of output, it can also be imagined as a professional practice of which the outcomes can be new products and services, design principles that can guide designers, and opportunities for activist anthropology. It is possible that this work could inspire different forms of collaborations between designers and craftspersons, which in turn could result in new product designs.

Finally, and most importantly, I hope that this thesis has value to the *tambats* themselves, whose designs, products, skills, work, and lives inspired me to write about them in the first place. As far as I know, this is the first doctoral study of Pune's *tambat ali*. The *tambats* have said to me that a detailed documentation of their craft does not exist and could be beneficial to the community. It can serve to raise awareness of their work, which can lead to tangible and intangible benefits. The *tambats* have said that the step-by-step breakdown and analysis of their production processes that is included in this thesis has historical value as techniques of making are changing on a regular basis and things are no longer made the way they used to be. My goal is to have sections of the thesis translated into Marathi, which will increase readership in the *tambat* community.

Acknowledgements

This project would never have been completed without the endless encouragement, expert guidance, and solid support of scores of people. I wish I could mention everyone who has been there for me, and I wish there was some way for me to list all that they have done for me. Sadly, I cannot do so but only express my immense gratitude.

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I have no words to describe how much I miss you, Dan.

In Memory of…

Daniel Brouwer and Shraddha Kadu

Glossary of Marathi Terms

Adi ____________________ Anvil

Akar ____________________ Shape

Akhi ____________________ Compass

Akhne ____________________ Marking

Ayurveda ____________________ Traditional Indian medical system

Badli ____________________ Bucket

Bamba ____________________ Wood or coal fired water heater/s

Bhangar ____________________ Scrap

Bhatti ____________________ Furnace

Bhok ____________________ Hole

Bola ____________________ Wad

Budchaki ____________________ Base cap of the bamba

Chavarshi ____________________ A hammer with a unique texture

Chincha ____________________ Tamarind

Daag ____________________ Brazing paste

Dabba/Dabbe ____________________ Box/Boxes

Dat/Datey ____________________ Tooth/Teeth

Dhani ____________________ Poker

Dhune ____________________ Washing

Funkni ____________________ Blower

Gadkam ____________________ Shaping

Gadwa ____________________ Utensil used in ceremonies

Ghangal ____________________ Wide-mouthed water container

Ghasne ____________________ Rubbing, Scrubbing

Handa/Handi ____________________ Small mouthed water container/s

Hatodi ____________________ Hammer

Jaat ____________________ Caste

Jadavkam ____________________ Assembly

Jalkam ________________________ Heating, Brazing

Jasta __________________________ Zinc

Jhakan ________________________ Lid of the bamba

Jodkam _______________________ Joining

Kalshi _________________________ Small mouthed water container

Kan ___________________________ Ears

Kapad ________________________ Cloth

Kapkam _______________________ Cutting

Katri __________________________ Shears, scissors

Kharvai _______________________ Bar anvil

Khod _________________________ Wooden support of the kharvai

Kholkam ______________________ Sinking, hollowing

Kholnya _______________________ Specialised hammer

Kolsa _________________________ Coal

Korda _________________________ Dry

Koti ___________________________ Coal reservoir of the bamba

Matharkam ____________________ Creating a hammertone texture

Mogri _________________________ Mallet

Nal ____________________________ Faucet of the bamba

Nala ___________________________ Flue of the bamba

Nakhi __________________________ Specialised hammer

Otivkam ________________________ Casting

Pani ____________________________ Water

Patra ___________________________ Sheet

Patta ___________________________ Main body of the bamba

Pela ____________________________ Drinking vessel

Peth ____________________________ Ward or region of a city

Pimpa __________________________ Cylindrical water container

Pital ____________________________ Brass

Pogar __________________________Punch

Polad ______________________ Steel

Ribit ______________________ Rivet

Sandshi ______________________ Tongs

Sari ______________________ Bead making machine

Sarkhi ______________________ Specialised hammer

Supari ______________________ Betelnut

Swadi ______________________ Borax

Tag ______________________ Jute

Tamba, Tamra ______________________ Copper

Tambat ______________________ Coppersmith, coppersmith caste

Tambat Ali ______________________ Coppersmith Alley

Tambya ______________________ Small mouthed water container

Tamhan ______________________ Wide utensil used in ceremonies

Tapele ______________________ Vessel used in cooking

Tar ______________________ Wire

Tejav ______________________ Acid

Tejavkam ______________________ Acidwash

Tival ______________________ Stand for Bamba

Twashta Kasar Samaj ______________________ Coppersmith Community

Ubala ______________________ Anvil

Vastu ______________________ Things, stuff, plots

Varna ______________________ Caste hierarchy

Vijavne ______________________ Quenching, Extinguishing

Zara ______________________ Mesh for the bamba

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Chapter 1
Introduction

1.1 *Tambat Ali*

In the heart of Pune in Western India is Kasba Peth, the oldest part of the city established around 1300 CE (Benninger, 2011), an area densely packed with narrow streets, row houses, small convenience stores, workshops, open courtyards, schools, and temples. Nestled deep in this area is *tambat ali* (which means coppersmith alley in the local language Marathi), where roughly forty coppersmiths (known as *tambats*) beat malleable sheets of copper (*tamba*) into a variety of traditional and contemporary products. These *tambats* ply an old trade, as did several generations of coppersmiths before them. The community of coppersmiths traces its history back to the late 1600s to the time of warrior king Shivaji Bhosale (1630-1680 CE) who invited these metalworkers to settle in Pune and tasked them with making religious objects and military equipment such as temple finials and cannons from copper and its alloys. The community grew and their work expanded in scope in the 18th century during the Peshwa regime in the region, as the *tambats* started making coins, letterforms for printing, as well as cooking utensils. In the 19th century, after being forbidden by the British (who had created military encampments in Pune) from manufacturing arms, the *tambats* increased production of utensils for domestic use, beginning a practice that continues to date.

Today the *tambats* are known for several traditional copper objects such as the *bamba* (a coal-fired water heater), *pimpa* (a cylindrical water container), *handa* (also a water container but with a small mouth for transport), which they have been making for generations.

But many of the *tambats* are also creating a variety of new objects such as flowerpots, *masala dabbe* (spice boxes), *supari dabbe* (betel nut boxes), lamps, and more, some on their own and some in collaboration with local architects and designers.

Figure 1.1: *Tambat ali* in Pune, India (Photograph by Alex Velasco)

The work done here is recognised as being unique to *tambat ali* primarily because of the striking hammertone texture that the coppersmiths beat on to the things they make using a variety of highly specialised tools. Each copper object travels through a chain of practiced hands until it ends up with experts in *matharkam* (creating a hammertone texture) who strike the surface with a precise pattern that gives the object its strength and lustrous beauty. Using hammers and anvils they have designed themselves as well as a range of highly practiced and precise motions, they beat row after row of dimples into an even pattern on the surfaces of the copper products they make. This skilled trade requires manual strength, extreme concentration, special techniques, distinctive gestures, customized tools, and years of practice. Copper, this luminous red-orange metal is ubiquitous in *tambat ali*, and its critical examination is the fundamental purpose of this thesis.

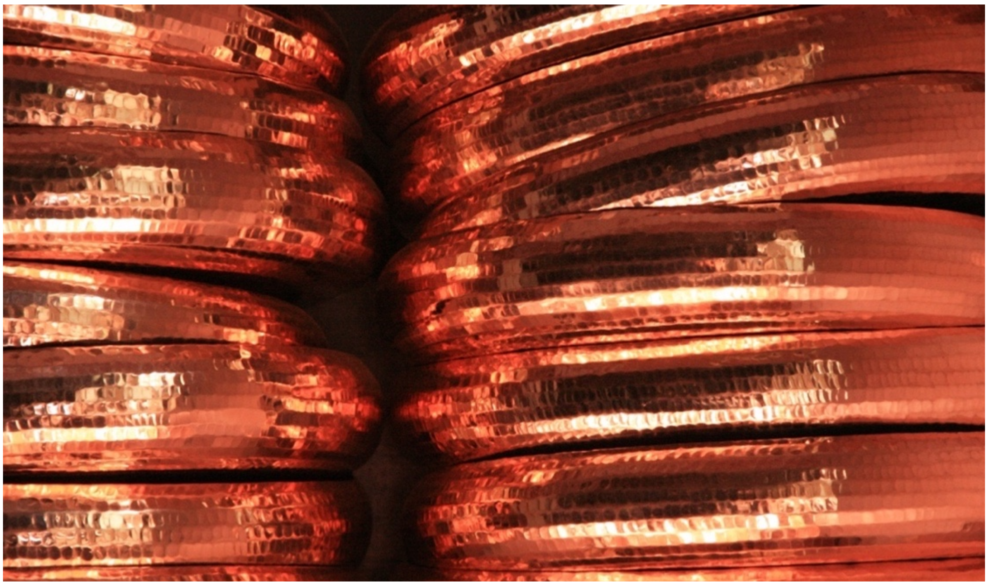

Figure 1.2: Finished copper vessels with the hammertone texture, stored on a shelf in the workshop of Bajirao Karulkar (Photograph by the author)

1.1.1 The Introduction

This introductory chapter starts with a description of *tambat ali* and an account of my first visit when I walked around the place, met people, and saw some of the copper artefacts being made in the workshops. This section is followed by an overview of some of the key topics of significance to the thesis as well as a discussion of the primary and secondary questions that guide the study. My work is primarily and substantially concerned with copper and therefore materials and materiality are the focus of the subsequent section. Design and craft, topics that make up the secondary concern of this study, are examined broadly and in the Indian context, following the discussion of materiality. I then outline the methodology and ethical considerations that guided my work while helping me learn about *tambat ali.* A review of some of the relevant literature (from which this thesis borrows theoretical concepts but also hopes to contribute to) then follows with a focus on understanding personhood, objects and things, techniques of production, the emerging field of design anthropology, and additional background information on design. Brief summaries of the chapters wrap up this introduction.

1.1.1 My First Visit to *Tambat Ali*

The ringing of iron hammers on copper utensils, a sound unique to *tambat ali* that I became extremely familiar with in the subsequent years, first fell on my ears during the summer of 2012. Though I had been to the city of Pune several times, this was my first visit to this region in the heart of Kasba Peth. Over the years I kept coming back to *tambat ali*, drawn to the sound of the hammers, the lustre of the material, the winding streets where the workshops are located, and the people who welcomed me with open arms into their workshops. That day in summer, I was following architect and product designer Rupali Rane, who has been working with the coppersmiths for over a decade. She has been designing new products along with them for manufacturing in *tambat ali*. In following her footsteps through the streets, I discovered my field site. Through her introductions, I met several craftspersons and their families.

On this first trip to *tambat ali*, I followed Rane as she navigated her way around the area speaking to craftspersons, workshop owners, and elder statesmen of the community. The first two craftspersons I met when we got there were Sadashiv Apte and Bijubhauji Palekar, both sitting on the street outside Murli Palekar's workshop with their tools, hammering copper and aluminium utensils. Rane talked to them for a few minutes and observed the work they were doing, while I was taking photographs and shooting videos of their activities. I was struck by the fact that they were sitting out on the street as pedestrians, scooters, motorcycles, and rickshaws whizzed by them, inches away from the place of their work and the products of their creation. I learned that copper was the primary material the craftspersons worked with, but they did make things from aluminium, brass, silver, gold, and a few alloys as well. Palekar was hammering an aluminium vessel that day, putting evenly spaced dimples along its rim. Apte, seated next to him, was hammering a large copper utensil. He would, over the next few years, take the lead in teaching me the fine craft of hammering copper.

After a few minutes of conversation with them, Rane and I walked down a narrow alley to the workshop of Bajirao Karulkar. As we entered the small office at the end of the lane, we found him seated at his desk, on which were several photo albums of his work, drawings of his products, and a few copper artefacts. Rane introduced me to Karulkar and explained that he was one of the elder statesmen of the *tambat* community, and someone she worked with closely on a regular basis.

Figure 1.3: Bajirao Karulkar's workshop (Photograph by the author)

Behind the office were two additional rooms separated by an open courtyard. In the room behind Karulkar, I could see large sheets of copper leaning against a wall, partially finished products, moulds and dies, old copper and brass artefacts, and an assortment of tools. This was a space of imagination and of making. Evident in the objects scattered and piled around the workshop was the energy of creation. The *tambats* were engaged in conversation, in sharing tools and materials, in helping each other, and in constant contact with the material responsible for their very presence there—copper.

After some conversation with Karulkar, we left his workshop to head over to the third region of *tambat ali* known as Bakkhal. The short walk from Karulkar's workshop involved going out on the main road and back through a series of narrow alleyways to a small nook just outside the main section of Bakkhal where we met Govind Waghmare. He was seated on a bar anvil known as *kharvai*, hammering a large copper *bamba,* amidst a large number of hammers of all shapes and sizes scattered on the floor near him. Stacks of jute cloth saved from packaging, photo albums of his work, a cell phone, and several brass and copper artefacts lay nearby. After a few minutes of conversation with him, we walked through a doorway that led into a dark chamber before opening up into a large sunlit courtyard. All around the courtyard were rooms with open verandas in front of them where several *tambats* were busy at work, hammering copper products, embossing silver sheets, acid-washing large containers, polishing brassware, and so on. In the centre of this open area was a water tank, called *houd*, around which were several taps where some of the craftspersons were scrubbing copper utensils and a few women were washing clothes.

Figure 1.4: Bakkhal with the water tank on the left (Photograph by the author)

We walked around the courtyard, greeted some of the craftspersons and wound up in the workshop of Uddhav Kadam, who everyone referred to as Uddhav Kaka (Uncle Uddhav). He was in the process of hammering a product designed by Rane, a tea light that held a votive candle. She introduced Uddhav Kaka to me as another one of the more accomplished and meticulous craftsmen, highly skilled in creating an extremely precise and even hammertone. While most of what I saw on this day was craftspersonship expressed on the surfaces of the objects being hammered, I was to learn later that the coppersmiths are adept at moulding objects of myriad shapes manually and on machines, imparting a range of textures on them using specialised hammers, and finishing them using various tools and chemicals. In other words, their skill is manifest in working with materials to create specific forms, textures, and surface finishes. We sat with Uddhav Kaka for a few minutes while Rane asked him for updates on the jobs he was completing for her. After a while, we walked back out of Bakkhal and left *tambat ali* for the day. This was my first day there, and I found myself intrigued by the visit, wanting to learn more about the history of the community, their processes of making, the tools and machines they used, the range of artefacts they created, the materials they worked with, their relationship to copper, and the system of exchange between the makers, designers, and sellers.

1.1.2 Recent Changes in *Tambat Ali*

The techniques, skills, and tools of making these objects have been passed down through generations, but some of the *tambats* and designers have mentioned to me that they are not quite sure how *tambat ali* will evolve over the next few years. In addition to the traditional objects that they have been making for several decades, the *tambats* have more recently been creating several new objects that they sell locally. And for the past several years, architects, interior designers, and industrial designers have been working collaboratively with the *tambats* to create a series of new products like tables, washbasins, lamps, bookmarks, etc. The *tambats* have also mentioned to me that the number of new apprentices willing to learn the craft has dwindled as many of their children are choosing to get formal college education and are entering other professions. Some of the younger *tambats* who have not learnt the skill of making but have been formally educated in contemporary practices of business development, human resource management, marketing, and design, are beginning to engage this work in new ways, potentially as workshop owners, export licensers, and designers. While they may not be able to make a *bamba* or a *pimpa*, these young *tambats* do express tremendous pride in being part of a community that produces such remarkable work and want to stay engaged, albeit through new roles.

Figure 1.5: Govind Kapre hammering a *pimpa* in Vangevadi
(Photograph by the author)

1.2 Key Topics and Research Questions

This thesis is about copper; it is an investigation into how the materiality of copper, in a substantive relation to all that is around it, shapes everything it encounters. The critical examination of this material will emerge through descriptive ethnography and theoretical analysis of the processes through which the material is transformed into objects, the objects themselves that emerge from the techniques of the coppersmiths, the community that has been engaged in this work for generations, the collaborative practices of design and craft, and the places where copper is worked on and worked with. Discussions of technique and technology, craft and labour, objects and things, architecture and place, caste and profession are essential in talking about the material; but at the heart of it all, this is a conversation about the materiality of copper.

1.2.1 Questions of Materiality

The questions that inspire and guide this work engage in a critical enquiry of the transformative properties of materials and the substantive potentiality of materiality in shaping things, techniques, persons, and community. The meanings and relationality of materiality are rooted in the place of their emergence and existence, but they can also be free of boundaries and serve as representative of other places. In other words, I hope that what is learnt in *tambat ali* can make valuable additions to the ongoing discourse on materiality and inform other design and craft collaborations.

In spite of the burgeoning interest in material culture studies in anthropology, focused, in-depth, critical examinations of the materials themselves of which things are made is a somewhat new scholarly activity in the discipline (Drazin and Küchler, 2015; Ingold, 2007; Knappett, 2007; Küchler & Were, 2009; Miller 1998, 2005, 2011; Tilley, 2007). This thesis contributes to the corpus of work on materiality and adds copper to the list of other materials such as iron (Herbert, 1993), soil (Puig de la Bellacasa, 2019; Salazar et al., 2020), indigo (Hoskins, 2008; Taussig, 2008), stone (Tilley, 2004), silk (Douny, 2013), and sugar (Mintz, 1986) that have been analysed for their sociocultural significance. The purpose of this thesis is to add to this existing literature a recognition and nuanced understanding of the social properties of copper which coexist along with the mechanical, chemical, and electrical properties of the material. While physical properties are visibly, audibly, and tangibly evident, social properties can only be seen by uncovering the material's relationality in its environment. Copper, whilst still in material form prior to being worked on and worked with, has the transformative potential to create persons and communities, along with objects. Questions of how this transformation occurs and who as well as what it affects are core to this thesis. Answers to these questions form the key contributions that this work hopes to make to social anthropology and more specifically, to the field of material culture studies.

1.2.2 Questions of Design and Craft

This examination of the social life of copper (Drazin and Küchler, 2015) is also an attempt to discover what we can possibly learn from a contextual inquiry of design and craft in *tambat ali*. The global discourse of design has typically revolved around its definition, purpose, and scope (Buchanan, 1992; Margolin, 2002), practice and methodology (Archer, 1979; Jones, 1992), history and theory (Dilnot, 1984; Doordan, 1995; Margolin 2002; Sparke, 1998, 2004; Woodham, 1997), and education (Archer & Baynes, 1992; Meyer & Norman, 2020) to name a few. However, this thesis is more concerned with questions of design in the context of *tambat ali* and India. So far, the conversation about design in India has focused more on understanding its role in social innovation, figuring out its relationship to craft and industry, assessing its impact on the economy as well as livelihoods, and exploring non-Western educational models (Balaram, 2005 & 2011; Chatterjee, 2005; Ranjan, 2005; Thackara, 2013).

The definitions and language used to describe design in English speaking parts of the world face a few challenges in India and in *tambat ali*, as the word “design” does not fluidly translate into Hindi, the national language, or Marathi, the local language spoken by the *tambats* in Pune (and in the state of Maharashtra). The etymological root of the word “design” can be traced back to *designare*, Latin for “to mark out” or “devise.” Both marking out and devising signify an intent to create concepts that can be realized and materialized as objects. In other words, a designed object is “reified intention” (Mitcham, 1994, p. 200). What is the language of design in and for *tambat ali*? A variety of established and emerging definitions of design will be discussed later in the chapter, and most of them emphasise the form-generating activity of designers. And typically, the process of ideation in design starts with sketching and drawing new forms; materials selection and techniques of production follow later. However, in *tambat ali*, design does not begin with an emphasis on form, but on material. ‘What can the properties of copper enable us to design’ is the question with which design starts. In other words, design intention is defined not as much by form as it is by material. ‘What is the nature of design in *tambat ali*, and how is it differentiated from a global understanding of design’ is also a question that guides the thesis, and in this process it hopes to supplement the body of work on design anthropology.

Anthropological examinations of craft often focus on concerns regarding art and design, thinking and making, production and technology, space and place, identity and personhood, skill and virtuosity, and so on (Adamson, 2010; Burke & Spencer-Wood, 2019; DeNicola & DeNicola, 2012; Herzfeld, 2004; Ingold, 2013; Marchand, 2016; Sennett, 2008; Venkatesan, 2009; Wilkinson-Weber & DeNicola, 2020). Earlier work has presented craft-based making as tradition-bound, primitive, and as symbolic creation of skilled individuals and societies (Boas, 1955; Munn, 1986). And while these particularities of craft are evident in *tambat* work, DeNicola and Wilkinson-Weber’s explanation of craft as a means by which to “understand relationships between places, people, and time” seems significantly more appropriate here (2020, p. 2). This thesis hopes to extend the discourse of craft in this vein with an emphasis on relationality among craftspersons and external agents (such as designers) as well as a focus on the social properties of materials. While craft communities are often described as engaged in heritage-focused, traditional work, the *tambats* are constantly innovating and developing new products, defying this characterisation.

Products and practices of craft and design are not clearly distinguishable in *tambat ali*. The *tambats* employ design methods in all aspects of their thinking and making; and design's charter in India started with an urging to engage both craft-based forms of production as well as industrial manufacturing. This fluidity between design work and craft work, between being a designer and being a craftsperson, suggests that the boundaries drawn between these professions and professionals are far from impermeable and need to be redescribed. The relation between craft and design is another area of scholarship in anthropology that this thesis hopes to strengthen. It is through the topics discussed above, and the relationality between materiality, design, and craft that the questions which guide this thesis arise.

1.2.3 Research Questions

1. What does materiality mean, and what is the social life of copper in *tambat ali*?
2. What does the presence of materials do, not only to the social life of things, but also to the material life of people?

3. What kinds of transformations do materials undergo in their journeys from raw state into objects, and what is their agency in these technological and social forces of production?
4. By what techniques of the body, gestures, tools, skills, and knowledges do the *tambats* shape copper into objects?
5. Who are the *tambats*, as persons, as craftspeople, and as designers? And how is their personhood shaped by the materials with which they work?
6. What do design and craft mean in the context of *tambat ali* and what is the nature of the interaction between them?
7. What kinds of objects emerge from *tambat ali* through the practices of design and craft?
8. How do global, local, and vernacular definitions of design and craft work (or fail) in *tambat ali*, and at the national level in India?

These are the questions that crystallised during my time in *tambat ali*, and over the next few chapters they will be examined in the context of my observations and supported or disputed in relation to relevant anthropological literature.

1.3 Materials and Materiality

This section and Chapter 2 that follows the introduction to the thesis will focus on examining materials in an effort to understand their properties (physical, mechanical, chemical, sensorial, and social), agency, and relationality. “It is through materials that the social world is given substance” (Küchler and Were, 2009, p. 192). All forms of production, whether in workshops of craft or in factories of industrialised mass manufacture start with raw materials. These materials, generally provided by raw materials suppliers, are handled, processed, transformed, shaped, and reshaped, until they leave these places of production to enter markets and people's homes. There, a second part of the journey of these materials begins, where they are used in everyday routines, until such time when the objects of which they are part are no longer seen as valuable in their current forms and context. The third stage then, often referred to as end-of-life, starts when the objects are either passed on to someone else, thrown away to end up in landfills, or recycled to enter this journey all over again. This material journey is also a social one, during which these materials come in close contact with a wide range of other substances, tools, and machines, energy forms like heat and pressure, a variety of places, and a large number of people. In other words, these spatiotemporal lifecycles of materials are as much social journeys as they are technical ones.

In the examination of materiality and material culture, insufficient attention has been afforded to materials themselves, though they form the core substance of which things are made. One of the landmark publications that has recognised that materials have physical and mechanical properties, but they also have cultural properties is *The Social Life of Materials* (Drazin & Küchler, 2015). Offering an overview of why and how materials are social, the authors provide several case studies supported by ethnographies from around the world. The sheer diversity of materials—whether solid, liquid, or gaseous, metal or non-metal, pure or composite, natural, synthetic or hybrid, recyclable or non-recyclable, and so on—opens up tremendous possibilities for anthropological study as the social circles through which they traverse are different. The study of materials can help us understand practices of art, craft, and design, skills and virtuosity, meaning and symbolism, landscape and the environment, and a lot more. And while the physical properties of materials such as colour, texture, hardness, conductivity, etc. can tell us a lot about their presence in the world, it is the examination of their social properties that can reveal other dimensions that are often not visible. For example, materials play a key role in transactions of oppression and colonialism as seen in the case of indigo (Taussig, 2008), they shape gender and power relations as with iron (Herbert, 1993), and they can affect persons and property relations (Strathern, 1999). In addition, materials also have sensorial properties that shape our experience and therefore our relationality to them.

While materials may appear to possess a satisfying physicality that affords touching, holding, throwing, pushing, etc., they are not as concrete as they may seem. In fact, they are everchanging and protean, constantly morphing and transforming, and often rapidly going through visible (colour, shape, texture) and invisible (strength, malleability, softness) changes. And this ability of materials to transform themselves also gives them the agency to transform all that engages in transactions with them. Copper is one such material. It is inherently relational; its properties and its agency depend upon and are influenced dramatically by its relation to other materials and agents in its vicinity. It is a material that has configured *tambat* bodies, gestures, movements, interactions, ideas, and meanings, and it has shaped their lives as individuals and as a community.

1.4 Design, Anthropology, Materials

In rather general terms, design may be described as an activity engaged in creating new material things with which to populate our social world, while anthropology focuses its energy in critiquing the material to understand the social. Design is largely a generative activity, while anthropology is fundamentally analytical. This by no means implies that design does not engage in critique or anthropology in creation; the subdisciplines of design studies and activist anthropology clearly prove otherwise. But the differences in the fundamental charters of these disciplines have led to questions regarding whether and how they may inform each other. “On the face of it, anthropology and design would seem to point in opposite directions” (Ingold, 2014, p. 1). Ingold goes on to refute this polarity and points out the common ground between the disciplines. “Both design and anthropology are inherently speculative disciplines, whose propositions nevertheless only carry force to the extent that they are grounded in a profound understanding of human lived worlds” (Ingold, 2014, p. 1). However, these two disciplines cannot be seen purely as speculative; both are deeply immersed in a materials world (Drazin, 2020). Clearly, design and anthropology engage in speculation of our lived worlds which are replete with materials, and both are materially immersed in this world through practice. The shared concerns of design and anthropology have led to several areas of convergence between the disciplines. From an anthropological perspective, design can be imagined as an activity that creates new objects (artefacts, buildings, graphics, and so on), but also creates social relations. Design processes play out and rely on a complex of relations among people (users, engineers, manufacturers, financers, supply chain experts, and so on), materials (a wide range depending upon what is being made), objects (tools, machines, packaging, vehicles, etc.), places (factories, offices, seaports, airports, etc.), and institutions (companies, governments, NGOs). In addition, the material things that design engenders themselves have social lives (Appadurai, 1988) situated in their own networks and journeys. Generally speaking though, design and designers assume that society is a given, rather than something being constantly created. Design and materiality, both with their transformational capabilities and productive tension, shape each other in *tambat ali*, while also participating in creating a unique *tambat* society and culture.

1.4.1 Defining Design

In its global definitions, the word "design" is most frequently employed to refer to the action of planning and making (designing something), but it is also used to describe the end result or artefact of this action (a design). In other words, it indicates both–process and product.

> No single definition of design, or branches of professionalized practice such as industrial or graphic design, adequately covers the diversity of ideas and methods gathered together under the label. Indeed, the variety of research reported in conference papers, journal articles, and books suggests that design continues to expand in its meanings and connections, revealing unexpected dimensions in practice as well as understanding." (Buchanan, 1992, p. 5)

Most definitions of design refer primarily to design practice as manifest in the professions of architecture, industrial design, fashion design, exhibition design, UI/UX design, and so forth. Designers involved in such activity often refer to their task as problem-solving and view their work as a response to opportunities and needs in the market identified by corporations, entrepreneurs, consumers, governments, or non-profit organizations.

The variety of domains in which designers operate and the range of outcomes they produce have made it difficult to establish a thorough taxonomy of design disciplines. In addition, as it evolves, design takes on new meanings, adopts new methodologies, addresses a broader range of problems, and redefines its scope, making it challenging to keep categorical structures current. Though the divisions that exist among the various forms of design practice fracture the discipline, they do serve a critical role. “There are, of course, some good reasons why these practices were separated in the first place, and the issue is not to meld them all into a new, comprehensive profession that is at once everything and nothing” (Margolin 1989, p. 4). The design and manufacture of a hand-held device presents a set of challenges that are far different from those faced by an architect who is called on to oversee the design and construction of a hospital. Similarly, the design of a car interior demands the attention of transportation designers, ergonomists, mechanical engineers, materials experts, and others, making it a vastly different challenge from the design of an archaeological exhibition about Egypt’s history, for example, which might involve archaeologists, exhibition designers, curators, graphic designers, historians, and other experts. The level of granularity in the division of design labour encourages the development of domain-specific knowledge and gives designers the opportunity to refine their craft. However, it also presents the danger of narrow and compartmentalised thinking that can seriously limit design’s impact.

A comparative study by Atwood, McCain, and Williams (2002) demonstrates some of the semantic diversity visible in the various definitions of design.

Scholar	Definition
Herbert A. Simon	Devising courses of action aimed at changing existing situations into preferred ones
J. Christopher Jones	Initiating change in manmade things
L. Bruce Archer	Collected experience of the material culture, and the collected body of experience, skill and understanding embodied in the arts of planning, inventing, making and doing
Christopher Alexander	The process of inventing physical things which display new physical order, organization, form, in response to function
Horst Rittel	Structuring argumentation to solve ‘wicked’ problems
Donald Schön	A reflective conversation with the materials of a design situation
Pelle Ehn	A democratic and participatory process
Jens Rasmussen/Kim Vicente	Creating complex sociotechnical systems that help workers adapt to the changing and uncertain demands of their job
Richard Buchanan	The conception and planning of the artificial
Gui Bonsiepe	Design is concrete invention to develop and produce artefacts

Figure 1.6: Diversity in the Disciplines of Design, updated from Atwood, McCain and Williams (2002)

While most explanations of design in the table above tend to focus on the cognitive activity of generating ideas that eventually achieve tangible form, Simon’s definition is much broader in its scope and shifts attention to external conditions. In addition, it suggests a motive for change that expects designers to know and specify what a “preferred situation” should be, thereby introducing an ethical and moral responsibility. The authors (Atwood, McCain, & Williams 2002) explain that this list is by no means exhaustive; the individual definitions represent but a small sample extracted from seminal definitions that scholars have formulated over time. Some common threads do emerge from this diversity. It is clear, for instance, that design is a form of planning and problem-solving for the future. The employment of such terms as “action”, “change”, “inventing”, and “creating” in these definitions establishes design as a generative process of transformation that leads to tangible outcomes. If the goal of design, as Max Bill of the Hochschule für Gestaltung in Ulm once explained, is “to participate in the making of a new culture-from spoon to city” (Lindinger, 1991, p. 10), its scope is vast and the diversity in definitions is only to be expected.

1.4.2 Design Theory: New Approaches

In recent years, design’s charter has expanded beyond creating goods and services for the market to include tackling the enormous challenges posed by environmental pollution, social inequities, poor access to healthcare, lack of clean drinking water, and other problems of a global scale. Whether it is the design of small devices or large systems, designers have to consider issues of aesthetics, usability, ergonomics, safety, accessibility, marketability, materiality, affordability, profitability, manufacturability, functionality, and sustainability. And while materials are discussed in the conversation about manufacturability and aesthetics[1], the concern is primarily centred around whether or not the materials desirable for the product can be manufactured using the production technologies selected (or vice-a-versa, i.e. whether the production technologies appropriate for the product can accommodate the materials of choice), and whether or not they meet the aesthetic needs of the user as well as design systems and standards of the corporation. However, a deeper discussion of the sociability of materials is rarely a topic of conversation. Selection of materials is often driven by

1 The discussion of materials is typically subsumed under the rubric of CMF (colour, material, finish) in industrial design. However, in these situations there is rarely any talk about the social life of materials.

aesthetics, manufacturability, and affordability with choices made by sifting through a range of options available in materials libraries (Drazin and Küchler, 2015; Küchler, 2008; Wilkes, 2011).

While there are various forms of design (graphic design, architecture, service design, UI/UX design, interior design, fashion design, etc.) the focus here is on industrial design—generally understood as the creation of physical products by industrial means—because of the nature of the goods made by the *tambats*. Industrial design has found itself closely tied to industrial production over most of the twentieth century, but a variety of new movements and intellectual directions have emerged that are leading to redesign of design itself, of which a few are summarised below. Human-centred design emerged as a backlash to market driven or technologically driven design, and while the notions of designing with people's needs in mind was not a new idea, it gained significant adoption starting in the 1990s (Brown, 2009; IDEO, 2015; Norman, 2013). And in order to discover people's needs, designers turned to anthropological research methods. Participatory design and co-design go a step beyond human-centred methods to invite and involve stakeholders into the design process so that the outcomes are designed *with* rather than *for* communities (Sanders & Stappers, 2008; Simonsen & Robertson, 2013). Research on human factors and ergonomics started around the second World War, but in industrial design, its incorporation into the design process started after Henry Dreyfuss's work on anthropometrics and designing for the human body. The primary recommendation that emerged here was that there is no such thing as an average or 'one-size-fits-all' and design should take into account the diverse physiological and cognitive needs of individuals (Dreyfuss, 1952; Tilley & Dreyfuss

Associates, 2001). In his first publication, Victor Papanek presented a scathing critique of industrial design for not focusing on critical human and societal problems, and it had a significant impact on the design profession (1982). Since then, there have been several calls for design to not pander to capitalist demands but instead play a critical role in enabling positive social change through innovation (Manzini, 2015; Tromp & Hekkert, 2018; Whiteley,1993). The critique of standardised, large-scale manufacturing has led to the emergence of mass customisation, which may be described as a collection of new adaptive production strategies and design methods to create made-to-order goods for people (Kolarevic & Duarte 2018; Pine, 1999). Speculative design takes the approach of creating fictions and proposes conceptual products that question established practices of design as well as the meanings of things (Dunne & Raby, 2013). Sustainable design emphasises the urgency to develop systems and strategies to mitigate impacts of production, distribution, and consumption on the environment and society (Bhamra & Lofthouse, 2016; Papanek, 1995; Tonkinwise & Lopes, 2014). More recently, several publications have started to highlight the fact that design has been dominated largely by richer and more industrialised nations and people, and it has effectively silenced the voices of the majority of the world that has access to significantly fewer resources. In response, there has been a rise in considering decolonising methodologies to recognise and value indigenous knowledges that have been suppressed through forces of imperialism (Smith, 2016; Tunstall 2013). In this vein, Escobar suggests a new form of autonomous design of world-making that takes on patriarchal, capitalist, and individualistic forces that have shaped our lives (Escobar, 2018). Design justice too takes on these issues and suggests how marginalised communities may lead design to address structural inequalities in the world (Costanza-Chock, 2020). Irwin and colleagues at Carnegie Mellon University present another form of design that they refer to as transition design, which incorporates systems thinking in order to create a more sustainable and equitable future (Irwin, et al., 2015). Tony Fry presents the concept of defuturing, which can be explained as a loss of the future caused by design's reckless anthropocentrism, but also as a tool through which one can review what is lost so we may renew again (2020).

Clearly, there is no dearth of philosophies, approaches, frameworks, strategies, or tools available for redesigning design itself. All these new directions suggest that design has been a myopic, insular, and unjust practice controlled by a privileged few that benefits those few, at the expense of the disadvantaged many. In addition, the planet itself has been badly scarred, and therefore design needs to be radically reimagined and restructured so that it may redress its past and current mechanisms of environmental exploitation. While these new design approaches might certainly be able to bring about positive change, it is clear that design, on its own, has limited potential to do so, without larger political, economic, technological, social, and structural changes. In *tambat ali*, one sees participatory design activities unfolding, indigenous knowledge of the *tambats* being recognised and valued, and some economic imbalances being tilted in the right direction. However, issues of environmental, social, and cultural sustainability remain, established power structures continue to be difficult to dismantle, and the future of the *tambats* is open to speculation and imagination.

Each of these design theories and approaches tackle the task of what it means to do design differently; their framing of design's problem is unique to their ways of seeing the world. Their design praxes and the objects that emerge from their design critiques and activities are cultural artefacts and social commentaries, each local to the situation they have defined, but global in their reach. The *tambats* are designers themselves, and while in their work they incorporate several design methods, none of the approaches listed above truly describe what they do. The problems they focus on start with materiality; this includes understanding the properties of copper, recognising its transformative potential, visualising what forms could emerge from it, and so on. In addition, they are eager to continue making the traditional objects they have been making using their unique processes, while constantly experimenting and creating new products. Theirs is a type of design I would like to call 'enduring design', because it sustains over multiple temporalities, draws on historical precedent but is also forward-looking, and is inspired by a material that itself has endured over time.

The designers creating copper products do not define their work with the *tambats* entirely in terms of the new global design approaches listed above. They too, like the *tambats*, see an opportunity to work with a new material that is repeatedly recyclable and therefore potentially sustainable; they see a possibility of engaging with a craft intimately rather than dealing with anonymous manufacturing, and they find value in helping sustain a craft practice. In this case too, the notion of an 'enduring design' serves as an appropriate approach.

1.5 Craft

The last two decades have yielded increased scholarship about craft with several monographs and anthologies (Adamson, 2007, 2010; Risatti, 2009; Pye, 2007; Sennett, 2008; Wilkinson-Weber & DeNicola, 2020), as well as peer-reviewed academic publications like *The Journal of Modern Craft* established in 2008 and *Craft Research* established in 2010, devoted to this subject. The journal *Craft+Design Enquiry* which had outlined as its goal, "establishing a dialogue between craft and design practice and cultural, social and environmental concerns" ceased publication in 2015. It is evident that this is an active area of study, with scholars seeking to address the "complaint that craft suffers from a lack of intelligent writing" (Adamson, 2010, p.1), or that "the craft field lacks a critical theory that is specifically its own" (Risatti, 2009, p.xiii).

Art, craft, design, and innovation operate within social and industry structures to which the identities of artists, craftspeople, designers, and innovators are closely tied. Scholars are rejecting the notion that craft labour is "subordinate to artistic labour" in the creative industries (Banks, 2010, p.305), and are "arguing that craft is art" (Trapp in Risatti 2009, p. xi). As distinct words for art, craft, and design do not exist in Marathi, the word art (*kala*) is frequently used by the *tambats* in describing their work. *Tambat ali* craftsman Bajirao Karulkar "likes to think of himself as an artiste, not a coppersmith" (Eriksen, 2014, p.6).

Craft generally operates in "socially embedded workshops" and is often characterised by skilled labour, material specificity, pre-modern or pre-industrialist economics, patriarchal systems, and religious structures (Banks, 2010, p.305). In its traditional expression, craft can be described as a tightly networked, sustainable activity—goods made by members of the community for consumption within the community, often through a barter system. In such situations, craftspeople generally have thorough knowledge of their markets; they are intimately familiar with communal social customs; and they are able to translate this wisdom through their craft into aesthetic, utilitarian objects. Their artistic and economic activity is closely tied to the needs of the community. They often find raw materials in their immediate environment, make their own tools, and sell to or trade finished goods with members of the community. Globalisation brought with it efficient mechanisms by which to rapidly transport goods across continents. Though the fascination with and trading of artefacts of another civilisation is by no means new, we now have supply chain systems that can bring handcrafted goods made in remote villages into homes in faraway cities across the globe.

In *The Craft Reader*, Adamson offers what he refers to as an open-ended and simple definition of craft: "the application of skill and material-based knowledge to relatively small-scale production" (2010, p. 2). This description seems to favour individual engagement in the process of creation and does not make any mention of the social and relational aspects that are central to activities of making. On the other hand, in their critical analysis, DeNicola and Wilkinson-Weber explain craft as a means by which to "understand relationships between places, people, and time", and mechanisms people use to "negotiate their roles and places within their material and social environment" (2020, p. 2). It is clear that in *tambat ali*, the actions and transactions among the *tambats*, and their engagements with designers, materials, place, and ideas are essential to defining not only what they create but also who they are. The emphasis on the social has led to critical analyses of processes by which craft communities shape themselves as they shape things they make (Greenhalgh, 1993). The interest in the role of the mind and body in making has further advanced the study of craft knowledges (Bunn & Mitchell, 2021; Ingold, 2013; Marchand, 2010, 2016). Modern craft is said to have emerged during the industrial revolution (Adamson, 2010) and whether or not it declined during this time is a point of significant debate (Babbage, 1832; Smiles, 1863), some arguing that machines are replacing skilled craftspersons (Carlyle, 1829), while others suggesting that it created new forms of work for craftspersons (Clarkson, 1985), because some things such as shoes, clothing, interchangeable components for complex mechanical devices, could only be made by craft techniques (Hounshell, 1984; Berg, 1980). Recent scholarship rejects the representation of craft as an activity that is being brutally overthrown by forces of industrialisation and modernity. A sense of idealism of manual work, search for a new world order, and finding honest beauty in human-made things were the ideas that accompanied craft revival efforts (Adamson, 2010). Craft has also been deployed in nationalistic rhetoric at times with romantic aspirations and at times with fascist ones (Kaplan, 2004). In a myriad of forms, practices of craft continue to co-exist along with industrialised, global forces of mass production and manufacture. These themes will be revisited in Chapter 7 on craft and design.

1.5.1 Craft in India

"The range and diversity of Indian crafts is staggering… Social and cultural diversity has multiplied particular forms of artifacts, each shaped by a multitude of forces leading to the vast canvas of variety that can be witnessed today" (Ranjan & Ranjan, 2005, p. 18). While there are several publications that document many of these crafts by geography, material, and technique, the sheer diversity of this vernacular expression is quite astonishing (Cooper & Gillow, 1996; Jaitly, 2012; Liebl & Roy, 2001; Ranjan & Ranjan, 2005; Saraf, 1982; Tchitcherov, 1998). Over the past several years, Indian designers, government organisations (like the Crafts Council of India or the Indian National Heritage and Cultural Trust and others), NGOs, and private corporations have been working with some crafts communities with the goal of finding mechanisms by which to sustain their artisanal traditions. Fuelled by an interest in such concepts as design for society (Whiteley, 1993) and social innovation (Osburg & Schmidpeter, 2013), designers are exploring new avenues for creative activity not sponsored by industry but by the desire to achieve positive societal impact. In many cases, designers (practitioners in industry as well as faculty and students) are creating new products and forms that might generate markets for the skills of the craft communities, and governmental organisations as well as non-profit groups are creating funding programs to assist the craftspeople and their families. It is important to ask if such efforts amount to fetishism or a new form of design imperialism, because the economic privilege, formal education, caste difference, and social position of the designers shapes the nature of the relationship among the groups.

In a study of block printing craft in the state of Rajasthan, DeNicola and DeNicola (2012) offer theoretical and ethnographic accounts of the social relationships between the artisans, designers, and students working together. Venkatesan too discusses the “deliberate bringing by powerful elites of marginalised people and things to the centre of a social space (here, traditional Indian craft), re-creating them as valued objects of attention” (2009, p.78). Venkatesan describes this space where craftspeople engage with external groups as a form of heterotopia, “wherein marginal people are made central to a project in line with certain utopian visions, and thereby partially objectified by powerful others” (2009, p.79). While the *tambats* have been working with external architects and designers for several years now and see mutual benefit in the collaboration, they are suspicious and cautious before they agree to engage in any new project. They do not always see projects presented to them as “utopian”, and neither are they powerless as Venkatesan’s example seems to suggest. The *tambats* confirm the intentions of these architects and designers before launching any collaborations, and at times refuse to work on projects in situations where there is lack of trust. Many of the designers are in more secure financial positions and are often from upper middle-class families, and that creates a power imbalance that disfavours the craftspeople (DeNicola & DeNicola, 2012). However, with the proliferation of design schools, more acceptance of design as a viable profession, younger *tambats* becoming designers, this is changing. The *tambats* have mentioned that sometimes their partnerships with designers and architects are one-off projects in which they merely provide labour, but in some cases, there is close and collaborative relationship which has led to mutual benefit to both communities socially and materially.

The industrial revolution introduced a new paradigm or production through factory labour, mass manufacture of goods, remote markets, and capitalist economic systems. This form of industrial production that swept through the manufacturing world in Western Europe and the US marginalising craft work and cottage industries was viewed by proponents of the Arts and Crafts movement like John Ruskin and William Morris as deskilling and dehumanising

(Greenhalgh, 1993). But “degradation of craft skills was fundamental to the efficient operation of capitalism itself” (Banks, 2010, p.308). The process of manufacturing of goods had to be partitioned into a series of repeatable tasks to maintain high production speeds and volumes. This led to the division of labour, and “consequently the processes of design, production, and marketing developed into segregated, specialized disciplines” (Dormer, 1997, p.12). However, the industrial revolution did not impact Indian craft systems the way it did in the West. And while industrial production in India went through several changes during British rule, craft production seems to have continued without being significantly affected throughout this time (Kulke & Rothermund, 2003; Reubens, 2010). As the table below demonstrates, through the eighteenth and nineteenth centuries, rural craft seems to have been relatively unaffected by industrial manufacturing, new factories and equipment being set up, or the economics of import and export trade.

Period	Phase	Consequent Effect on Craft in India
18th Century	Britain is able to produce its own fabric by machines because of industrialisation	Indian fabric exports become redundant
		Craft for the rural masses is unaffected
Early 19th Century	Severe deflation prevents the development of modern industry	Craft survives because of India’s subsistence rural economy
Late 19th Century	Economy prospers: railways and steamers link India to rest of the world, and India imports machines for its new factories	Craft survives in rural areas since there is little impetus to develop backward linkages to support industrialisation

Figure 1.7: “Three phases of colonial impact on Indian craft (based on Kulke and Rothermund, 2003)”. This table is reproduced from Reubens, 2010, p. 22)

Some literature suggests that the crafts which had potential of export or display in museums were supported and promoted, whereas others (such as the making of household copper utensils) were ignored or allowed to languish if they were unable to create objects that had utility beyond their local environment (McGowan, 2009). “Traditional craft continues to be frequently mobilised within the nation-building project” (Venkatesan, 2009, p.81). The politics of identity is clearly visible in the support for and marketing of Indian craft by the government, NGOs, educational institutions, designers, and consumers. Craft is cultural production, and therefore its survival is considered necessary for expression of national identity. Interestingly, the diversity that makes it difficult to define a single, cohesive identity for Indian craft, is also celebrated as a truly Indian tradition.

1.6 A Brief Review of Related Literature

Following the discussion of the core topics of examination of this thesis, namely materiality, design, and craft, this section now explores related literature on personhood, objects and things, and production, which are circumscribed within the reach of copper’s transformational properties. Copper, as we shall see, has the ability to mould people and community while it is itself being moulded into objects. Similarly, the techniques of production, which are as social as they are technical, while performed on the material, also produce the bodies and minds of the *tambats* themselves. This section also includes additional background material on design education and design’s role in Indian industry. The final topic of discussion in this section is emerging field of design anthropology, a subfield in the discipline within which this thesis can be situated. While anthropology’s interest in making is not new, it has only recently turned its attention to the profession of design and its contemporary practice, leading to this new branch of knowledge (Bjerregaard &

Lauring, 2014; Clarke, 2011; Drazin, 2012, 2013, 2020; Gunn & Donovan, 2012; Gunn, Otto & Smith, 2013; Ingold, 2014; Milev, 2013; Smith, 2011). It is this field of study that this thesis attempts to augment through its examination of practices of design and craft of the *tambats*.

1.6.1 Personhood

"The anthropology of personhood encompasses the definition and study of three conceptual terms: person, self, and individual" (Rapport, 2015, P. 932). Scholarly attempts have been directed towards understanding what it means to be a person and how that may be different than being an individual in society or having a sense of selfhood. The meanings of these terms are at times used interchangeably but are widely debated in anthropological literature. Clearly, this is of great social and cultural interest, but *being* and *becoming* persons have legal, moral, and ethical implications. As cross-cultural studies from India, Melanesia, Australia, Bali, Africa, and other places have shown, personhood cannot be understood as a rigid or fixed concept, but it is a theoretical construct that varies widely as it is shaped by context, place, time, and relations (Dumont, 1970, 1980; Fortes, 1973; Geertz, 1973; La Fontaine, 1985; Mauss, 1985; Marriott, 1976; Read, 1955; Shir-Vertesh, 2017; Strathern, 1988). Research into personhood has involved examinations of the sociohistorical evolution of the concept and the place of the individual in various social settings (Mauss, 1985), its relation to the notion of participation (Lévy-Bruhl, 1965), and studying the process of its development through social interaction (Goffman, 1959; Mead, 1981). In addition, personhood has been seen as being dependent on social context (La Fontaine, 1985;

Marsella et al., 1985) as well as shaped and defined by cultural mechanisms (Geertz, 1973).

One of the primary and ongoing debates on personhood has been shaped around the notion of dividual persons, who are defined not as individual entities, but as compound beings, relationally structured through processes of mutual exchange in society (Busby, 1997; Marriott, 1976; Sahlins, 2011; Strathern, 1988; Wagner, 1991). Other ideas such as relational, partible, and fractal persons are generally presented in contrast to the notion of the Western individual who is a monadic, independent, social actor made up of internal rather than external qualities. However, this rigid and oppositional representation of the individual and dividual, Western and Other is being questioned with newer conceptualisations which suggest that both ideas of the person exist in all cultures albeit in varying degrees, and a multiplicity rather than dichotomy might be a more accurate way to understand personhood (Ewing, 1990; Mageo, 1995; Smith, 2012; Spiro, 1993).

This literature helps in trying to unpack the notion of *tambat* personhood, and aids in helping answer the question: who is a *tambat*? The word *tambat* in Marathi refers to a caste as well as the coppersmith, and here we encounter a form of personhood that is configured in part by the nature of copper itself, techniques of the body in which the *tambats* engage while working with the metal, the history of the community, and the professional mobility of its members.

1.6.2 Objects and Things in Material Culture

Born out of anthropology, material culture studies is recognized today as one of the primary disciplines that is wholly engaged with objects, things, materiality, and their significance in the social world. Scholars in this area have established that though objects were largely ignored by the social sciences in the past as inconsequential to the concept of culture, they are now recognized as integral components of the culture of everyday life. In fact, all that was material was often regarded to exist in opposition to all that was cultural; matter was seen as subservient to mind; and the thing trivial in relation to thought. Material culture studies has played a significant role in changing this view. Objects are now deemed worthy of study, and it is generally accepted that their examination can help us understand the significance of materiality in human life. "This field of study centres on the idea that materiality is an integral dimension of culture, and that there are dimensions of social existence that cannot be fully understood without it" (Tilley et al., 2006, p. 1). Studies of material culture are dedicated to the task of understanding what objects, commodities, things—stuff, so to speak (Miller, 2010)—mean by examining their presence and value in everyday life, their journeys through processes of production, distribution and consumption, their relationality to each other and to humans, and so on.

The breadth of exploration of topics and the depth of specificity in each one make it impossible to meaningfully and succinctly summarise scholarship in material culture studies, though it is a relatively recent area of research in anthropology. Prior to the 1960s, "although major figures like Malinowski and Lévi-Strauss did notice material objects and describe them sporadically, the evidence drawn from observations of the material was reduced to a secondary level" (Hahn, 2018, p.6). The attention that French sociologists like Barthes, Baudrillard, and Moles paid to objects in everyday life in the 1960s through an examination of consumption, semiotics, and identity led to a more active interest in material culture (Busbea, 2009). Douglas and Isherwood (1978) as well as Bourdieu (1979) also applied a semiotic framework to uncover the social meanings of objects in everyday life by linking them to habits of consumption and presenting them as means of gaining distinction. Miller's publications, starting with *Material Culture and Mass Consumption* (1987) explored the role that activities of shopping (consumption) in which all of us are engaged in some form, shape social relations and society. Miller's subsequent publications and those of other scholars from University College London (UCL) established a significant repertoire of material culture scholarship that continues to date. This has involved critical explorations of entire disciplines such as art, architecture, landscape, photography, and design through a diverse range of concepts (which are much too prolific to include in entirety) of agency, biography, collecting, metaphors, materials, memory, museums, ownership, power, senses, technology, the body, and so on (Buchli, 2002; Coupaye, 2013, 2020; Drazin, 202; Henare, et al., 2006; Holbraad, 2011; Küchler, 2002; Küchler & Carroll, 2020; Miller, 1987, 1998, 2005, 2010; Pinney, 2011; Tilley, et al. 2006). Appadurai's *The Social Life of Things* (1988) is considered a critical and landmark publication that examined shifting values of commodities over their lives with changes in contextuality.

The focus of these studies and material culture in general is to unpack what the physicality of our world presents to us in the form of artefacts, objects, products, things, stuff, etc. and what it all really means. In Marathi, the word typically used to refer to physical stuff is *vastu*, and all the objects that the *tambats* make can be collectively referred to as *vastu*. Interestingly, *vastu* also means the plot of a story, and thinking of objects in terms of the arcs of stories they go through along with persons, may help foreground the multiple, sequential, and iterative engagements between the people, places, processes, and products of *tambat ali*.

1.6.3 Production

Economists and historians often list four major phases of development in the industrialisation of the Western world. The first, often referred to as the age of craft production, lasted a century from the mid-1700s through the mid-1800s. Craft production gradually started being replaced by a new mode of manufacturing developed by Frederick Taylor around principles of scientific management. Taylorism, as this form of production was called, was the second phase and it lasted until the First World War. The third phase, which spanned the early 1900s through the early 1970s is generally referred to as Fordism, and the last and current phase from the 1970s to the present has been termed by scholars as post-Fordism, neo-Fordism, flexible specialisation, and mass customisation. This form of industry is generally understood to have started in Britain, from where it spread to the northwest of Europe and North America.

However, the transformation of industry in other parts of the less industrialised world happened first during the “first globalization” of the late nineteenth century, progressing in 1914 with “two world wars, the Great Depression, the breakdown of formal and informal empires”, and then with the second globalization” in the 1980s

(O'Rourke & Williamson, 2017). India's industrialisation is often discussed in two large temporal frames—during the colonial time (1858 to 1947) and the post-colonial phase after independence (1947 onwards). The colonial phase is marked initially by a decline in indigenous industry followed by a revival that relied on imports, which is then followed by an increase in investment from the British colonial power which led to growth of the manufacturing sector, albeit in a limited number of cities. After independence, state-supported industry rose in fits and starts with import substitution policies and spread to a larger geographic area in the country. Over the years, with economic liberalisation, deregulation, and changes in foreign direct investment programs, big business in India started to grow. Today, the service sector is significantly stronger in India than goods manufacturing (Gupta & Roy, 2017).

Throughout this time, statistical analyses of economic data suggest that despite a few increases and decreases, artisanal production has continued to operate in India along with factory-based production. In fact, it has been argued that, "artisans should be seen as an example of industrialization rather than de-industrialization" (Roy, 1999 as cited in Gupta & Roy, 2017). Though factory production grew faster, handicraft production has been more stable, and in some cases (especially in textiles), artisans were able to adapt, borrow factory techniques, relocate, and apply their skills to new objects to maintain their livelihood (O'Rourke and Williamson, 2017). This form of adaption and application of skill to new domains is certainly visible in *tambat ali*. The skills and techniques of these coppersmiths have endured over centuries, but they have also added new ones because the objects they make and tools they make them with have evolved over time, as have their relations with designers. “At any given time, techniques form the backdrop of people’s material life as well as part of their systems of meaning” (Lemmonier, 1993, p. 27). The techniques of the *tambats* have not only shaped the materials they work with, the tools they deploy, and the objects they make, but the technological choices they have made and continue to make have also shaped their lives, culture, and community.

1.6.4 Design and Design Education in India

The making of objects for everyday use (which involves their conceptualisation and production) is a fundamental component of the practices of craft and design, and in the Indian context, this activity can be traced back at least to 2,500 BCE during the time of the Indus Valley civilisation (Wright, 2009)[2]. However, the professional practice of industrial design as described in Europe and North America is relatively new to India, and this can be traced back to the 1950s, a time soon after independence when such

2 The Indian subcontinent (inclusive of Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka) has witnessed human habitation for about 500,000 years. “Around 20,000 years ago, in places far distant from each other in the subcontinent, the use of smaller, sharpened tools designed for specialist tasks and fitted with handles: arrowheads, variously shaped cutting and piercing implements, as well as axes and scrapers have all been found” (Johnson, 1996, pp. 58). Some of the early evidence of cave art starts appearing about 10,000 years ago, and around 7000 BCE, more abundant signs of continuous settlement, agriculture, animal husbandry, etc. start appearing. By 5000 BCE, handmade pottery had arrived and as metallurgy flourished, stone tools had given way to copper ones. Finally, it was around 2500 BCE that the Indus Valley Civilization, referred to as the “earliest, urban, state-level society in South Asia (2600 – 1900 B.C.)” established itself in the region (Kenoyer, 1991, p. 258). Archaeological excavations have unearthed a rich array of artefacts including “seals, beads, copper tools and weapons, terracotta figures, bone, ivory, stone, and baked-clay items, and immense quantities of pottery” (Johnson, 1996, p. 59). The use of metals was widespread at this time, and included trade in copper, lead and tin, as well as gold and silver jewellery. This time period is also referred to as India’s Bronze Age and tools like knife-blades, razors, saws, chisels, domestic items like vessels, and weapons like spears and swords have been found. The making of such artefacts relies on a large range of variables, including the availability of materials, technical knowledge, and manual skill. These objects found in archaeological excavations and preserved in museums demonstrate the use of technology and a highly developed sense of craftspersonship.

designers as Le Corbusier as well as Ray and Charles Eames were invited by the Indian government to work on projects of national significance. Soon after India's independence in 1947, there was a hurried push for scientific as well as technological development and industrialisation. India's first Prime Minister Jawaharlal Nehru believed that it was through an investment in heavy industry that the poverty faced by the nation could be alleviated. In an address to the Lalit Kala Academy in 1959, Nehru said, "the main thing today is that a tremendous amount of building is taking place in India and an attempt should be made to give it a right direction and to encourage creative minds to function with a measure of freedom so that new types may come out, new designs, new types, new ideas, and out of that amalgam something new and good will emerge" (Mathur, 2011).

It was this desire that resulted in invitations to Le Corbusier to help design the city of Chandigarh and to Ray and Charles Eames to offer advice to a young nation about how it could use design in its development. After traveling across in India in the 1950s[3], visiting villages, cities, factories, and speaking to craftspeople, public intellectuals, and politicians, the Eameses presented their findings and recommendations in 1958 in what is famously known as *The India Report*. In addition to visiting places of interest and meeting

[3] The Eameses trip and several other activities were funded by a grant from the Ford Foundation, as part of a Cold War strategy by the US. "It has been noted that these philanthropic funds for NID – and the wider program of support for the post-independence Indian economic and social "modernization" of which they were a part – were a "soft power" initiative related to US Cold War diplomatic strategies designed to tempt non-aligned hearts and minds towards the US version of capitalist democracy, and away from Soviet-led communism (Adajania, 2014, p. 77; Clarke, 2016, p. 50). Often understood as "conscious instruments of covert US foreign policy" (Saunders, 1999, p. 116), US philanthropic foundations like the Ford Foundation, which also financed many other "modernization" projects in the global South, have been described as "directly engaged in extending and consolidating US hegemony around the globe" (Parmar, 2013, p. 2)." (Wintle, 2017)

people of consequence, they also examined and documented a large number of everyday objects like utensils, toys, furniture, etc. “The Eameses’ attention to what they called the “vernacular expressions of design” and to “everyday solutions to unspectacular problems” reflected their awareness of the specific dilemmas of design in a rapidly industrializing, ancient society—dilemmas which are by no means resolved in India in the twenty-first century.” (Mathur, 2011). In this report they recommended creating an educational centre for design, which we know today as the National Institute of Design (NID), established in Ahmedabad in 1961. The NID’s charter was to teach design as a means by which to assist in the accelerated industrialisation of a young nation with a long past.

> In India, production takes place at four levels: large-scale, small scale, craft, and cottage- or home-based. These all are sectors too large to be ignored by Indian design. The design requirements of each sector are vastly different. The last two sectors are unorganized and labour-oriented. Therefore, separate design education for each sector is hardly practical. Experience shows that the appropriate way for design education to address this production complexity is to teach design as an approach, a creative process that enables the student to find solutions in any given situation. The same design approach should work for any production level, even though the tools employed may be different (Balaram, 2005, p. 18–19).

The curriculum is set up with projects that expose students to a range of industry sectors with the goal that they may be able to work with a variety of clients, whether they are multinational commodity manufacturers or craft-based cottage industries. The NID was followed by the establishment of India's second post-independence design school called the Industrial Design Centre (IDC), my alma mater, in 1969. For several decades, these two institutions were the only colleges in India where industrial design was taught. In the last twenty years, however, a large number of new private and public design schools have emerged, some in partnership with universities elsewhere in the world. During this time, several design consultancies and in-house design groups within large corporations have been established as well.

1.6.5 Design in Indian Industry

The Indian economy has been growing unsteadily over the past two decades, and this development is transforming the nation and its peoples in dramatic ways. Market-oriented economic reforms that were initiated by the government in 1991 created an environment in which large multinational corporations like Intel, Philips, and Samsung were able to open offices in several metropolitan cities. For these corporations, India is an emerging market made up of a growing middle class[4] that has disposable income with which to buy new products and services. Imported goods unavailable a few years ago to Indian consumers are now not only in sight, but also within financial reach. And it is not just the middle class that has attracted attention from corporations. Marketing strategies often referred to as "base of the pyramid" (BOP) are targeting lower income groups with the promise that these approaches can alleviate poverty while generating profits (Best & Maclay, 2002; Hammond et al., 2007;

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[4] Estimates of the size of this middle class vary depending upon the source. "Economists from Mumbai University in India defined the middle class as consumers spending from US $2 to $10 per capita per day. By this definition, approximately half of India's population of 1.3 billion is now in the middle class." (Roy, 2018, p. 34). According to the Pew Research Center, "the middle class in India is estimated to have shrunk by 32 million in 2020 as a consequence of the downturn" caused by the pandemic (Kochhar, 2021).

London, 2016; Prahalad, 2006; Prahalad & Hammond, 2002). These BOP approaches have been critiqued by anthropologists and sociologists as they often depoliticise poverty, reinforce social inequities, reduce people to consumers, and homogenise poor populations (Cross & Sheet, 2009; Ilahaine and Sherry, 2012; Karnani, 2007). Therefore, a large variety of specialized goods, such as shampoos sold in small one-ounce satchels, generic medicines, detergent bars, and other low-cost consumer goods have flooded Indian markets. In addition to the increased presence of multinationals, large Indian corporations with significant capital resources are expanding their consumer offerings to include everything from fresh produce to financial services. For instance, the Reliance Group, self-described as “India’s largest business enterprise” boasts of grocery stores, petroleum refining plants, oil and gas exploration rigs, telecommunications services, and textile mills.

These large corporations are offering new products and services that are gradually changing everyday rituals, habits, and lifestyles of the population. In many cases, indigenous products made from locally found (and often organic) materials that have been used for hundreds of years are being replaced by global goods. For example, shampoo is replacing *shikakai*, a plant extract that has traditionally been used for washing hair; supermarkets are replacing *kirana* stores (grocery stores owned and operated by local entrepreneurs that make up the informal economy); and there is increasing competition between Kentucky Fried Chicken and fast street food like *bhel puri* (savoury snacks served by pushcart vendors). These are the types of economic, social, and material transformations that have been taking place in Indian society over the past few years.

Much of this economic growth is occurring without deep engagement with the design community. For far too long, the profession of design has focused its efforts primarily on the needs and desires of the minority, namely populations of the richer regions of the world. However, over the last two decades, as questions of sustainability have become more pressing worldwide, calls for socially responsible design and sustainable design have highlighted design's failure in addressing the needs of people in poorer parts of the world (the majority). As populations in poorer nations grow, the problems of global poverty, environmental pollution, access to clean drinking water, nutritional food, affordable education and so on will only get more pressing. These conditions will make it imperative for design to accelerate its engagement with economic, social, and environmental issues. Design has the potential of responding to these conditions, but this can be done in any significant way only if designers take an anthropological approach to understanding the contexts where the situations exist. The economic, political, technological, and social changes India has witnessed in the past two decades have been documented in a series of recently published ethnographies. Related to this discourse are the several anthropological studies of India, many of which deal with tribal communities, modernization, caste, religion, poverty, etc. (Atal, 2009; Berger & Heidemann, 2013; Clark-Decès, 2011; Grodzins-Gold, 2017; Karve, 1991; Krishna Rao, 2005; and others) but few focus on design or craft.

1.6.6 Design Anthropology

In *Design Anthropology: Theory and Practice* the editors offer an in-depth overview of the status of design anthropology research, suggesting that it is “coming of age as a separate (sub)discipline with its own concepts, methods, research practices and practitioners” (Otto and Smith 2013, p. 1). Defining design anthropology succinctly has not been easy, and I must admit that the name assigned to this new field is not entirely clear or convincing to me[5]. However, several definitions have been proposed. “Design anthropology… comprises a group of anthropologists who do anthropological work, producing critical cultural commentaries, alongside design and in ways that aspire to be constructive for design. Their aim is cultural commentary more than design or marketing, but their work is only justifiable when it engages with those aims in some sense” (Drazin, 2012, p. 253). For Clarke, design anthropology is an area of study that “brings together key thinkers and practitioners involved in making and theorizing our contemporary material and immaterial world: its rituals, its aesthetics, and its interactions” (2011, p. 9). Gunn and Donovan describe it as “an emergent field concerned with the design of technologies that build upon and enhance embodied skills of people, through attention to the dynamics and performance and the

[5] The term “design anthropology” appears to me as an inelegant juxtaposition of the words design and anthropology. After all, when referring to the anthropology of architecture, we do not say architecture anthropology, or anthropological examination of art is not referred to as art anthropology, but rather the anthropology of art (Morphy & Perkins, 2009), anthropology and art (Schneider & Wright, 2020), or the art of anthropology (Gell, 1999). Design anthropology, therefore, opens itself up to multiple interpretations without certainty about what precisely it stands for. Does it refer to the design of, for, with, and anthropology? Is this a new type of anthropology informed by design (a designerly anthropology), or a new form of design inspired by anthropology (anthropological design)? Or is this the anthropology of the processes, products, and cultures of contemporary design, a new theory and practice inspired by the interstitial spaces between the disciplines?

coupling of action and perception" (2012, p.10). Here, the authors emphasise the nature of the process, type of skill, and activities of people involved. They describe it further as "different ways of designing and different ways of designing and using" drawing attention to the relational nature of design, production, and use (Gunn & Donovan, 2012, p. 11). The sweeping scope of design anthropology is evident in this definition as it includes thinking and making, theory and practice, and tangible as well as intangible things. To me, design anthropology can be most useful when it engages in critical and deep examination of human and non-human relationships in the context of practices of design (inclusive of thinking and making) that unfold in a variety of places, so as to generate more useful reflections and recommendations of the impact of these activities on our social, material, and natural worlds. By engaging with designers and craftspeople in *tambat ali*, examining the material artefacts created through this collaboration, and understanding the sociocultural, economic, technological milieu in which this occurs, I have attempted to activate the principles of design anthropology to further my work.

Designers and design researchers have been borrowing heavily from anthropological methods while conducting research early in the design process (Laurel, 2003; Hannington & Martin, 2019; Milton & Rodgers, 2013; Müller, 2021; Nova, 2014); simultaneously, anthropologists are getting more interested in examining the activity of contemporary design and the products of this practice (Drazin, 2020; Ingold, 2013; Tunstall, 2013). In addition to the books, book chapters, and journal articles that have recently appeared in print, the presence of blogs, web groups, conferences, and workshops on the topic of design anthropology are evidence of the growing interest in this field of study. New academic degrees in Europe and the United States are now being offered under the title of design anthropology. It is clear from all this activity that there is significant overlap between these disciplines and growing numbers of people are engaged in this interdisciplinary study. Anthropologists and designers have attempted to delineate a position for this emergent topic by describing the theoretical intersections as well as distinctions between the two disciplines, outlining the methodologies through which anthropologists and designers practice their craft, and imagining ways in which they could inform each other.

1.6.6.1 Design Inspired by Anthropology

Designers frequently use anthropological research methods in the early stages of the design process as a means of practicing human-centred innovation (Ireland, 2003; Kelley & Littman, 2001; Cagan & Vogel, 2001; Griffin & Hauser, 1993; Dreyfuss, 1955). This form of design seeks to advance the profession beyond styling, technology led design or market driven design, by focusing instead on design for human need. It is clear that ethnographic methods germane to anthropology have directly inspired design research. Participant observations, interviews, and other ethnographic methods are regularly used to gain better insight into people's needs, habits, rituals, lifestyles, etc. "It must be borne in mind that the object being worked on is going to be ridden in, sat upon, looked at, talked into, activated, operated, or in some way used by people individually or en masse" (Dreyfuss, 1955, p. 8). Dreyfuss is often recognised in industrial design as one of the pioneers of user research as well as human factors and ergonomics.

Human-centred design rejects aesthetics or technology as the sole drivers for product development; instead, it emphasizes the need to understand the sociocultural context within which people interact with things, and using that knowledge to generate new design. The rapidly growing field of design research addresses this very need and has developed a variety of qualitative research methods for this purpose (Hannington & Martin, 2019; Kumar, 2003; Laurel, 2003). The goal of these methods is to be able to identify people's articulated as well as unarticulated needs. Corporations involved in human-centred new product development operate on the principle that knowing people's needs will lead to designs that are more readily assimilated into their everyday lives. Though the tradition of user research has existed in the design discipline for several decades, the explicit and widespread use of rapid ethnography is relatively new. In design research, it has been defined as "a research approach that produces a detailed, in-depth observation of people's behaviour, beliefs and preferences by observing and interacting with them in a natural environment" (Ireland, 2003, p. 26). Several large multinational corporations like Intel, Nike, Nokia, and others routinely rely on anthropologists to help design teams understand the attitudes, belief systems, lifestyles, and needs of social groups for whom they are designing new products and services.

This is probably the most active area of convergence between design and anthropology that has led to new research, publications, shared personnel, and employment opportunities across disciplines. This form of design anthropology as it is practiced today might fit under the label "applied anthropology", defined as the "application of anthropological knowledge, methodology and theoretical approaches to address societal problems and issues" (Kedia & van Willigen, 2005, p. 1). Interestingly, some of the definitions of yet another form of applied anthropology referred to as business anthropology or organisational anthropology are strikingly similar to design anthropology (Baba, 1986 & 2005; Caulkins & Jordan, 2013; Jordan, 2013; Denny & Sunderland, 2007). Baba outlines three key areas of business anthropology: "anthropology related to the process of producing goods and services, and the corporate organisations in which production takes place", "ethnographically-informed design of new products, services and systems for consumers and businesses", and "anthropology related to the behaviour of consumers and the marketplace" (2005, p. 84). It is clear in this charter of business anthropology that much of the work focuses on a specific form of application, i.e., the use of anthropological research methods in understanding a set of business practices, related outcomes and their impact on consumers. However, design inspired by anthropology does not constitute anthropology of design. Instead, it is merely a case of design borrowing such methods as participant observation, interviews in context, and more broadly ethnography to further its purpose of trying to understand individual and social situations before designing new products and services.

1.6.6.2 Anthropology Inspired by Design

Anthropologists have turned their attention in recent years to the study of consumption, the activity of design, and the social meanings of mass-produced, everyday objects. Exploratory and inductive in nature, sociocultural anthropology possesses the conceptual flexibility to study complex situations involving people, the environment, and cultures in dynamic and constantly evolving societies. According to Berger, “the task of the anthropological analyst of material culture is to see the role that various objects play in the most important myths and rituals of specific cultures and subcultures and the manner in which all of these relate to dominant values and beliefs” (1992, p. 47). By viewing objects as cultural data, sociocultural anthropologists are better able to comprehend their meanings and social import. They gather information over reasonably long periods of time using ethnographic research methods such as field observation and key informant interviewing. The material turn, often described as a recent surge of interest in objects, materials, the object-subject relationship, and the agency of things has swept through several disciplines in the social sciences and the humanities including history, anthropology and cultural studies (Drazin, 2013; Hicks & Beaudry, 2010; Joyce & Bennett, 2010). This has aided in making the process and products of design a focus of attention for anthropologists.

However, it seems that the relationship between design and anthropology has not been one of equal exchange. While design has explicitly adopted anthropological method into its core practice, a lot less design thinking or making has entered anthropology. Otto and Smith, for example, would like anthropologists “to develop ways to include the anticipation and creation of new forms in their ethnographic descriptions and theorizing” (2013, pp. 12-13). Gatt and Ingold “propose an anthropology not *of*, *as*, or *for* design, but anthropology *by means of* design” (2013, p. 141) (emphases in original). “In anthropology-by-means-of-design, the active participation of the anthropologist in building relationships and making things—that is, contributing to the unfolding happenings in fieldwork—necessarily becomes more deliberate and more experimental" (Gatt & Ingold, 2013, p. 149). However, can design's predilection for active intervention (instead of theorisation), rapid visualisation (instead of thick ethnographic descriptions), and making things (instead of observing things) reshape anthropology? And if that is indeed the case, what new form does anthropology inspired by design take? If anthropology imagines design as "conception and planning of the artificial" (Buchanan, 1992, p. 14) where the artificial refers to artefacts made of human agency, or as "courses of action aimed at changing existing situations into preferred ones" (Simon, 1996, p. 111) where situations are social in nature, then it starts to take on designerly characteristics.

1.6.7 In Summary…

As described in the preceding pages through the research questions raised and a review of the relevant literature, the exploration of the workings of copper and the difference made by the material in *tambat ali* will contribute to the anthropology of design and craft, as well as to the discourse in material culture studies and social anthropology.

1.7 Methodology

This anthropological study of *tambat ali*, which includes in-depth examinations of the coppersmiths, the materials they use, their craft and design methods, and the objects they make, may be described as a design anthropology. For Drazin, design anthropology involves "the use of design methodologies and epistemologies in the service of better sociocultural interpretation, understanding and critique, more than social research for better design" (2021, p. 11). The sociocultural interpretation of *tambat ali* has involved several methods including participant observations, interviews, photo and video documentation, method of loci, and learning the craft, which are outlined in this section.

1.7.1 Positionality and Anthropology at Home

In developing the approach to this study, I had to consider my positionality in relation to the *tambats*, which involved two key aspects: (1) class differences between the *tambats* and myself resulting from my role as an anthropologist-in-training and a designer-by-training, and (2) my research as anthropology at home. These two aspects are related, and they foreground issues of subjectivity, privilege, and difference posed by my presence in the field that deserve attention. Anthropological literature has clearly highlighted the complexities presented by the politics of power that exist while doing ethnography and how they can influence research (Anderson-Levy, 2010; Behar, 1996; Hernandez, 1995; Lambek, 1997; Marcus, 1998; Narayan, 1993; Pemunta, 2010; Rosaldo 1993, Tehindrazanarivelo, 1997). In fieldwork, power relations are structured by differences in positionalities between the researcher and the informants, imbalances in access to knowledge, inequities in availability of resources, and other factors defined by specificities of the context. Situating one's presence and acknowledging positionality in fieldwork "entails bracketing the wider frameworks of power" (Lambek, 1997, p. 33). This awareness of existing power frameworks is critical, as it shapes not only the nature of the relationship of the ethnographer to the informant, but also the type of information collected and insights generated.

The site of my fieldwork is Pune, India, and as a person of Indian origin (though having lived abroad for many years), I wondered if my study might be regarded as anthropology at home (Forster, 2012;

Jackson, 1987; Mughal, 2015), indigenous anthropology (Fahim, 1982), insider anthropology (Madan, 1982), or native anthropology (Kuper, 1994; Narayan, 1993). “There are many meanings to the expression ‘anthropology at home,’ the most obvious of which refers to the kind of inquiry developed in the study of one's own society, where "others" are both ourselves and those relatively different from us, whom we see as part of the same collectivity” (Peirano, 1998, pp. 122-123). There are clearly some things that I share with the *tambats*; we are Indians, we are trained as designers, and we speak the same language. However, not being a *tambat* myself (by caste or by occupation), not knowing the craft, and having been trained through different education systems separates me from them.

1.7.1.1 Anthropology at Home

Anthropology in familiar territory has clear advantages. As an Indian male, it was easier for me to avoid undue attention while spending time in the *tambat* workshops. Being able to speak the local language not only made it easier to communicate with the *tambats*, but also helped me understand how such words as things (*vastu*) and properties (*guna*) had different meanings in Marathi and how they opened up new spaces for analysis. But anthropology at home has detractors, who cite lack of cultural and geographic distance between anthropologists and informants and the absence of the “radical encounter with alterity” as problems (Peirano, 1998, p. 105). I wondered how my positionality and my “situated identity” (McClaurin, 2001, p. 57) as a native anthropologist would affect my data collection efforts and ethnography in general. Would I be expected (but considered unable) to detach sufficiently from my own cultural understandings to notice underlying patterns that exist in everyday life, see what might be unfamiliar to non-Indian eyes, not have any form of bias, and approach the work not as advocate but as anthropologist? While the notion of objective distance has been discussed as necessary for analysis, the concept has been widely critiqued as well (Agar, 1986; Lofland & Lofland, 1995; Lopate, 1976; Pemunta, 2010). Is the native anthropologist expected to harbour two identities then—one as the insider with equipped with insights that an outsider may not have but hampered by subjective overfamiliarity, and second as outsider anthropologist able to perform objective critique and analysis? However, the identities of the outsider and the insider, the ethnographer and the informant, the researcher and the one being researched are not as starkly distinct as one might think. “Identity, always multiplex, has become even more culturally complex at this historical moment in which global flows in trade, politics, and the media stimulate greater interpenetration between cultures. In this changed setting, it is more profitable to focus on shifting identities in relationship with the people and issues an anthropologist seeks to represent” (Narayan, 1993, p. 682). Narayan recommends an unabashed subjectivity instead of objectivity and invites anthropologists to rethink the notions of insider and outsider by acknowledging “the hybrid and positioned nature of our identities” (1993, p. 682). These hybrid identities suggest that we are all natives, that there is significant social and cultural complexity to examine at home, and that the anthropology of ‘tribal’ and ‘primitive’ cultures amounts to intellectual neocolonialism.

As Black feminist anthropologist Irma McClaurin explains, the assumption in the discipline is that any cultural, indigenous identity that native anthropologists might possess is wiped out by their education in anthropology (2001). She argues that this creates a sort of “disciplinary colonialism” that not only silences the native anthropologist, but also subjugates them by acculturating their place within anthropology (McClaurin, 2001, p. 59). She urges anthropologists working at home to engage in ethnographic praxis that negotiates personal histories along with those of the communities being studied within the context of larger global transactions. The task therefore is, for me to acknowledge and situate my identity (or identities) as I try to make sense of the individual and the social, local and global, formal education and sensate knowledge, as well as the past and present in *tambat ali*. In this process, we (as I include myself here) must create narratives that are nuanced, complex, layered with multiplicity, and perhaps inherent with some contradiction, in an effort to depict the social reality of the field.

When the *tambats* I know introduce me to other *tambats* or visitors, they refer to me as "a friend of our community", going on to add that "he is studying our *tambat* community". These words are uttered with the same sense of pride that the *tambats* exhibit while speaking of their work. I mirror the friendship extended to me by the community. And finally, I followed Malinowski's advice to Evans-Pritchard and tried my best at all times "not to be a bloody fool." (Schweder, 1997, p. 152).

1.7.2 Ethics

This research project was submitted to the Research Ethics Committee at UCL and was given project number: 9413/001. Research Ethics Application and Data Protection forms were filled out and sent to my advisors and the department of anthropology. The research has not put the participants at any risk of criminal or civil liability, nor has it inflicted any damage to their financial standing, employability, or reputation. I conducted my interviews at times when the *tambats* invited and allowed me to, during production down time, in the evenings, and on holidays. They had mentioned those as the most convenient times for them. When I observed their work, it did not disrupt them or slow them down. Their names in this document have been pseudonymised and facial features blurred for privacy.

In order to secure ethics clearance from a local university, I presented this project to the faculty and students in the Department of Anthropology, Savitribai Phule Pune University, Pune on the 10th of August 2016 at 3:00 pm. The head of the department, Prof. Anjali Kurane, on recommendation of the faculty, approved the project and sent a letter indicating the following. “The ethical issues involved in the research project were discussed by the committee members. The research project, methodology and precautions to be taken to maintain confidentiality and anonymity of the research participants ensured by the research scholar, is found suitable.”

1.7.3 Participant Observations and Interviews

“Anthropology studies social relationships over the life course, and its approach to the study of art objects should, accordingly, focus on their relations to the persons who produce and circulate them” (Hoskins, 2006, p. 82). In order to understand the everyday routines, skills, and socioeconomic systems of the community, I have spent time over the years in the various locations in *tambat ali* and beyond observing, documenting, and interviewing the *tambats* and the designers who work with them. Observing the production system and creating *chaînes opératoires* are techniques that have been extremely useful in helping me understand the transactional relations between the *tambats* and their materials. Conversations with designers have yielded beneficial information about how processes of design, craft, and production are understood by those working with copper. And observing and 'interviewing' the objects themselves has also generated material as well as social insights about the lifecycles of the products that emerge from *tambat ali*.

> Thinking about objects as in some ways similar to persons has led to several experiments with biographical writing about objects. These various experiments have taken two dominant forms: (1) those 'object biographies' which begin with ethnographic research, and which thus try to render a narrative of how certain objects are perceived by the persons that they are linked to, and (2) efforts to 'interrogate objects themselves' which begin with historical or archaeological research, and try to make mute objects 'speak' by placing them in a historical context, linking them to written sources such as diaries, store inventories, trade records, etc. (Hoskins, 2006, p. 78).

In his discussion of the memory of place, Casey (2000) refers to the old Greek activity described by Cicero called the "method of *loci*", in which a place, either a room full of things or a street full of shops is imagined and memorised in the form of a grid with every object situated on a particular point on it. Retrieval is then accomplished by mentally walking through the place and recalling each of the objects and their locations. Every walk through *tambat ali* gave me the opportunity to add detail to my mental maps of the place, which themselves became resources that I constantly relied on during my writing.

1.7.4 Learning the Craft

Many of the *tambats* (including Sadashiv Apte, Bajirao Karulkar, Anil Chauvhan, and Govind Lele) during down times from work spent time with me teaching some of the skill that they have learnt from their fathers, uncles, and other *tambats*. For instance, while much of the shaping of utensils can be accomplished by machines (and they do use some large presses for the purpose), the final hammertone finish can only be produced manually through *matharkam* with special hammers and techniques passed down several generations. Apte is recognised in *tambat ali* and beyond for his expertise in being able to create practically anything from a sheet of copper and also for his precise *matharkam*, while Karulkar's recognition is for his constant experimentation with new forms, processes, and tools, as well as his prowess on the lathe in the process of spinning copper. Everyone knows of Lele's hand in creating unique types of *matharkam* that has led to several innovations in the *supari dabba*. Similarly, Chauvhan's specialisation on the lathe is also known, as was his father's who also did metal spinning. I did not expect to learn this skill to any level of expertise from these teachers, but in the process of doing this work, I was able to experience some of the "techniques of the body" (Mauss, 1934), the highly evolved human actions that embody specific cultures. When I lamented on the shoddy quality of the things I made, Apte in his kindness reminded me of the decades of embodied, sensate knowledge of material, tool, body, and gesture he had in him. Experiencing these techniques (in addition to observing them) helped me understand the relation between the body, its action and the object produced. I learned how the *tambats* interacted with materials, tools, other *tambats*, as well as designers, and how this relationality shaped who they were. Sennett suggests that "thinking like a craftsman is more than a state of mind; it has a sharp social edge" (2008, p. 44). My goal, through this research method has been to engage in this process of social thinking and making.

1.8 Structure and Brief Summaries of the Chapters

The chapters in this thesis are organised around the topics of material, production, place, objects, people, design, and craft, in that order. This introduction, Chapter 1, offered an overview of the core topic of the thesis, briefly summarised some of the literature critical to the topics explored, described the methodology employed, and it now ends with brief overviews of each of the chapters. The thrust of Chapter 2 is on the material itself—primarily copper, but also a large number of other substances that are essential to *tambat* work, including sulphuric acid, tamarind paste, brass, and so on. Copper is presented in this chapter as a malleable material capable of continually transforming itself and the lives of those it encounters. Chapter 3 offers a visual representation and textual documentation as well as analysis of the *tambat* techniques of production using the method of the *chaîne opératoire.* The chapter includes the sequential analysis of the *bamba* that the *tambats* have been making since the mid 1800s, as well as a few new products designed by them and some local designers. These sociotechnical practices of making not only shape the objects but the *tambats* themselves into who they are. Chapter 4 focuses on place—the neighbourhood, streets, workshops, studios, and markets—through which copper travels as it makes its way from locations where it is designed and shaped into objects to the shops where it is sold. It is in these places that the complex of transactional relations among the *tambats*, designers, shop owners, materials, and objects they make unfolds and plays a role in assembling a sense of community. Chapter 5 is a critical examination of the outcomes of the production process of the *tambats*—the objects—some that the *tambats* have been making for decades, some that they have recently designed, and some new designs have come out of their transactions with other designers. The Marathi word *vastu*, which commonly refers to physical objects, serves here as a useful device through which to explain the arcs of the journeys of what the *tambats* make. The major thrust of Chapter 6 is the analysis of personhood through an examination of such anthropological concepts as hierarchy, individuality, and dividuality, none of which suitably work here. *Tambat* personhood is multidimensional and pliable, changing between persons, and over space and time. Design and craft are explored in Chapter 7, first as broad concepts as defined in the two professions, followed by how they make sense and are practiced in India, and more specifically how they unfold in *tambat ali*. Chapter 8, the conclusion, revisits some of the key ideas and issues explored in the thesis in the form of a summary. I have also included an account of the current conditions, as of September 2021, of *tambat ali* due to the impact of the SARS-CoV2 virus that has led to a series of shutdowns, loss of work, drastic drop in revenue and significant hardship. In addition, the chapter also discusses the speculative and potential futures of *tambat ali* as imagined by the *tambats* and the designers who work with them.

Chapter 2

Copper: Understanding the Material

2.1 Introduction

This chapter turns its attention to materials with a specific focus on copper, a metal ubiquitous in *tambat ali*, and seen in the form of large square sheets sent by the raw materials supplier, circular discs cut up with shears for processing, bent and distorted scrap pieces, as well as filings and powder discharged from machines and piled up on the floor. The material is seen in various states of becoming, as partially shaped products, prototypes, misshapen failures, and finished objects loaded on machines, leaning against walls, stacked up on the floor, shoved into corners, and in the hands of the *tambats*. These workshops are busy and full. While a variety of other substances such as sulphuric acid, tamarind paste, brazing powders, etc. are essential and widely used in all the *tambat* workshops as well, it is copper that really distinguishes itself, its properties overshadowing other materials in the landscape. This chapter sets out to explore the notion of materials in materiality, a central topic of concern for this thesis and one that has been attracting increasing interest in anthropology (Carroll & Parkhurst, 2020; Drazin & Küchler 2015; Ingold, 2007; Küchler & Were, 2009; Miller 2005; Tilley, 2007; Were, 2019). I hope to discover where the ongoing discourse in the discipline about materials helps and where it falls short in understanding what copper means in *tambat ali*.

Having read about copper's archaeological past and its importance in commodity markets worldwide today, encountering its presence on the ground in *tambat ali* makes it appear as a global material with local presence. It is one of the earliest metals to have been used in making things, and today it is likely to be found in most electronic products and electrified buildings all over the world. It's price, which is fixed in global commodity markets, has gone up dramatically in the past ten years, and that has impacted every *tambat* who has to buy sheets of the metal to make things.

2.2 A World of Materials

We are surrounded by natural, synthetic, and hybrid materials of all kinds—metals, alloys, woods, stones, ceramics, fabrics, plastics, composites, etc.—but seldom are we actively aware of how they are the essential elements of our buildings, products, clothing, and everything with which we interact. Industrial designers, architects, engineers, polymer scientists, and other specialists engage materials regularly in their work. However, while designers and architects often think of materials in functional and aesthetic terms (considering their weight, colour, texture, tactile properties, etc. for specific applications), engineers and scientists tend to think of them in terms of their mechanical properties (tensile strength, compressive strength, durability, etc.). These properties not only help people who work with the materials in shaping and forming them to what they need, but as we shall see, they also shape people themselves in the process.

In *tambat ali*, coppersmiths and designers live in a world of materials (Drazin, 2015), and their collaboration relies on an understanding of the properties of copper, the techniques available to work the material, and the type of value that can be generated with it. I shall refer to this form of living with copper as an immersion into the world of the material, an idea we will revisit later in the chapter. Copper's properties play an essential role in what the *tambats* do with it, how the designers think of designing with it, and how objects made of the material are used. Copper is not inert; it is a highly active and reactive metal that is constantly changing itself as well as else with which it comes in contact. The *tambats* have deep understanding of copper, the techniques to which the metal responds, the types of innovations that are possible with it, and means of manufacturing products with it at scale. Theirs is a specific and specialised knowledge. On the other hand, designers are typically equipped with the knowledge of a generic design process that is agnostic to materials and focused on form. However, it is the unique aesthetic properties of the metal copper that draw designers and architects to *tambat ali*. Sheets of copper, as raw material, before they are designed, formed, transformed, and locked into things, are more open to imaginations and interpretations. At this stage, the properties of the materials are more visible, accessible, significant, and transformable. Though generally stable in typical atmospheric conditions, pure copper does react with moisture and start to oxidize. The properties of copper desirable for each of the manufacturing processes are slightly different. For instance, for metal spinning, the *tambats* need copper that contains less than 1% impurities, but for *kholkam*, the metal can be less pure. The *tambats* take their material seriously; they care for it and tend to it regularly, just as Ingold urges anthropologists to “take materials seriously, since it is from them that everything is made” (2007, p. 4).

2.2.1 Transformative Materiality

Materials (and matter) have been described variously as brute (Tilley, 2007), vibrant and vital (Bennett, 2010), alive (Puig de la Bellacasa, 2019), stubborn (Assmann, 2020), assertive (Jeevendrampillai et al., 2021), technical (Coupaye, 2020) and a lot more. Considering this form of power of materials, copper can be described to possess a form of transformative materiality that empowers it to shape not only objects, but people, place, process, and community. Though nested within the term "materiality" is the word "material," and though materiality as a concept relies on the undeniable actuality that all things are made of some kind of a material, the discussion of materials themselves—the stuff of which stuff is made—is limited in the discourse on materiality especially in comparison to the scholarship on things. One exception is Drazin and Küchler's edited volume *The Social Life of Materials* (2015), which offers a critical examination of the role of materials in society with case studies, arguing that their cultural properties have been generally overlooked in anthropology. Drazin summarizes existing approaches to the anthropological study of materials into four major categories (2015, p. xxv): (1) those that focus on techniques of making, (2) on properties of materials as means of conveyance of other social and cultural phenomena, (3) on material metaphors, and finally (4) on experience of materials through ethnographic studies. The goal of this volume is to address the gap in the social and historical sciences literature regarding the examination of materials and offer a new vocabulary and scholarly engagement for future work (Küchler, 2015, p. 280).

In his discussion of materiality, Miller suggests that the meaning of the word material "needs to encompass both colloquial and philosophical uses of this term" (2005, p. 4). The first and more mundane interpretations of the term material, Miller goes on to explain, simply foreground the "quantity of objects," "proliferation of artifacts," and so on (2005, p. 4). In addition to their abundance and ubiquity, though, this discussion of materiality also references the physicality of things and is therefore of critical consequence to design. This materiality of designed objects is manifested through their physical presence, which includes weight, size, proportion, texture, and surface, as well as sensorial qualities such as tactility, visuality, aurality, and so on. It is through these properties of materials that we first engage objects. At the second, and philosophical level, Miller expands and augments the definition to “consider the large compass of materiality” which stretches into “the ephemeral, the imaginary, the biological, and the theoretical; all that which would have been external to the simple definition of an artifact” (2005, p. 4). Materiality, in this interpretation, enlarges its conceptual boundaries far beyond the obvious and evident categories of things to include all that can be imagined to be material culture. However, as the idea of materiality stretches beyond the physical, it seems to lose touch with the fundamental material of which things are made. Ingold laments this by pointing out that while anthropologists and archaeologists talk about materiality and material culture, they have “hardly anything to say about *materials*” themselves (2007, p. 4).

If, in the discussion of materiality, we do not account for the presence of the materials, we ignore the very substrate from whence all properties and agency rise. It is from materials, raw or processed, that things emerge. Tangible goods like hammers and nails are visibly and evidently made from such materials as iron and wood; but even intangible things like apps need devices on which to function. Services too rely on physical infrastructure. The substance from which things materialize demands acknowledgement in the discussion of the presence and power of things. “In urging that we take a step back, from the materiality of objects to the properties of materials, I propose that we lift the carpet, to reveal beneath its surface a tangled web of meandrine complexity…" (Ingold, 2007, p. 9). In turning our attention away from the abstract notion of materiality to the properties of materials, as Ingold suggests here, we might uncover an entire network of people, products, places, and practices that make up a culture. The copper goods, the material itself, the craftspeople, their tools and machines, the location of this crafts cluster in Pune, and a host of other agents connected to *tambat ali* represent an extended and complex, relational network of people, products, and place.

For Tilley, the concept of materiality goes beyond the "brute materiality" of materials and takes into account why certain material properties are important to people (2007). "All materials have their properties which may be described but only some of these materials and their properties are significant to people" (Tilley, 2007, p. 17). For the *tambats*, copper's malleability, softness, colour, and brilliance are significant as these properties enable the material to be shaped into things. In addition, copper's healing properties, the benefits they believe it offers by sheer contact, give it additional significance. It is when we extend our thinking from materials to materiality is when we understand social and historical contexts in which materials are significant to people. In his study of landscapes and stones, Tilley suggests that "the concept of materiality is one that needfully addresses the 'social lives' of stones in relation to the social lives of persons" (2007, p. 17). To Tilley therefore, materiality recognises and accepts object-subject relationality.

Copper is an essential component in the lives and stories of everyone who engages *tambat ali*, and it has been so for centuries.

Materiality, therefore, offers a theoretical framework that takes into account copper's spatiotemporality through generations and across lives, not only of the *tambats* living in *tambat ali*, but designers as well as people who buy these copper objects, wherever all these persons may be in the world. While Tilley offers these explanations of materials (as concrete) and materiality (as abstract), Ingold struggles with the term materiality. To him, "the concept of materiality, whatever it might mean, has become a real obstacle to sensible enquiry into materials, their transformations and affordances" (Ingold, 2007, p. 3). The very abstractness of materiality that Tilley refers to is refuted by Ingold. He argues that there has been a "slippage from materials to materiality" in anthropological thinking because the discipline has gone too far abstract and has left the physicality and properties of materials behind (Ingold, 2007, p. 7). He bemoans that he can touch a material, but he cannot touch materiality. He summons the work of ecological psychologist James Gibson suggesting that concepts of medium, substance, and surface are more appropriate to understand materials. However, Knappett argues that these concepts are "deeply asocial" (2007, p. 21), and Ingold himself admits that Gibson "downplays any notion of the materiality of the world" (2007, p. 6). Deep sociality is visible in Bennett's discussion of the vital materiality of metals. "Metal is always metallurgical, always an alloy of the endeavors of many bodies, always something worked on by geological, biological, and often human agencies" (2010, p. 60). In case of copper, the agencies she refers to can be imagined as operating at several scales: planetary, social, and individual.

At a planetary scale, copper ore in various amalgams and compounds resides in earth's crust, which by using mechanical and chemical agencies (explosions, excavations, mining acids) is blasted out and subjected to further forces of heat and pressure to purify into metal. As pure metal in sheet form, copper is further subjected to human and mechanical agencies in its transformation into objects. Bennett goes on to explain that "human metalworkers are themselves emergent effects of the vital materiality they work" (2010, p. 60). The vibrant, vital materiality she refers to acts on people and communities, forming them through the work they do. Copper's agency transforms coppersmiths; the copper in their life becomes their life in copper.

Copper is hidden deep in the earth's crust, and in order to extract it, mining has to occur at depths ranging between 50 to 1200 metres. Immediately underneath our feet is soil, which only extends approximately 2 metres below the surface. Recent scholarship has described soil as animate, alive, living, and spiritual, not only because it contains an extraordinary diversity and quantity of living organisms, but these are qualities inherent to its material being (Puig de la Bellacasa, 2019; Salazar et al., 2020). As one digs on, literally and metaphorically to get deeper under the earth's surface, there are no living organisms found anymore, but deposits of copper ore (if present) that exist in the form of potentialities. Lying at this depth is material that has yet to enter the social sphere; its transformational materiality yet to be discovered. But as soon as the enormous rotary drills and powerful hydraulic shovels hit the ground and start excavating, these potentialities start to be realised and the material enters the social world.

While materials might appear to be solid and stable, rigid and concrete, they are in fact rather the opposite. Tilley reminds us that "each object has its own material properties but that these are processual and in flux" (2007, p. 17). The apparent firmness and solidity of materials give the impression of stability and permanence. The very surfaces described as touchable by Ingold are the ones that beguile us into thinking of them as stable, However, this stability is fleeting. And while concrete is indeed a material, one may say materials are not necessarily concrete. Copper, for instance, is dynamic, volatile, and protean. It is constantly changing in the presence of air, water, acids, oils, heat, force, impact, the human body. It loses itself to its own oxides when exposed to air, and when these oxides come in contact with water, it releases itself into the liquid as ions. It dissolves in the acids that the *tambats* use regularly in cleaning copper objects. It changes dramatically when heated in fires, quenched in water, and subjected to hammering.

In all these transactions that copper has with all other substances around it, it changes them as well. It is around this material that the *tambats* have built their skill, their livelihood, their community. It is the knowledge of working this material that has shaped their gestures and their bodies. Copper not only transforms the substances with which it interacts, it also transforms the people with whom it engages. The material relations in which copper is engaged are also simultaneously social relations. I shall refer to the conceptual, social framework that places copper in the life of the *tambats* while also situating them in the life of copper as 'transformative materiality'. This form of materiality includes in its fold the social and material transactions that occur through processes of production, distribution, consumption of the objects they make (which they refer to as *vastu*); it contains stories of the tambats and their collaborative relation the designers with whom they work; and it embodies narratives of people who buy things from *tambat ali*, often bringing them back for repair and restoration. A complex network of transactions and transformations between material, place, and people is held within this form of transformative materiality.

2.3 Copper: History and Global Trade

Copper derives its name from the Latin *Cyprium aes* (Cyprus metal) as it was mined and shaped into a variety of objects on the island of Cyprus as early as the 4th millennium BCE. The word became *cuprum* in Late Latin, followed by coper or copor in Old English. Archaeological evidence shows that copper was known to prehistoric people and was possibly one of the first metals to be smelted, cast, alloyed, and transformed into everyday articles of use. The use of copper has been traced back even further to 5000 BCE to the Americas and the Middle East in such places as the Sialk and Tālmesi districts in Northern Iran and the upper peninsula in Michigan in the US (Radetzki, 2009). Some evidence of copper smelting has been traced back to 5500 – 5000 BCE to an archaeological site in Serbia.

The quantity of copper found in the earth's crust is significantly less (at 0.006%) than aluminium (at 8%) and iron (at 6%) (Alexander & Sheet, 1972). It is rarely found in the form of nuggets of pure copper (known as native copper) soft enough to be able to be beaten and shaped into objects at room temperature with relative ease. Most copper in the earth's crust is found in the form of ore, and it was the invention of smelting (the process of reducing ore to pure copper in a furnace) that accelerated the early use of copper in making such things as beads, ornaments, figurines, knives, etc. Though the origins of the smelting of copper ore are not precisely known, it is believed that it might have occurred accidentally in pottery kilns, as campfires are not hot enough to melt and extract the pure metal from its ore. “For about 2000 years until the metallurgy of iron was mastered around 3000BP, copper and bronze were the dominant metals, employed predominantly for weapons, tools, weights and measures, water pipes, roofing for the nobility, household utensils like vessels, polished mirrors, even razors, and for artistic decoration, like jewelry and statues” (Radetzki, 2009, p. 178). The production of copper has seen several peaks in the last 7000 years—first during the Roman Empire (~250 BCE – 350 BCE), second during the Sung Dynasty of China (900 CE – 1279 CE), and again during the Industrial Revolution (around 1850 – 1900 CE). Since the 1950s through the present, copper mining and production have been on a steady increase largely due to the thermoelectrical properties of the metal.

Copper has played a role in global trade and exchange in two forms: first, as a commodity material to be used in the production of goods, and second, as the material of currency itself in the form of coinage. Early uses of copper for coins of lesser value (with gold and silver for higher values) were seen around 500 BCE. Later, its use in coinage expanded substantially during the Roman Empire. Copper was adopted for currency by Spain in the 14th century and later by Sweden. In the 1700s and 1800s, Europe and China were the primary producers of copper. The UK took the lead around the 1850s, followed by the US from 1900-1980s, and today Chile produces a third of the world’s copper (Hong et al., 1996; Radetzki, 2009; Schmitz, 1979).

Copper is found in nature in the form of sulphides such as chalcopyrite and chalcocite, carbonates such as azurite and malachite, and oxides such as cuprite and tenorite. Most pure copper is extracted from sulphide ores through open pit mining, and the five largest producers are in Chile, Peru, China, Democratic Republic of Congo, and the United States. Copper has several properties that has made it a highly desirable metal for a variety of applications. It is highly ductile and malleable, and an extremely good conductor of heat and electricity. Copper easily propels electricity through its body because it has several delocalized or free electrons in its atomic structure. And when connected to a battery, these electrons are activated to move in the direction of the positive charge, in effect, transmitting electricity. Therefore, one of the primary uses of the material is in electrical applications, especially for household wiring and circuit boards. It's unique ability to draw heat away from the source and dissipate it as and where needed has made it an excellent material to be used as a heat sink in products and for cooking utensils.

2.3.1 The Global Presence of Copper

Copper is a global material with a long history, and it is expected to have a long future on account of its heavy use in electrical applications. "From electronics to home construction, copper is used extensively in manufacturing and demand for the metal is seen as an economic bellwether. Earlier this year, copper prices hit their highest level in a decade. So far this year, copper prices have risen about 21%" (Tan, 2021)[6]. In October 1960, copper traded at $0.28

[6] This discussion of the global economy of copper, commodity prices, supply and demand, and international trade should not be seen as expressions of abstract, universal laws of economic behaviour, or endorsement of a formalist position as described in economic anthropology. The substantive position, as described by Polanyi (1944) in opposition to the

per pound, and as of May 2021, it was at $4.76 per pound. Between October 2001 and July 2006, it rose quickly from $0.62 per pound to $3.63 per pound. The use of copper wires in buildings and in circuit boards for electronic products plays a role in these increasing prices. Copper is also at times used as collateral in large transnational loans. According to some estimates, a global shortage is expected between years 2021 and 2024 and the price could rise to $9.07 per pound (Tan, 2021). These fluctuations in prices are seen in relation to the general economic outlook as well as demand, and are tracked with the prices of oil and gold. When copper gets too expensive, it is sometimes replaced with aluminium in applications where it does not affect performance dramatically (such as in car radiators).

Copper and brass cooking pots tinned on the inside have been traditionally used in Indian kitchens for decades. However, stainless steel and aluminium vessels, which do not need to be lined with tin, have now replaced copper for the most part, as they are cheaper and more convenient. In other words, the prices of the metal are relationally attached to a variety of other substances such as oil, aluminium, and gold. Even minor changes in the prices at a global level have an impact on the *tambats*, who buy small quantities of sheet copper for their jobs. While they have to pay more for the raw material, people who buy from them are often unaware of these relational impacts of prices that travel from the global stage to the local workshops.

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formalist position is more contextually grounded in social relationships and cultural values rather than a centralised financial superstructure. The economic system in which the *tambats* operate can be seen as a hybrid version of formalism and substantivism. This will be discussed later in Chapter 4 on place.

2.3.2 Copper in India

The absence of bronze implements from archaeological digs in India suggest that the Neolithic Stone Age passed into the Iron Age without an intervening Bronze Age. Though no copper artefacts have been found in southern India, copper tools and weapons have been found in northern India (Smith, 1905). Over 400 copper shovels, axe-blades, agricultural implements, and weapons of war have been discovered in the village of Gunjeria in Balaghat district. Additional artefacts have been found in the state of Bihar and Orissa, suggesting that significant regions of northern and central India went through a copper age; and the objects found may be dated at 1500 – 2000 BCE (Neogi, 1918). Most of these implements appear to have been created using metallurgical techniques of extracting copper from ore, casting it into ingots, and then hammering it into objects, a production technique that continues to date. The metal was formed into a variety of small and large objects like coins (1st century BCE to 1st century CE), copper plates with inscriptions (~300 BCE), utensils (1st century CE), structural items like large bolts (as seen on the Ashoka pillar), statues (as seen in the 7½ foot Buddha from the 5th century CE), and so on (Neogi, 1918).

According to a report by the Indian Bureau of Mines, copper mining and smelting continues in several states in India like Rajasthan, Jharkhand, and Madhya Pradesh that have the largest resources of copper ores (Gundewar et al., 2011). In 2019, India became a net importer of copper, primarily from Chile, Indonesia, Australia and Canada, and the metal is now used to satisfy the domestic need in electrical applications, construction, energy, telecommunications, and automobiles.

2.4 Sensorial Materiality

When going to *tambat ali* you hear it before actually seeing it. The rhythmic sound of scores of steel hammers hitting copper utensils on steel anvils emanates from the workshops of the *tambats* and spreads outwards into the city of Pune. The city itself is loud, busy, and bustling with sounds of scooters, motorcycles, rickshaws, cars, buses, shouting pushcart vendors, temple bells, calls to prayer from mosque loudspeakers, and voices of people out in the streets. And the hammering provides a steady, repetitive soundtrack to these chaotic sounds of the city. Interestingly, a bird (*Psilopogon haemacephalus*) that has its habitat in the nearby Western Ghats, is named coppersmith barbet or *tambat pakshi* (in Marathi, *pakshi* is bird) because of its monosyllabic, metronomic call.

Many of the indoor spaces of the workshops are crammed with machines, stacks of materials, moulds, dies, and prototypes, and therefore the *tambats* work out on the streets or under partially roofed porches, a practice that further amplifies the sound. As you travel closer to the workshops from anywhere in the city, the hammering gets louder and louder, until you reach *tambat ali* and get a visual confirmation of the source of the sound. That's when you see copper everywhere. The red-orange metal, in all stages of production from sheets to finished product, appears startlingly vibrant against the backdrops of aging, corrugated sheet metal, earth-toned jute sacks, greasy steel machines, oily rags, and asphalt roads. You see *tamba* in large sheets stacked against walls in workshops, cut into circles spread out on tables, glowing red hot on open coal furnaces, loaded on machines undergoing the process of shaping, laid out as semi-finished products on metal roofs drying in the sun, placed on anvils to be hammered, and finally stored in room corners as finished products, ready to be shipped out. And the remnants of the process lay as scrap in the form of swarf (turnings, shavings, and filings) in large shiny heaps in plastic bins and jute sacks, awaiting recycling.

The brilliant presence of this material is what distinguishes *tambat ali* from the rest of Kasba Peth. And in addition to copper, a variety of other materials that play a supporting role in the process of making are also scattered all around the workshops. This includes such materials as tamarind paste, diluted sulphuric acid, clumps of coconut fibre (coir), and jute rags used in cleaning copper, acacia wood blocks used for making spinning dies, old rubber slippers (flip-flops) used for polishing hammers, coal for furnaces, and old clothes used for drying freshly washed utensils. A large variety of specialized tools made primarily of wood and steel are also lined up on the floors and benches in these workshops. The *tambats* sit in the midst of all this, surrounded by the materials they rely on to be able to do their work. This is truly, as Drazin describes, “a materials world” (2015, p. 3).

2.4.1 Anthropology of the Senses

New sensory studies in anthropology have critiqued the inordinate amount of attention paid to the visual realm at the expense of the richness of other senses, referring to it as the “imperialism of sight”, and a “Western pentad sensory model” (Low, 2018). Scholars in this area of research such as Howes (1991, 2004, 2015), Classen (1993, 1997), Pink (2009), Pink & Howes (2010), Ingold (2011) and others are outlining approaches to anthropological enquiry into the role of senses in everyday life. These authors suggest that perception should be studied in cultural terms and not understood only as biological and psychological processes. They recommend that the senses should be studied out in the world in all its modalities through ethnography rather than in controlled laboratory settings split up in the typical bracketing of the five individual sense organs. To walk around in *tambat ali* and experience it sensorially through what one encounters is central to understanding the *tambat* world. Sensorial experience is in fact social experience.

2.4.1.1 Sounding Out Copper

I understood over time during my attempts to learn the hammering techniques of the *tambats* that these sounds carry specific meanings which are decipherable to the craftspersons. The process of *kholkam* (sinking) refers to the technique of converting flat circular discs of copper into bowl-like shapes. The tool used for this is a specialized anvil called the *adi* and a large wooden mallet called the *mogri*. The *tambat* starts out by placing the copper disc on the *adi*, hammering the centre and gradually spinning it and sliding it linearly along the radius so that the hammer strikes move outward from the middle to the periphery. As the hammering continues, the disc gets thinner and starts hollowing out, eventually transforming itself into a bowl. A deep, lower frequency sound is created during this process.

Before spinning lathes entered the workshops of the *tambats*, all utensils of a hemispherical base were made with the *kholkam* technique. The more distinct, higher pitched, and louder sound that travels farther is produced during *matharkam*, the technique of creating the hammertone texture on the utensils for which *tambat ali* is known. When the hammer is struck correctly, the sound is clear, bright, ringing, and loud. However, should the hammer hit an incorrect spot or if the utensil is placed inaccurately on the anvil, the sound is muted and dull. In this case, instead of creating the hammertone texture and indenting the utensil, the hammer dents the metal, misshaping it. Here, I would like to refer to an 'indentation' as the result of a correctly executed hammer stroke that does not change the shape of the object but only creates a shiny dimple on the surface; and a 'dent' as an incorrect hammer stroke that misshapes the object without creating the desired hammertone texture. Novices dent objects routinely while learning, and it is only after significant amount of practice that they are able to get it right. While distinguishing the sound of an indentation from that of a dent is not difficult, being able to wield the hammer such that it creates the right sound and therefore the desired effect is difficult. Years of knowledge is built into these sounds.

The syncopated rhythms of multiple hammers from the several workshops in *tambat ali* mark the daily rituals of the craftspersons. Work generally starts every morning between 9am and 10am and continues until 5pm or 6pm depending upon the number of products to be made. Lefebvre and Régulier's "rhythmanalysis, a technique developed to analyse and understand urban rhythms in all their magnitude from particles to galaxies" may be deployed here to situate the work of the *tambats* in their everyday lives (2004, p. 87). The authors suggest two types of rhythms: cyclic and linear. Cyclic rhythms tend to have cosmic origins such as those seen in the routines of hours and minutes, days and nights, months and years, and so on. "The linear, by contrast, defines itself through the consecution and reproduction of the same phenomenon, almost identical, if not identical, at roughly similar intervals; for example, a series of hammer blows, a repetitive series into which are introduced harder and softer blows, and even silences, though at regular intervals" (Lefebvre & Régulier, 2004, p. 90). Interestingly, the authors use the example of hammer blows to talk about linear rhythms. However, in *tambat ali*, these rhythmic sounds are not linear but produced in cyclic routines. For eight to ten hours each day of the week, throughout their entire working careers and over several generations, the *tambats* have been following these rhythms. It takes years for a *tambat* to be able to get the position of the body, movement of one hand in indexing the utensil, and the motion of the other hand doing the hammering just right in order to ensure that the individual dimples are equal in size, evenly spaced, of the same depth, and in a straight line, row after row. The gestures of the body and the techniques involved in transforming the material copper into things are discussed further in Chapter 3 on production.

While several anthropological studies have examined sound, speech, and music in a variety of contexts (Feld, 2012; Feld & Brenneis, 2004; Merriam, 1964; Powell & Gershon, 2020; Samuels, et al., 2010), limited research exists on sound and its relation to material. In his seminal book *The Soundscape: Our Sonic Environment and the Tuning of the World* in which he discusses soundscapes as environments that consist of "events heard, not objects seen", Murray Schafer presents several terms, such as sound signals, keynotes, and soundmarks in explaining acoustic phenomena (1994, p. 4). Signals are "foreground sounds and they are listened to consciously… they are figure rather than ground" (Schafer, 1994, p. 10). These are sounds that must be heard. On the other hand, keynote sounds are those that may not be heard consciously; they are the ground in the figure-ground analogy. Keynote sounds are often ubiquitous in environments, they influence human behaviour, and they "help to outline the character of men living among them” (Schafer, 1994, p. 10). Finally, he presents the concept of soundmark (derived from landmark, just as soundscape is derived from landscape), a “community sound which is unique or possesses qualities which make it specially regarded or noticed by people in that community” (Schafer, 1994, p. 10). These concepts of soundscape, keynote, signals, and soundmarks can be deployed to explain the acoustic sensibility of *tambat ali*. However, these terms and related sounds are not as distinct as they may seem. Conversations among the *tambats* and the hammering are sound signals, but over time and repeated listening, they become keynote sounds that recede from figure to ground. The rhythms of these signals and keynotes are mirrored in the bodily movements of the *tambats*. The arms descend, hammers strike copper, sounds emanate, and the process repeats itself. And together, all these sounds make up the soundmark of the *tambats* and *tambat ali*, a complex soundscape.

However, Ingold takes issue with the very notion of the soundscape by suggesting that it objectifies sound by tying experience to a specific sensory register. “Sound, in my view, is neither mental nor material, but a phenomenon of experience - that is, of our immersion in, and comingling with, the world in which we find ourselves” (Ingold, 2022, 170). One may enter *tambat ali* guided by the sounds of production, but the sensory experience of being there extends beyond the auditory, to includes smells of burning charcoal on furnaces and the visual brilliance of copper objects scattered all around. These together define the “sensescape”, to use a term from Howes (2004), which he defines as “the idea that the experience of the environment and of other persons and things which inhabit the environment, is produced by the particular mode of distinguishing, valuing and combining the senses in the culture under study" (2004, p. 143).

2.5 The Properties of Copper

Materials are often described by their physical and mechanical properties. Physical properties are typically measurable, and they include such things as density, melting point, conductivity, coefficient of expansion, etc. Mechanical properties describe their performance when exposed to external forces, and these include strength, malleability, ductility, wear resistance, etc. These physical and mechanical properties are determined by the internal structure and chemical composition of the materials, and by the external conditions to which they are exposed. Contact with gases such as oxygen, exposure to moisture or heat, and being subjected to pressure (such as impact, bending, pulling, etc.) can dramatically change properties of materials. For instance, applying heat can change the ductility of a metal, dipping it in a solvent changes its surface characteristics, and beating it can change its surface hardness.

2.5.1 Malleability

Copper is highly ductile and malleable, which means that it will allow itself to be pulled into wires and pressed into sheets with comparative ease in relation to other metals on the periodic table. Though not as soft as gold, copper is significantly more supple than steel. Thick sheets of copper are too hard to be easily formed by hand, but soft enough to be pliable when subjected to the concentrated and exaggerated forces of tools and machines.

Copper's malleability and relative softness give it an almost clay-like quality, and I have often observed the *tambats* bend and fold thin sheets of copper with their bare hands or the simplest of tools. In her research on the use of clay in the Neolithic age, archaeologist Nicole Boivin writes "engagement with the unusually malleable qualities of soil during this particular period not only allowed but probably also encouraged the creation of a myriad of new material culture forms which in turn both enabled and encouraged new patterns of interaction between individuals and between groups" (2004, p. 67). In another study in the state of Rajasthan in India, she explains that it is the malleability of mud with which people build their houses that engenders "highly fluid and organic structures to which divisions, walls, rooms and other features are constantly being added and removed to suit the needs of a developing family group" (Boivin, 2004, p. 65). In both cases described by Boivin, it is evident that the malleability of the material directly led to new patterns of interactions amongst people as well as new forms of objects.

And while copper is clearly not as malleable as clay, it is this property of the material that the *tambats* activate with remarkable efficacy in making a wide variety of objects with diverse forms. They have created unique processes such as *kholkam* and *matharkam* that mobilise and effectively utilise this property of the material. They have designed and developed an array of specialised hand tools and powered machines with which they shape the material. In addition, they are constantly engaged in creating new tools, acquiring novel and advanced machines, and at times designing new mechanical equipment that capitalise on copper's malleability. Malleability, as we shall see, is a critical property of copper for the *tambats*; it is what they rely on to shape the objects they make, and it is also a property by which we can describe their personhood and their community.

2.5.2 All that Glitters is Red

Colour is the unique property of a material to reflect visible light of a certain wavelength. When in pure form, copper has a red-orange lustre and glow. However, in certain conditions, it starts to bind with other elements present in the atmosphere, creating a layer of compounds on its surface, such as carbonates, sulphates, and oxides that give the copper a range of colours and patinas from bright green to black. In describing the draw of indigo, Taussig describes colour as “that which pulls the observer into the observed, which may even include being pulled into time as in history” (2008, p. 1). Walking around in *tambat ali* amongst a variety of copper objects that have been in production for hundreds of years certainly draws attention through the material into history. The same things, the same techniques, and the same *tamba* have persevered over time, visible in an array of colours from brilliant red to coal black.

Figure 2.1 Copper *pimpa* drying in Vangewadi (Photograph by Alex Velasco)

“Colour has the ability to animate things, to embody and transform social relations. It can be ‘agentive and thus capable of effecting events and transformations’” (Eaton, 2012, p. 62). While the *tambats* work with a variety of metals such as brass, aluminium, steel, gold, and silver, it is only copper that has the unique red-orange hue. The purer the copper, the redder it appears. As other metals are added to it (such as zinc to make brass and tin to make bronze) the redness starts to be replaced by a yellowish tinge. The *tambats* refer to the purer variety of copper they work with as “number one”, and that is used for spinning, which stretches the material substantially through processing. On the other hand, “number two” copper often has zinc in it, and it is used for such objects as the *bamba*, *pimpa*, *tapeli*, *ghangal*, etc. It is the pure, red metal that has given the people and the location the unique names by which they are known—*tambat* and *tambat ali*—and has bound and transformed the community through its presence in their work and livelihood for generations.

In order to maintain the colour and brilliance of the material, the *tambats* clean the products with an acid wash, polish the surfaces, or spray them with clear materials like polyurethane so that more light reflects from the surface and gives the material a lustre and gloss. While pure copper is naturally reflective, once it has the hammertone texture, it reflects light in multiple directions giving it a unique dimpled shine that is visible from any direction. The sheen of the material itself has a quality that is capable of producing an emotional response (Douny, 2013), and this is certainly true in *tambat ali*. In her discussion of the sheen of silk, Douny refers to it as a “living force… a kind of “aura” of the textile [that] embraces the medicinal and magic properties of wild silk but also its durability, strength and material brilliance” (2013, p. 59). The hammering of the copper not only creates a faceted surface that reflects light in multiple directions, but also strengthens the surface in a process called work hardening. Rane, who has designed tea lights, candle holders, and a variety of other things with the *tambats*, says, “I love the way copper ages. So… a copper product… grows with you. It will not disintegrate, but it’ll change colour and it’ll change texture. Also, it is so light sensitive... It catches even the smallest change in light. So there's something very, I would say, very…hmm… what is the word… cosmic about it.” A material that emerges from the depths of the earth and reflects light from the sky, in a poetic sense, does appear to be cosmic. This notion of giving copper a vague cosmic quality or relating it to something cosmic anchors it to a form of “material cosmology” (Miller, 2009, p.8); an overarching complex structured around a metal which includes in its broad reach objects, people, and place. This cosmology has also been described as a “complex and multiply differentiated collectivity” (Abramson & Holbraad, 2014, p. 13). This cosmic quality of copper can be described as an expansive concept that includes the material’s origins in the deep recesses of the earth and its reflective presence to the sun once it is transformed into objects, but also to all the complex relationality within which it exists. Visitors to the *tambat* workshops, whether tourists, designers, shoppers, or those who may have come to get an old copper utensil re-tinned or repaired, often express awe at the brilliance of the material.

2.5.3 Impurity and Purity

The periodic table organizes elements (pure substances that consist of only one type of atom) into metals, metalloids, and nonmetals. Copper, an element with atomic number 29 (number of protons in the nucleus), appears on the periodic table as it is a pure substance, but alloys such as bronze and brass do not, being mixtures of metals. Copper, if it has to be spun on a lathe, needs to have a certain level of purity. If there is more than 0.7% of impurity in the metal, it is no longer considered soft copper, and is not appropriate for spinning as it may split and rip on the lathe. “Although generally converting a positive condition, purity can only be defined negatively: as an absence of or mixing of one thing with others” (Forth, 2017, para. 2). Concepts of purity and impurity have found application primarily in religion and ritual as a means of analysing social systems like the Hindu caste but also in Judaism, Christianity and Islam (Dumont, 1970; Forth, 2017). Mary Douglas (1966) describes dirt as “matter out of place” borrowing an older description by William James. If we were to consider the presence of anything in a sheet of copper that is not copper (such as oxygen, sulphur, tin, zinc, etc.), it is indeed matter out of place, and can be considered akin to dirt. “Dirt is the by-product of a systematic ordering and classification of matter, insofar as ordering involves rejecting inappropriate elements” (Douglas, 1966, p. 36). Douglas explains purity and classification in the context of relations, arguing that categories are culturally imposed schemes that invariably leave things out, which are residues and impure, therefore polluting. When copper is not 100% pure, it has residues in the form of impurities or other metals, creating a material that is unfit for spinning. Some of the things the *tambats* make, like the *bamba*, can have as much as 30% zinc in it. While this ‘impure’ material can be employed for such techniques as shallow *kholkam* and *matharkam*, it cannot be used for spinning or when deep *kholkam* needs to be done. Impurities are also a form of pollution, and may be described as the “body’s permeability to external objects” (Valerie, 2000, p. 112). Copper is a reactive substance and binds with other elements such as oxygen to quickly form oxides. Its body is permeable to this polluting oxygen. Pure copper, often referred to as soft copper by machinists, can be bought in sheets that are 99.9% pure and only contain 0.1% of oxygen. These are the sheets that are ideally suited for spinning.

2.5.4 Healthy Copper

Copper also has the ability to contact kill microbes. “The antimicrobial activity of copper and copper alloys is now well established, and copper has been recently registered at the U.S. Environmental Protection Agency as the first solid antimicrobial material” (Grass, Rensing & Solioz, 2011, p. 1451). When microbes such as bacteria, yeast, and viruses are brought into contact with copper, a thin layer of the material begins to damage the microorganisms by rupturing their cell membranes. The process degrades the genomic DNA of the microbes and eventually kills them (Warnes, et al., 2010). Copper is therefore considered to be a self-sanitizing material and is used for medicinal purposes.

The *tambats* believe that copper has all the properties of gold and silver, and some more, but above all, it is affordable and therefore its properties can reach large numbers of people who may not have access to the more expensive metals. The *tambats* advocate storing drinking water in copper vessels because they believe it purifies the water and helps reduce hyperacidity. Some of them also believe it can cure scabies, ringworm infections, as well as leprosy. Bathing with water that is heated in a *bamba* can improve the texture and shine of the skin. Though described as a practice no longer followed due to the advent and popularity of allopathic medicine, the *tambats* used to press copper coins against wounds caused by dog bites to aid the healing process. A copper ring worn on the big toe can draw out any excess heat generated by the body and a copper bracelet can reduce the pain caused by arthritis. The Indian traditional medicinal practice of Ayurveda, for example, advocates storing water in copper vessels because of its perceived health benefits.

The Marathi word for good properties is *guna*, defined as "a quality, attribute, affection, or property, whether of matter or mind; a power, faculty, excellence, virtue; a property inherent" (Molesworth, 1857, p. 238). And some of the *tambats* believe that their bodies are healthier on account of constant contact with this metal because copper's *guna* are transferred to them. Their bodies get imbued with copper's *guna*. Here we see an example of copper's transformative materiality. It transmits its *guna* of purifying and cleansing to people, from its body to the bodies of the *tambats*.

The Sanskrit word Ayurveda can be translated as knowledge of life and longevity, and this is the practice of traditional Indian medicine followed all over the country. The fundamental concepts of Ayurvedic medicine are found in the Atharvaveda, written probably sometime in the second millennium BCE (Narayanaswamy, 1981). Copper, as pure metal and compounded with other materials, features with other metals like gold, silver, mercury, lead, and tin in Ayurvedic texts. Fine powders of the metals, their sulphates, and other chemical formulations were recommended for several health conditions. Copper was also recommended to be used in the manufacture of such objects as tongue scrapers, nozzles of enema pods, and containers for materials used in pharmaceutical procedures (Narayanaswamy, 1981).

2.6 Material Agency

In the swell of recent scholarship in the social sciences and humanities often referred to as the material turn, there is significant writing about the agency of things (Hoskins, 2006; Hicks & Beaudry 2010; Verbeek, 2005; Latour, 2005; Gell, 1998; Knappett & Malafouris, 2008). The primary question in these conversations is whether nonhuman entities have the power and means to cause change in the world. One of the most engaging accounts of agency appears in Gell's *Art and Agency* (1998). Gell explains that agents are the originators of series of events, and that they do so by intention. "Agency is attributable to those persons who/which are seen as initiating causal sequences of a particular type, that is, events caused by acts of mind or will or intention, rather than the mere concatenation of physical events." According to Gell then, an agent "causes events to happen" (1998, p. 16). He then offers concrete examples that include the "treachery" of cars that break down and "mines which have caused so many deaths," while also recognizing the "somewhat bizarre" nature of such attribution of intention and will to objects (Gell, 1998, pp. 19-20). While human agency is accepted as fact, the notion that things might have agency and the means of acting on their own behalf might be perceived as mildly peculiar or simply outlandish. However, making that very assertion of the intention of things is one of the explicit goals of the scholarship that has emerged in support of the material turn. Gell creates categories of primary and secondary agents to deal with this issue of intention. He explains that "social agency manifests itself, via the proliferation of fragments of [human] 'primary intentional agents' [soldiers, for instance] in their [non-living] 'secondary' artefactual forms [the mines they plant]" (Gell, 1998, p. 21).

It seems clear that for Gell intention is an essential attribute of an agent; and while nonhuman things cannot possess intent, they act as secondary agents because of the presence of humans, who serve as primary agents. In other words, a thing that is relegated to this position only has secondary agency because it cannot function on its own without the presence of the primary agency of the human. Agency can exist without intention and the presence of humans. While intention relies on an inherent notion of aim or purpose in the mind of the agent, in case of materials, the properties that define their being can serve an agentic role. The steel, plastic, and composite materials that are used in manufacturing Gell's treacherous cars and death-causing mines are responsible for some of the agency these dangerous objects possess. In the case of materials, agency is less about *that which gives material its intention* and more about *that for which is a material is responsible*. The chassis of a car is made of steel because it has desired properties of hardness, malleability, shear strength, tensile strength, and so on. A fender is made of a copolymer because it has specific properties of moldability and impact resistance. The properties of materials are responsible for the way they behave. And it is from these properties that their primary agency emerges.

We can refer to this form of agency as material agency. However, the discussion of "material agency" tends to focus on the agency of things, technologies, landscapes, and in general nonhuman entities, rather than the substance of which they are made (Knappett & Malafouris, 2008; Kirchhoff, 2009; Malafouris, 2008; Oyen, 2018). In the concluding remarks of her article, Oyen points to a few unresolved issues in the examination of agency, one of which is the lack of theorisation of the material properties of things. She suggests further research into “how the physical stuff of things contributes to their social effects” (Oyen, 2018, p.4). Copper’s properties give it agency even in the absence of humans; these are things *it does* on its own. These properties, which the material unleashes in the absence of humans, represent a form of fundamental or primary agency—a material agency. The material does what it does simply on account of its inherent nature as a metal with a certain atomic structure, a set of unique properties, and its *guna*. It is also important to note that this material agency of copper (and every other material) is not a fixed entity; it changes with geographic location, weather conditions, ambient temperature, atmospheric pressure, and so on. Copper, therefore, is inherently relational; its properties and its agency depend upon and are influenced dramatically by its relation to other materials and agents in its vicinity. And if we imagine agency to be relational, it resides not in the material or other agents, but perhaps in the interactional spaces between them. “While agency and intentionality may not be properties of things, they are not properties of humans either: they are the properties of material engagement, that is, of the grey zone where brain, body and culture conflate.” (Malafouris, 2008, p. 22).

In an analysis of Foucault’s *Order of Things* (1989), Maniglier explains the significance of order, positionality, and relations between things, which “do not result from the projection of an external grid onto them, but derive from their nature” (2013, p. 107). Materials too, behave in this fashion—it is the nature of copper that structures its relations to other elements, and it is this that drives the process of continually defining and redefining its properties and its behaviour in the world. According to Foucault, things “have ceased to be apprehended in atomic terms and started to be defined as bundles of relations" (Maniglier, 2013, p. 109). The *tambats* and the designers who work with this material know this all too well. In order to get copper to do what they want, the *tambats* modify the conditions surrounding it. Softening the metal by heat so that it may be forced into moulds and dies, hammering it to give it a specific texture, or exposing it to chemicals to build a patina of a desired colour are some of the standard practices they follow.

But as humans exercise their creative agency on the material, it fights back. And in this process, it exercises its own agency in the form of resistance—a direct response to the human agency to which it is subjected. So, as the material is being shaped into things, it performs two roles—it acts as an agent on account of its sheer properties in aiding the transformation that is being urged upon it by the craftsperson, but it also acts as a counteragent in resisting that change. It yields and acquiesces to the agency of the human equipped with a machine tool, but only after putting up a certain amount of defiance. All craftspersons speak to the material they work with, and it is through resistance that the material "speaks back" (Holbraad, 2011; Pels, 1998).

Designers working with copper speak of the metal not only in terms of its electrical, thermal, and chemical properties, but in terms of how the material enables itself to be transformed into things, and how it relates to the atmospheric conditions to which it is exposed. According to designer Rane, "there is so much magic to this material. And there's something about it that is extremely natural in terms of… the way it plays with other elements in nature, the way it plays with fire, the way it plays with water, the way it plays with light, and the way it plays with time. So, in that sense, I think there are very few metals which talk to a human being in terms of nature. I find copper does that." The "bundles of relations" described by Maniglier are clearly visible to the designer in copper's interaction with fire, water, light, and time. The relations between the designer, the craftsperson, the material, surrounding forces, and other substances are embodied in the experience of working with copper. "The experience of materials has profound effects on people's lives and understanding of the worlds in which they live, and on their actions" (Tilley, 2008, p. 19). These physical and relational properties of copper guide how designers think of the material, it directs their attention to the external forces that make the material what it is, and it shapes their design intent.

Design has been characterized as a "reflective conversation with the materials of a design situation" (Schön, 1992, p. 3). The *tambats* have been engaged in such conversations with copper as individuals and as a social group over a long period of time, and this exchange has configured their bodies, gestures, and movements, while they have been configuring and conforming the metal into things. The etymology of the word "converse" reveals that in Late Middle English it meant to "live among, be familiar with". The *tambats* are surrounded by this metal; it lives among them not only in their workshops but also in their homes and on their bodies. Though Schön's quote above references design situations and the conversations designers/makers may have with the materials during processes of making, this interchange and reciprocity extends into all aspects of social life. Schön's definition also suggests that this conversation is isolated and individualistic; perhaps a more accurate description would refer to it as a reflective and *collaborative* conversation with materials. Knowledge of materials and making is shared across individuals and groups; and not only in the form of one-to-one conversations.

2.7 Making with Copper

Ingold suggests that we re-connect with the materials of which things are made "by engaging quite directly with the stuff we want to understand: by sawing logs, building a wall, knapping a stone or rowing a boat", and that is how we can learn more deeply about the material nature of our world (2007, p. 3). "Could not such engagement – working practically with materials – offer a more powerful procedure of discovery than an approach bent on the abstract analysis of things already made?" (Ingold, 2007, p. 3). In order to pay heed to Ingold's advice and learn some of the "techniques of the body" (Mauss, 1973)—the highly evolved human actions that embody specific cultures—I have been making a few utensils under the guidance of Bajirao Karulkar, Sadashiv Apte, Govind Lele, and Anil Chauvhan in Karulkar's workshop. This has given me the opportunity of learning some of the techniques in which they engage every day and gaining insights into some of the sociotechnical aspects of copper marking, cutting, spinning, hammering, polishing, and lacquering. Each of these techniques demands a highly evolved and precise set of gestures that defines the relation between the body, the material, and the tool. The process of acquiring the skills and knowledge of making a single artefact involves absorbing into the body a long list of chronologically organized steps of material manipulation. Each step demands thought, position, movement, gesture, and action of the body that is essential in shaping these copper artefacts; because it is through these activities that the *tambats* exercise their agency on copper. "I call technique an action which is *effective* and *traditional*"

(Mauss, 1973, p. 75). Mauss explains that without tradition, there is neither technique nor transmission. The techniques I learned have been passed down through generations of *tambats* and are deeply rooted in tradition. However, it is important to note that the *tambats* have invented new processes, experimental tools, novel methods, and several new artefacts over the years. So, while there is tradition, there is also innovation. While some of the techniques of the body have significant historical precedent, some are entirely contemporary, and it is through these that the *tambats* exercise their agency on copper.

2.8 The Configuring/Transforming Power of Copper

"The transformative potential of materials… plays a fundamental role in their selection and uptake and is met with an empathy that is shared intersubjectively, the nature of empathy with materials being crucial for explaining how individuals interpret their social world in abstract, generalizable and often unchanging ways" (Küchler & Were, 2009, n.d.). Empathy is a term used widely in design practice (Chapman, 2015; Kolko, 2014; Koskinen, et. al., 2003; Van der Ryn, 2013) to indicate that designers need to empathise with the people for whom they are designing if they want their new products and services to be successful. However, Küchler and Were's notion of empathy with materials is a novel form of relationality between people and materials. They suggest that people's handling of materials encounters a shared empathy which makes it possible to realise intentions. The *tambats* have been reliant on copper for as long as their profession has been in existence, and it is this material that has transformed them into who they are. And if we imagine empathy as a relational property of shared understanding, this engagement between the *tambats* and their *tamba* can certainly be seen as empathic. Though many coppersmiths do work with other metals such as gold, silver, brass, and aluminium, the products that have defined them as a community are all made of copper. They think with and of the material in myriad ways often not recognized outside the community, and this knowledge shapes the way they work with copper. The word "configure," derived from Latin *con* ("together") and *figurare* ("to shape"), succinctly encapsulates the reciprocal form of the engagement between the *tambats* and the *tamba*, the people and the materials with which they work and live.

Copper has the agency, the property, and the power to transform humans, germs, fluids, and other materials with which it comes in contact; and it has made the *tambats* who they are. Therefore, they hold this material in high regard and bestow upon it properties that appear to be magical. Such magical power is seen in Holbraad's analysis of *aché*, "a mana-type term that Afro-Cuban diviners use to talk both about their power to make deities appear during divination, and about a particular kind of consecrated powder that they consider as a necessary ingredient for achieving this" (2011, p. 13). He further suggests that "Cuban diviners do not 'believe' that powder is power, but rather *define* it as power" (Holbraad, 2011, p. 13). In other words, the powder *is* the concept of power. For the *tambats*, copper is transformation; it configures everything with which it comes in contact.

Sometimes, when materials are transformed into things, the transformation renders them invisible. The raw materials recede, and we become less aware of their material presence as thingly qualities of the thing emerge. "At this point materials appear to vanish, swallowed up by the very objects to which they have given birth…

by the time they have congealed into objects they have already disappeared. Thenceforth it is the objects themselves that capture our attention, no longer the materials of which they are made" (Ingold, 2007, p. 9). This inaccessibility also relates to the types of things into which the materials have metamorphosed. A printed circuit board might be made up of such materials as porcelain, mica, epoxy resin, glass fibre, copper foil, cadmium, chrome, lead, nickel, and so on—an extremely long list that vanishes into the product. There is no way for us to recognize or relate to these individual materials once the printed circuit board emerges.

A somewhat similar transformation occurs when fibres are converted into yarns and then into textiles; the single fibres disappear into sheaths of fabric and eventually into the garment. A painted wooden toy, an anodized aluminium bowl, a glazed ceramic pot; these things too can hide the material of which they are made. Copper, on the other hand, on account of its colour, sheen, and texture, ability to reflect and scatter light from its dimpled surface, its slow aging, and transformation over time, is able to maintain its vibrant presence as a material and resist being subsumed into the thing.

2.9 Immersion in a World of Materials

In a perfunctory sense, being immersed in a world of materials can refer to a situation in which one finds oneself in the constant company of that material, and that its presence becomes an essential part of one's everyday life. However, a few more characteristics of immersion can be identified that make particular and deeper sense here. I suggest considering the notion of immersion in reference to three specific aspects of the relationship between *tambats* and copper—conversing with, configuring, and imbuing. As we have seen, the *tambats* "converse" constantly with the metal as an essential aspect of their work. If we consider the Late Middle English meaning "live among" of the word converse, it points to the social presence of the material in their lives. We have also seen that the *tambats* are engaged in "configuring" copper, shaping it in myriad ways as they make things. Here too, the root of the word configure from Latin *con figurare* or "shape together" perfectly captures the nature of the reciprocity of action between the coppersmiths and their copper. And finally, constant contact with copper either directly or through water "imbues" the material's *guna* into the bodies of the *tambats*. The late Middle English root of the word imbue is "to saturate", and here we see an instance of how copper's properties saturate into *tambat* persons. These three aspects of the *tambat* relation to copper help describe their immersion into the world of this material.

2.10 Conclusion

This chapter has been about the transformative materiality of copper. A ubiquitous global material with remarkable properties on account of which it has made its way into electronic products and electrified buildings all over the planet, copper is also deeply local. *Tamba* is the metal that has been at the core of it all, responsible for the very name, profession, and caste of the craftspeople as well as the place where they live. Copper's transformative materiality has generated unique techniques and gestures, places of assembling, a variety of objects, a unique form of personhood, and new ways of thinking and doing design. This chapter also outlined the notion of material agency: not the agency of things, but of the material with which things are made. Copper's material agency is relational. It depends upon and is influenced by its transactions with other agents (materials, objects, people, the atmosphere) in its surroundings. The upcoming Chapter 3 deals with production, an activity that involves actualising into material form, the sensate, embodied knowledges that have been memorialised and perfected in these places over generations.

Chapter 3

Producing Copper

3.1 Introduction

"He creates and at the same time he creates himself; he creates at once his means of living, things purely human, and his thought inscribed in these things" (Mauss, 1927, p. 119). In every workshop in *tambat ali*, the most common sight one encounters is coppersmiths with a tool in one hand, partially made copper object in the other hand (and at times held with both feet as well), working sheet metal day after day in a production routine that has shaped their bodies, their everyday lives, and who they are as persons. The focus of this chapter is on understanding details of their production techniques using the method of the *chaîne opératoire* (Leroi-Gourhan, 1966; Lemonnier, 1992; Coupaye, 2009, 2021), drawing attention to how the *tambats* work individually and collaboratively in activating materials, tools, energies, gestures, place, and knowledges. Included in this chapter is a *chaîne opératoire* of a *bamba*, a coal-fired water heater that the coppersmiths have been making for several decades. This analytical method will not only make *tambat* technology more visible, but it will also reveal the relationship between the artefacts they make, their practices of making, and networks on which they rely in this process (Coupaye, 2021). In addition, it will also help uncover some of the technological choices (Lemonnier, 1993; van der Leeuw, 1993) the *tambats* make through a set of sequential operations. While these operations are clearly material and technological, they are inherently social as well. In making such objects as the *bamba*, we see how the *tambats* collaborate and transact amongst themselves and with designers, how they forge and manage relationships, how they interact with a variety of materials, how their gestures shape their bodies, and how they pass on knowledge and skill across generations. The goal here is not to engage too deeply in an analysis of technology itself, but to uncover how the *tambats* utilise it to manipulate copper, and better understand how this has created an entire *tambat* culture around the material.

Many of the techniques the *tambats* employ today have endured over centuries, but many are newly introduced into their repertoire, as the things they make and tools they make them with have evolved over time. Designers working with the *tambats* have taken into account their techniques of working copper while designing new objects to be made in *tambat ali*. And it is these techniques, whose descriptions “involve considerations of materiality, artificiality, the appropriation of nature, the production of goods and the application of knowledge, usually augmented with references to society, culture or civilisation” (Schlanger, 2006, p. 2) that uniquely identify the *tambats* of Pune, the things they make, and their community, called the Twashta Kasar Samaj.

3.2 Tradition, Efficacy, Collaboration

In his introductory essay to Mauss’ *Techniques, Technology and Civilisation*, Nathan Schlanger (who has done remarkable translations of Mauss’ works) offers an overview of the evolution in the conception of “techniques” especially in the work of Emile Durkheim and Marcel Mauss but also Henri Hubert, André-Georges Haudricourt, André Leroi-Gourhan and others. In explaining some of Durkheim’s earlier thinking on the topic, he writes, “What Durkheim particularly valued about techniques was their potential to serve as measurable markers of civilisation…” (Schlanger, 2006, p. 10). For

Durkheim, all techniques derived in some way from religion, but Mauss expanded the notion of what techniques meant and from where they were derived. While he had initially related techniques to magic, he also recognised “the inherent difficulties of distinguishing traditional efficient acts of techniques, of magic, or of religion” (Schlanger, 2006, p. 20). While Schlanger uses the term “efficient” here, Mauss’ preferred term was effective or efficacious, and it is important to note the difference between them. While efficiency generally refers to increased productivity and reduced waste, efficacy alludes to the knowledge and ability to generate an intended or desired result. In addition, Mauss introduces the notion of tradition, essentially because techniques unfold and are activated in a collective situation, and they are passed down from person to person through processes of learning and doing. Traditional *tambat* techniques like *kholkam* and *matharkam* have been taught and transmitted from generation to generation primarily from fathers and uncles to sons and nephews, who often pick them up in their early teens.

> When one generation hands down to the next the technical knowledge of its manual and body actions, as much authority and social tradition is involved as when transformation occurs through language. In this there is truly tradition, and continuity. The important deed is the handing over of science, knowledge and power from master to pupil; everything can perpetuate itself in this way. (Mauss, 1934, p. 34)

The *tambats* have been sharing their knowledge of the techniques of copper working not only with their children, but also with the many designers, design students, and visitors who drop by *tambat ali*. But only a few designers spend enough time and effort to sit down with the *tambats* and learn the techniques. And in such cases, knowledge transmission occurs through language, in the form of descriptions of processes and material properties. The designers ask questions, take photographs, shoot videos, and leave with documentation rather than deep knowledge. Knowledge is passed on to family members and to others who spend more time in the workshops through "techniques of the body" (as described by Mauss), gestures with instruments, as well as visual and auditory reactions of copper as it is being worked. The ability to imagine and design new forms, textures, and finishes with the material is also core to the knowledge transfer.

While Mauss employs the terms "effective" and "traditional" in describing techniques as actions (1973, p. 75), there is little to no reference to the role that the material being worked on plays in the process, or the sensorial experience of technician/actor. The *tambats* rely on the sound of the hammer to know whether a particular stroke creates an indentation on the surface (as it should) or a dent (which disfigures the object). As we have seen before, when the hammer stroke is successful in creating the right dimple, it generates a unique ringing sound that the *tambats* recognise and when that happens, they refer to it as "*net lagla*" (which may be translated from Marathi as "got net" or "hit net"). The language used here is specific to the *tambats* it and signifies a correspondence between a specific bodily position, a unique gesture, a recognisable sound, and particular impact on the surface of the copper.

In addition to the sound, they rely on careful visual observation to ensure that the dimples are accurately placed where they should be. This sensory engagement is critical for an action to be referred to as a technique. A novice, untrained in shaping and hammering the utensils if invited to do this work, will not have this audio-visual engagement during the action, and is therefore unlikely to produce the expected outcome. In such a situation, the action is not effective, it does not carry the skill the *tambats* have learnt over years through tradition, and it therefore cannot be referred to as technique.

3.3 Technique

"It is technique which, through the development of societies, has brought about the development of reason, sensibility and will. It is technique that makes of modern humans the most perfect of animals" (Mauss, 1953, p. 54). He goes on to say that while archaeologists, ethnographers, and technologists know that all social life depends upon techniques, it is unclear to what degree (Mauss, 1927).

However, it is not the degree that is of significance here, but *how* social life is shaped by techniques, and that is what this chapter will explore in further detail. Designers (whom we may regard as technologists) who work with the *tambats* focus on the role and outcome of techniques on aesthetics. In order to create new products, designers need to learn about the range of formal possibilities that the *tambat* techniques open up. For them, understanding the techniques of the *tambats* is critical knowledge without which it is possible that what they design may be impossible to be manufactured in *tambat ali*. Only when they thoroughly understand the techniques of working copper can they imagine new forms and objects that the *tambats* will be able to make effectively employing knowledge that is part of their traditional repertoire. During the design process, it is the space between the problem and the solution in which designers create a series of sketches, renderings, technical drawings, paper prototypes, scaled models, mock-ups, etc. before the final product is created. The creation of these intermediate things bridges the gap between the idea of a thing and the physical thing itself. This process of invention relies on the social interaction and the nature of the relationship between the *tambats* and the designers. This relationship is built around a series of exchanges—of shared knowledge, new learnings, material artefacts, cautious trust, and economic resources. The *tambats* accept projects with caution, negotiate prices of goods to be delivered, and discuss production volumes possible within scheduled deadlines. This often involves a back-and-forth conversation between the *tambats* and the architects/designers, with each side pushing for certain prices or delivery dates. As we shall see later in Chapter 7 on design and craft, sometimes these relationships are fraught with tension, friction, and dispute, and at times they are built around mutual trust, respect, and cooperation.

Techniques, Lemonnier reminds us, “are first and foremost social productions” (1993, p. 3) and they are, as Mauss emphasizes too, unique to specific societies. And all the elements of those techniques—the people, their materials, tools, instruments, mental actions, bodily gestures, spaces, etc.—work together cohesively and compatibly in order for some physical outcome, a product for instance, to emerge. The *tambats* have special and unique conceptions (Lemmonier refers to them as ideas or representations) of each of these elements regarding what they are, how they should be used, where in the process they should be deployed, and so on.

It is clear while observing them in the process of making, that *tambat* bodies and minds have a fluid relationship with each of these elements. As the making a *bamba* or a *pimpa* unfolds in time, their bodies engage and disengage with the elements through a series of well-choreographed, agile movements. A sheet of copper is placed on hot coals for a few moments and picked up gingerly with tongs, bodily weight and force are applied and released on the spinning lathe with a lever arm tool, a hammer is picked up and dropped after a while, a brush dipped in clear polyurethane liquid is gently drawn across the surface of the object and set down. While these processes appear to be clear expressions of physical, material engagements, they are representations of wider symbolic systems. And, as Lemonnier himself admits, "it becomes tricky to separate the "technical" from the "social"" (1993, p. 4). Or as Akrich explains, there is an "indissociable nature of the association between these two terms…" (1993, p. 331). The material copper, the workshops where the *tambats* ply their trade, the objects they create, the processes they employ, and the knowledge of making that resides in *tambat ali*, all are transmitted within families from generation to generation in the Twashta Kasar Samaj, and this situates them squarely within *tambat* society and culture. In other words, it is not possible to separate who the *tambats* are from what they do.

This view of the intertwined nature of technical processes and social systems is supported not only by anthropologists from the Anglophone and Francophone traditions but also in the disciplines of the philosophy of technology as well as science and technology studies (Bijker,1985; Coupaye, 2021; Dobrès, 2000; Latour, 1993, 2005; MacKenzie & Wajcman, 1999, Mitcham, 1994; Pfaffenberger, 1992). Coupaye explains that in some cases, scholars (especially Foucault and Bourdieu) have proposed a more “metaphorical understanding of ‘technology’… as opposed to more ‘materialist’ approaches” but cautions that this could border on a form of social determinism (2013, p. 66). He adopts Haudricourt’s view of technology as a *science humaine*, suggesting that

> the study of technical activities… is fundamentally empirical; it deals with physical laws, but also necessarily with the relations created by the process, through human practices, between an already socialised physical domain and sociality, cosmology, belief, aesthetics, social organisation – in other words it is a form of anthropology. (Coupaye, 2013, pp. 68-69).

The expansiveness of this explanation is helpful as it enables the anthropologist to create descriptions and analyses that are all-encompassing in their purview, but it also makes it difficult to circumscribe the topic clearly and to be able to select what is acceptable to leave out. The *tambats* are engaged in some form of technical activity throughout their diurnal routines, and later in the chapter, I have used the mechanism of the *chaîne opératoire* to figure out which of their actions that involve their bodies interacting with tools, materials, or the environment are critical towards understanding their society and culture.

3.3.1 Precision and the Body

Notable in the production of copper vessels and the skills of the *tambats* is the attention they direct to precision. In my time in *tambat ali*, sitting in a workshop surrounded by the materials, tools, and instruments ready-at-hand, and with the sage advice of seasoned craftspersons in my mind, I hammered away at sheets of copper and created several objects. Even the most cursory examination of the things I made reveals that the inaccuracy of my hammer strokes led to uneven, misaligned, and irregularly spaced dimples as well as ungainly dents in the utensils. These are, very literally, marks of imprecision and expressions of lack of skill, which expert craftsman and my teacher Sadashiv Apte examined and kindly said to assuage my dismay, "you've done a good job for someone who has not been doing this like us for thirty years." The dexterity, hands-feet-eyes coordination, knowledge of the tool and the material, comfort with gesture, full-body engagement, ease of movement… all of these are developed over years, aided by observation of fathers and uncles since childhood and learning with them over time. In addition, conversations with other craftspersons about their techniques and the hidden curriculum of being in the presence of the work also plays a role in learning. The *tambats* are always surrounded by what they intend to make, are making, and have made; they work in the midst of the objects of their labour. Some of these objects are incomplete and in process of being worked on, some are set aside as failures, some are finished and ready to be sent out; each one of them adds to their embodied knowledge.

When I was learning from Apte, I found myself intently focused on what his hands were doing, but I soon realized the moment I sat down with a sheet of copper to make a vessel, that this practice requires total engagement of the body. The object being made is held in place on the *kharvai* not only with one hand (while the other holds the hammer) but the feet as well. And during the process of creating the hammertone, the object is moved linearly along the axis of the *kharvai* and also indexed along its own radius. In order to maintain the object in its precise location it needs to be held with the fingers of one hand (typically thumb, forefinger and middle finger) as well as the toes of both feet. The tambats rely on bodily memory as they sit down to do this work, but they also adjust their gestures, tools, and techniques constantly depending upon the object being made, thickness of copper, type of *mathar*, and so on.

Govind Kapre tells stories of his gradual entry into working with copper. As a young boy, in 8th or 9th standard in school, he recalls, he would assist his father and grandfather during summer vacations from school in the months of May by performing simple tasks like fanning the furnace, cleaning *handis* with cloth dipped in sulphuric acid, drying out the utensils with rags, and so on. He continues, "And after that I started learning how to do the hammer blows… while using the hammer how to place my foot, how to rotate the *handa* with my hands, how to balance it with my feet, how to land the hammer blows correctly… that is what I started learning. I was allowed to create only two rows of the dimples on the *handa* or *pimpa* at first, the third one wasn't allowed. And then, when the first two rows were even, then I would get permission to do two more…. When we start doing *matharkam*, balancing the vessel with the feet and rotating it with the thumb… that is the game." The repertoire of skills essential to do this work is wide, and being able to perform it well requires several forms of learning that are individual, collaborative, and communal. In explaining how skill and status change over time, Marchand suggests that "individual learning occurs with changes in position within the community of practice that progressively bestow wider access to resources and more opportunity to extend one's skill and knowledge, leading eventually to full-participant status" (2018, p. 6). The learning that occurs is not only individual; it also includes learning how to collaborate. When the *tambats* start learning this work at a young age, it always happens a few hours at a time, often after school and during summer vacations, and by helping another *tambat*. Assisting someone could include such activities as cranking the furnace blower while one of the more seasoned craftspersons is heating up a sheet of copper to the right temperature or aiding in drying vessels on which someone may have recently completed *ujalkam* (acid wash). Learning this form of collaboration is critical to their work as we shall see in the making of the *bamba*, a complex product with many components made by several *tambats* together. In order to achieve the full-participant status to which Marchand refers, skills of individual learning and collaborative making are critical.

3.4 Making a *Pimpa*

Every morning between 8:30 and 9:00am, Govind Kapre walks from his home nearby to *tambat ali's* Vangewadi area to open up his workshop and take stock of his work for the day. This workshop, a brick-and-mortar structure with wooden scaffolding and corrugated metal roofing, was used by his father and his grandfather before him. Govind makes a variety of small and large copper utensils, but his routine often involves hammering several *pimpa* each day. The *pimpa* is a cylindrical vessel with a lid that is made in several sizes and has traditionally been used to store water. In case of the *pimpa*, Govind does not actually create the shape of the vessel from a flat sheet of copper; instead, its components—the main body, lid, and base ring—arrive pre-manufactured from the local trader. Govind's job is to create the hammertone texture on the main body as well as the lid and attach the base ring for stability. The main bodies are deep drawn on a mechanical press into pre-forms and then spun on a lathe until they achieve the final diameter and height. The lids and base rings are also spun on a lathe.

Govind sets out his hammers, tamarind cleaning paste, sulphuric acid, wet and dry rags, steel wool, and polishing tools for the day. The *kharvai* is pulled out and placed in the doorway, the wooden seat called the *khod* is adjusted along its length, and jute sacks placed on top for sitting.

Figure 3.1: Govind Kapre in Vangewadi, hammering a *pimpa*
(Photograph by the author)

When they are delivered by the trader to Govind's workshop, the main bodies, lids, and rings are entirely covered with grease, which was applied on the copper during the processes of deep drawing and spinning. Therefore, the first step is to degrease and clean everything. He fires up his coal furnace and places the items on it until the copper turns red hot. This not only burns off the grease but also softens the copper, making it ready for hammering. Once the parts are taken off the furnace, they are immediately dipped in water to cool them down in a process called quenching that maintains the material's softness. The items are then cleaned with sulphuric acid, washed with water, and then tamarind paste is applied on them to stop the reaction of the acid. The items are then washed and polished to remove the tamarind and prepare the surface for hammering. After polishing they are washed again with water, followed by a second application of tamarind paste, a second washing with water, and then dried with cloth rags. All the items are then laid out in the sun to remove any remaining moisture and ensure that no further oxidation of the copper occurs. Having selected the appropriate *kharvai*, hammer and utensil to work on, Govind settles down to start the *matharkam*.

He ensures that the main body of the *pimpa* is dry, situates it properly on the *kharvai*, polishes the hammer with an old flip-flop that removes stains and dirt, and then starts the process of hammering. Being right-handed, he grasps the hammer in his right hand and holds the inside edge of the *pimpa* with his left. He adjusts the position of the *pimpa* on the *kharvai* depending upon the precise location where the hammer has to strike and stabilizes it with the big toes of both his feet. Copper is extremely sensitive to moisture and body oils and can leave stains on the surface that have to be avoided. Therefore, all body parts that come in contact with the copper have to be covered with cloth. Govind does this either by inserting a thin rag between his digits and the object he is working on, or wears gloves and socks. He now starts hammering the *pimpa* rapidly, indexing it after every five strokes of the hammer. Each row of indentations has to be parallel to the edge of the *pimpa*. Once the main body of the *pimpa* is covered top to bottom with the hammertone texture, Govind picks up the lid (which has already gone through a similar process of degreasing, cleaning, polishing, and drying) for hammering. Finally, he attaches the ring to the base of the main body by press fitting it. By the end of the day, Govind is able to finish approximately eight to nine *pimpa* depending upon their sizes. Before leaving each evening, he locks up all his tools, materials, and finished goods in the workshop as did his father and grandfather several decades ago.

3.5 Transforming Copper

When metals are processed, some of the more energy intensive and radical material transformations occur during the first few stages in their life history, when they still exist in the form of ore embedded underneath the earth's surface and have to be converted into pure metal. In case of copper, extracting pure metal from chalcocite or chalcopyrite requires mechanical, chemical, and electrolytic processes in which the ore is drilled, blasted, crushed, smelted, and exposed to a variety of powerful reagents. These operations merely convert ore into sheets and ingots of pure copper, which then are flattened and thinned through rolling processes into sheet metal. The *tambats* acquire sheet stock from raw material dealers, and through a series of operations that make up their manufacturing process, convert them into vessels and other products for sale to consumers. This sequence of operations that transforms the material into a thing, the *chaîne opératoire*, has been defined by Catherine Perlès, French archaeologist and expert on lithic technologies, as a "succession of mental operations and technical gestures, in order to satisfy a need (immediate or not), according to a preexisting project" (Perlès (1987) in Sellet, 1993, p. 106). This notion of an operational sequence is derived from ethnology and the analysis of life histories of stone tools (lithic technologies) and is being applied currently in anthropology and material culture studies as a form of processual analysis of the manufacturing of things (Coupaye, 2009, 2013; Lemonnier, 1983; Leroi-Gourhan, 1964; Sellet, 1993). While Perlès' definition of the *chaîne opératoire* only mentions cognitive and technological factors, one cannot ignore the social forces at play in shaping objects. Schlanger explains this well.

> With the *chaîne opératoire*, it is possible to appreciate that alongside tools, raw materials, energy and various physical or environmental possibilities, technical systems are also composed of such crucial elements as the knowledge, skills, values and symbolic representations brought to bear and generated in the course of action, as well as the social frameworks (including gender, age or ethnic differentiations) implicated in the production and reproduction of everyday life. (Schlanger, 2005, p. 21)

A *chaîne opératoire*, therefore, is formed by individual, cognitive, social, technical, material, and environmental agents and their actions. Coupaye (2021) explains the *chaîne opératoire* as a tool for description as well as interpretation that visualizes the structures as well as steps involved in technical actions, and highlights social, cultural, as well as material heterogeneity. In addition, it can also make relations amongst the actors visible in the entire process (Coupaye, 2021). All of these specificities of engagements that Coupaye mentions between people, places, and things become evident in making and reviewing *chaînes opératoires*, as will be demonstrated in the next section.

3.6 The *Bamba*: A Traditional Water Heater

The *tambats* say that the *bamba* was designed by Atmaram Jayaram Potfode in 1890 in Narayan Dere's factory in Girgaun, Mumbai, where the regular production involved a variety of copper and brass utensils. One day, Potfode attached a tap to one of the brass utensils, filled it with water, heated it, and demonstrated that it could be conveniently used to draw hot water. The *bamba* was born at that time, and over the years it went through several variations to arrive at the form in which it is made today. However, this is not a story that is widely known in *tambat ali*, and it is certainly not familiar to people who buy and use *bamba*.

Figure 3.2: The Number 15 copper *bamba* outside Mahesh Metals. Placed in front of it are two objects used for hot water baths: a brass *ghangal* (with a copper base) and a small copper *tambya* (Photograph by Rushikesh Bapat)

As the *bamba* is a coal or wood-fired water heater, its use has been declining since people have moved into apartments that are equipped with electric water heaters. The product was designed to be used in outdoor spaces, in the courtyards that were seen in traditional homes called *wadas*. While the *bamba* is no longer seen in urban areas in Pune, it still is used in villages and other rural areas. The rising prices of copper have made it difficult for people to leave them outside as they are apt to be stolen for scrap. All the large enclosures of this product are made from copper; however, the handles, hinges, and the tap are typically made of brass. The *bamba*, like a few other products in *tambat ali*, are made in a variety of sizes and are numbered by the diameter of the outer cylinder. One of the more popular *bamba*, for instance, is the "Number 15", named so because its outer diameter is 15 inches.

One of the few surviving workshops where the *bamba* is made is Mahesh Metals, owned and operated by Jayesh Yashwant Kanvinde, a fourth generation *tambat*, whose family moved to *tambat ali* from the village of Khed in the Konkan region of Western Maharashtra around 1910. This workshop has been making *bamba* as their primary product for over a century, but over the past few years, Kanvinde said, business has slowed down drastically. One morning, he kindly allowed me to observe and document the making of a *bamba*. Located just a five-minute walk from the Bakkhal, the entrance to Mahesh Metals is almost hidden, tucked away in a narrow lane, flanked by a rock and mortar wall on one side and row houses on the other. Like several others in Kasba Peth, the house facades were once painted in bright colours that have now faded and aged over time. Large chunks of plaster from the walls of the houses have fallen, exposing the brick-and-mortar underneath. A few trees planted along this narrow lane sway in the morning's gentle breeze, throwing dappled shadows on the pale green wall of the workshop. Parked bicycles, scooters, motorcycles, pushcarts, potted plants, milk crates filled with odds and ends, rags hanging on clotheslines, a large orange tarpaulin sheet, and cans of chemicals line the sides of the lane. Underneath a hand-painted sign that reads “Mahesh Metals, Copper Brass Utensils, Making and Repairing” is a metal gate and a wooden door, both painted white, that lead into Kanvinde’s workshop. It is cool and dark inside, though it is bright and sunny just outside. Flat, rolled, and bent sheets of copper, unfinished parts of *bamba*, electrical cables, cloth and jute rags, as well as all kinds of hand tools and mechanised equipment crowd the three rooms where most of the work of making *bamba* happens.

Figure 3.3: Inside Mahesh Metals (Photograph by Rushikesh Bapat)

This section includes a *chaîne opératoire* of the *bamba*, which will demonstrate the complexity, sequentiality, relationality, and organisation that are essential to its production. Four craftspersons working indoors and outdoors, using physical, mechanical, electrical, and thermal energies, deploying a large number of tools and a variety of materials, in a series of learned and practiced gestures, make very specific choices based upon their knowledge that result in the *bamba*. They use the same spaces and tools, and the choices they make are of significant consequence to all of them as they share partially made components that must fit well with each other. If the *tambat* who makes the collar on the lid does not hammer it correctly, it will not fit the main body of the *bamba* that is made by another *tambat*. In addition to reliance on the physical mating of parts, there is also a reliance on shared knowledges gained over time. Each of the processes involved take different amounts of time, and the *tambats* have to take their own and others' rhythms and pacing into account so that the flow of work progresses in a timely manner. The production of the *bamba* follows a series of sequential steps, each calibrating the input of the craftspersons with some shared and some specialist skills. This section will describe the workflow of the production process to reveal not only the intricacies of how the *bamba* comes into being in a very material sense, but also to uncover the relations that come into play as people, artefacts, materials, and tools shape each other through a series of gestures, energies, transactions, and ideas. The observation and documentation of the complex set of sequences and relations also show that technical processes are also social, making it impossible to separate them from each other.

3.6.1 The *Bamba*: Overview of the Overall Process

The *bamba* described in this *chaîne opératoire* was made by Nathuram Palekar, Kapil Kanvinde, Ramesh Waghmare, and Pavan Waghmare working together. Each one of them created or worked on one or more of the twenty-five components of the *bamba*, sharing materials, parts, equipment, and tools among each other as the assembly progressed. Never did they work simultaneously on the same part; instead, they would hand each other components back and forth in coordinated and choreographed motions as they finished their specific tasks for which they are uniquely skilled. The procedure can be divided into six phases as described below:

1. *Kholkam*: Shaping sheet copper into overall forms (Nathuram Palekar and Kapil Kanvinde)
2. *Jalkam* and *Vijavne*: Brazing forms into components (Nathuram Palekar and Ramesh Waghmare)
3. *Ujalkam*: Finishing the components (Pavan Waghmare)
4. *Matharkam*: Hammering the surfaces (Ramesh Waghmare)
5. *Jadavkam*: Accessorising the components (Ramesh Waghmare and Kapil Kanvinde)
6. *Jadavkam*: Assembling the final *bamba* (Ramesh Waghmare and Kapil Kanvinde)

Manufacturing systems are often classified by the volume of goods produced, level of automation, types of assembly lines, and the nature of the labour involved. The *Handbook of Design, Manufacturing, and Automation* classifies production systems into four major categories: custom manufacturing, intermittent manufacturing, continuous manufacturing, and flexible manufacturing (Dorf & Kusiak, 2007). Custom manufacturing is one of the oldest forms of manufacture, and it typically includes all craft-based production made in low quantities without assembly lines. It generally involves a single craftsperson working on individual objects from end to end (raw material to finished product) using manual and machine tools. Intermittent manufacturing (also referred to as job shop) is generally found in companies where a variety of products are made on the same assembly line, typically in low quantities. Continuous manufacturing is what is often referred to as mass production, where a single product is manufactured in very large quantities at extremely low unit costs. Finally, flexible manufacturing refers to a new trend that enables mass production of a variety of products because assembly lines are often controlled by robotic arms that can be reconfigured quickly. Each of these manufacturing systems relies on some form of mechanised production as well as standardisation of parts that allows interchangeability. The *chaîne opératoire* reveals how principles of mechanisation, standardisation, and interchangeability are used by the *tambats* in making of the *bamba*.

In his analysis of ancient Chinese systems of manufacture, art historian Lothar Ledderose uses the term modularity to describe how these principles were used in making artefacts from such materials as bronze, porcelain, and terracotta (2000). "The Chinese devised production systems to assemble objects from standardized parts. These parts were prefabricated in great quantity and could be put together quickly in different combinations, creating an extensive variety of units from a limited repertoire of components" (Ledderose, 2000, p. 1). Ledderose refers to these components as modules. This is common practice in high volume, industrialised mass production. However, in the Chinese system, as many of the components were made by hand, each of them had a slight variation, leading to objects that were very similar but not identical. In other words, this form of manufacturing enabled rapid and economically viable production at scale, maintaining the individuality of every object that is the hallmark of craft production while avoiding the absolute homogeneity of mass manufacture.

Similar terminology is applied in the contemporary practice of industrial design, when creating product architecture for a new device being designed. Product architecture refers to the volumetric layout of all the components that make up a product, which serve as "the basic physical building blocks of the product in terms of what they do and what their interfaces are to the rest of the device" (Ulrich & Eppinger, 2003, p. 164). There are two major kinds of product architectures—modular and integral—exemplified by such devices as a desktop computer and a laptop computer. The desktop computer (an example of modular architecture) enables easy replacement of components by users (such as motherboards, hard drives, CD drives, etc.), is upgradeable after purchase as it allows adding more components (such as additional boards or RAM modules), is often easier to repair, and due to these reasons is typically large in volume. On the other hand, the laptop computer (an example of integral architecture) is extremely compact, does not permit adding more components, cannot be easily upgraded, nor can it be easily repaired without replacement of entire sub-assemblies. Modularity therefore offers several advantages to the manufacturers as well as consumers. The *tambat* techniques of making can best be described as a system that incorporates aspects of custom and intermittent production, as they often create highly unique, one-off objects like temple finials, architectural elements, and large installations, but also products like water containers and *bamba* that are made in large quantities.

As this *chaîne opératoire* will demonstrate, the making of the *bamba* is a lengthy procedure with a significant amount of complexity. "By following the sequences, and the logics that drive people's choices and actions, the 'components' of the technical system appear more as assemblages of a variety of domains including materials, social relations, spirits or tangible and intangible substances, all parts of what we can define as 'collectives'" (Coupaye 2013, p. 13). This notion of collectives serves well in illuminating some of the salient aspects of the *tambat* technical system, personhood, and society.

One can distinguish five collectives in *tambat* work: materials and substances (enduring copper and consumables like acid, tamarind, coal); body, gestures, and skill (virtuosity, unique movements, and positions); sound and light (sensual properties of copper); purity and healing (Ayurvedic influences); and relations (between the *tambats* themselves, with traders, and with designers). The *tambats* carefully manage interactions among all the materials, making choices along the way regarding dilution, application, removal, and so on. They become craftspersons of chemicals, applying acid to catalyse reactions and tamarind to stop them. They immerse their entire bodies and minds into the work, using fingers and toes to hold the copper, hands to grasp tools, eyes to focus, and ears to listen for the right sound. Their bodies bend over their tools, their gestures suited to the task at hand. They rely on the sounds of the steel hammers hitting copper *bamba* resting on steel anvils to ensure that the strokes are just right so that they indent the material without denting the object. For them, copper is a medicinal material that purifies water, removes acidity from the body, cures wounds—a material recommended by Ayurvedic texts. Some *tambats* believe they are healthy because of constant contact with the material. And the final collective of relationality that is visible in the making of the *bamba* includes the relations between the bodies of the coppersmiths and their copper, between their place of work and the work that emerges from that place, and between themselves. These are relations of substance, shaped by the substances to which they are deeply related.

Technical actions and material transactions are social; and the *chaîne opératoire* of the *bamba* described over the next several pages attempts to demonstrate these relations. In archaeology, "*chaînes opératoires* were much more than the identification of past ways of doing things, as they enabled researchers to bring "objects to life," to "humanize" them, to "find the people" who made these objects, and thus to raise a number of questions concerning their behavior, their characteristics, their interactions, their mobility, or their ideologies" (Tixier (1967) in Roux, 2019, p. 2). My attempt here is to bring the objects and the subjects to life through all the actions and transactions that occur between materials, people, tools, energies, place, and knowledges during making.

Each of the phases of the manufacture of the *bamba* is accompanied with a flow chart that mentions the *tambat* doing the work, materials and tools used, sequence of operations, components made, as well as the movements and flow of subjects and objects. In order to distinguish the descriptions of the process from interpretation and analysis, I have presented specific details of the sequential production in single-spaced text, with observations and analysis in regular, double-spaced text.

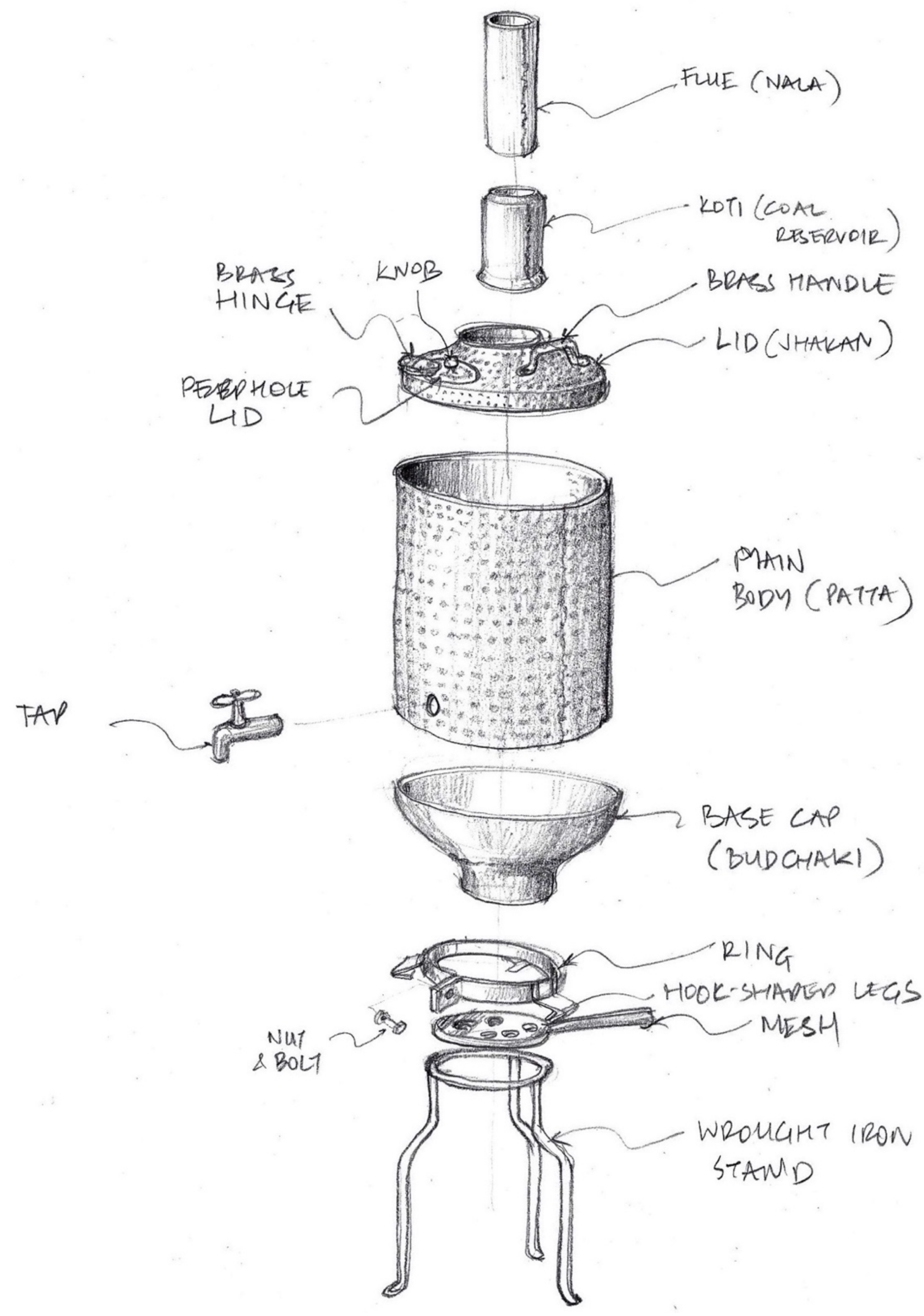

Figure 3.4: An exploded view of the *bamba* with part callouts
(Sketch by the author)

3.6.2 The Number 15 *Bamba:* A *Chaîne Opératoire*

A traditional *bamba* is made of three hollow cylinders which vary in diameters, lengths, and the thicknesses of the copper sheet from which they are made. All three cylinders are made by bending pre-measured sheets of copper, which Kanvinde buys cut-to-size from the raw material supplier. The thickness of copper sheets (and sheet metal in general) is often measured by gauge, and the thinner the copper sheet the larger is the gauge number. For instance, a 22-gauge copper sheet is 0.66mm thick, while a 12-gauge sheet is 2.01mm thick. The larger, outer cylinder that makes up the main body of the *bamba* is known as *patta*, and it is made from a 20-gauge sheet measuring 15 by 45 inches. The flue, referred to as *nala*, is made from a 12-gauge sheet measuring 15 by 17 inches, and the lower most cylinder which holds the fuel (wood or coal) is called *koti*, and is made of a 20-gauge sheet measuring 12 by 19 inches.

3.6.2.1 *Kholkam*, *Jalkam*, and *Vijavne*: Shaping sheet copper into overall forms and brazing forms into components (Nathuram Palekar)

Nanthuram Dattatray Palekar, who has been making *bamba* for about 50 years and says he might have made approximately four to five thousand of them in his lifetime, starts the process by forming three sheets of copper into approximate cylindrical shapes. This can be done by beating the sheets with a flat iron scale, bending them on the *kharvai* (bar anvil) manually, or by running them through a roll bending machine. Today, he uses the machine, and by tightening and loosening the screws to adjust the distance between the two steel rolls, he feeds the sheet stock between them, cranks the wheel, and bends the sheets to make the initial forms of the primary components of the *bamba*: the *patta*, *nala*, and *koti*. This operation is quick, and each sheet takes less than half a minute to shape into a cylinder.

Mechanisation of processes has been steadily ongoing in *tambat ali* and the *tambats* have shown no aversion to adopting new tools into their processes. The roll bending machine is a recent addition to the *tambat ali* workshops.

Figure 3.5: The *patta* of a *bamba* on a *kharvai* (Photograph by Rushikesh Bapat)

Palekar grabs a *kharvai* and *khod* that are leaning against a wall and sets them up to start the process of joining the two edges of the cylinders. He inserts the *kharvai* through the *khod*, places folded jute sacks in the cradle, and sits down with a pair of metal shears with which he cuts notches or tabs (referred to as *date*, the Marathi word for teeth, by the *tambats*) into one of the two edges that are to be joined. He bends the tabs with the shears, aligns the other edge of the cylinder, and hammers the tabs down to interlock the two edges to create a seam. He repeats this process with all three cylinders, the seams of which now must be brazed to create a watertight seal.

The speed and dexterity with which Palekar accomplishes this task of converting the sheets into cylindrical forms demonstrates a sense of ease that his body has developed with the material. Having made so many *bamba* over his lifetime, he is aware of the malleability of the sheet and knows exactly where it should be struck to bend it. There is no template, jig, fixture, or gauge that he references in order to create these forms. The sheets are pre-cut to size, their geometries partially configured to enable the forms he shapes them into. The embodied knowledge that he brings to this work and the on-the-spot judgements he makes during the process make it evident that he is keenly aware of the potentialities of the sheet of copper in his hands as well as the tools at his disposal. His movements are fluid and his body flexible, rather like the material with which he works.

Palekar picks up the cylinders and walks down a narrow hallway over to the coal-fired forge blower which has an electrically powered fan. He starts the blower, throws some charcoal on it, and applies a brazing paste to the seams of the cylinders. The *tambats* use a brazing paste (which they refer to as *daag*) made of coarse brass filings, copper filings, zinc chloride salt, borax powder and a few drops of water. Once the *daag* has been applied to the seams, he places the cylinders, one by one, over the fire with the seam facing upwards. After the copper starts softening and the brazing paste gets hot, the cylinder is turned over. During this process, the brazing material melts and fills the gaps creating a water-proof joint. The red-hot cylinders are lifted with tongs from the fire and quenched by dipping them in a vat of water. This process softens the copper, making it a lot easier to work with. Palekar carries the cylinders back to his *kharvai* to reshape them (as they deform when heated), and to remove the flux residue (that builds up along the brazed seam). He uses quick and repeated hammer blows along the seam that serve the purpose of knocking off the residue, and follows with soft blows of a wooden mallet to reshape the deformities.

Figure 3.6: The *nala* on the blower furnace (Photograph by Rushikesh Bapat)

The main body of the *bamba* is marked with two grooves on the top which serve as rests for the upper lid and prevent the body from distorting or warping. Today, Palekar creates these grooves on a manual bead making machine called the *sari*. Prior to the introduction of this machine, these grooves were made on a cast-iron slab with depressions that served as a die over which the cylinder was rotated and grooved using a hammer. The *patta* is clamped into the bead making machine and Palekar gradually adjusts the groove depth screw as he starts spinning the crankshaft. In a few rotations, the groove appears, and he takes the *patta* off the machine.

He takes the *patta* back to the *kharvai* one more time to form the end inwards in order to ensure that the lid fits snugly. The edge folding involves three steps: first, he places the *patta* on the *kharvai* and forms the edge inwards with the mallet, he then places the *patta* on the floor and uses a hammer to fold the edge on to itself, and finally puts the *patta* back on the *kharvai* and hammers the edge down to create a double-layered rim.

The next steps involve forming the ends of the *nala* and the *koti* so that they can be brazed together, one on top of the other. As these cylinders have differing diameters, Palekar places the top edge of the *koti* which has the larger diameter on the edge of the *kharvai* and bends it inwards with a mallet. He flips the *koti* over, places it on the floor against the edge of the *kharvai* and flanges the bottom edge outwards. He then picks up the *nala* and dulls the sharp edges by hammering it first on the *kharvai* and then on the floor so that both top and bottom ends are smooth. The top edge of the *nala* is exposed and can come in contact with people who will eventually use it, and therefore the edge has to be smooth. Palekar now grabs the metal shears, notches the top edge of the *koti*, and then bends them on the *kharvai*. He then flanges the bottom edge of the *nala* outwards so that it matches the top edge of the *koti*. Once these two parts (the *nala* and the *koti*) are joined together, the assembly is eventually installed inside the larger *patta*, which serves as the flue that carries the smoke upwards and exhausts it into the atmosphere. The flue also serves as primary heating element which transfers heat from the coal or wood fire to the water. Copper is an appropriate material choice in this case, as it is an effective conductor of heat. The top end of this flue is open to air and the bottom end serves as a reservoir for the fuel (coal or wood).

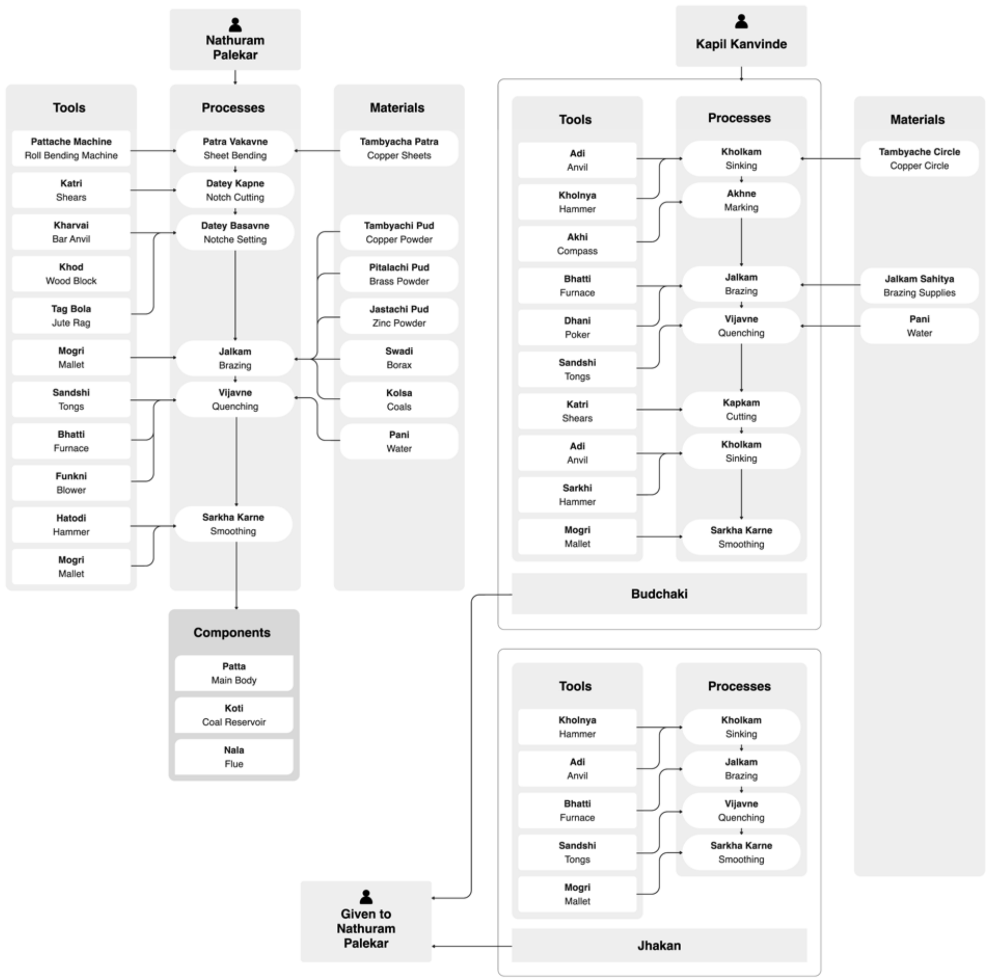

Figure 3.7: *Kholkam*, *jalkam*, and *vijavne* of the *bamba chaîne opératoire* (Diagram by the author and Amethyst Saludo)

3.6.2.2 *Kholkam*, *Jalkam*, and *Vijavne*: Shaping sheet copper into overall forms and brazing forms into components (Kapil Kanvinde)

While Palekar has been making the *patta*, *nala,* and *koti*, Kapil Sadashiv Kanvinde has been occupied in making the two end caps of the *bamba*: the lid (*jhakan*) which is removable, and the bottom (*budchaki*) which is permanently brazed to the *patta*.

Though Kanvinde makes these end caps using the traditional technique of *kholkam* today, they are now frequently made by the process of spinning on a lathe. This form of mechanisation has sped up the process of manufacturing, enabling the *tambats* to increase their production rate. Though Mahesh Metals does not have any lathes, Kanvinde often outsources the work to other shops when jobs have to be done more quickly.

Today, Kanvinde will use the traditional process to make these parts. While the making of the cylinders started with rectangular sheets of copper, the making of the end caps starts with circular sheets. Kanvinde sits down on a small wooden stool barely 3 inches high. The *adi*, an annular cast iron die shaped like a ring, is used here. He stacks two circular sheets of copper, both 15 inches in diameter, puts them on the *adi*, and places his feet around the circumference of the discs. He then grabs a hammer called the *sarkhi hatodi* and starts the process of hammering them to convert them from flat discs into bowl shaped end caps for the bottom end cap, the *budchaki*. His body rocks back and forth as he brings down the hammer on the copper, while simultaneously spinning it around with his feet.

Figure 3.8: *Kholkam* of the *budchaki* (Photograph by Rushikesh Bapat)

After denting the sheet for approximately four minutes, he switches hammers and grabs one called the *kholnya*, which has a much longer head and is used with both hands. This hammer is designed specifically for *kholkam* and it hastens the process of sinking the metal. After another three to four minutes of hammering, the flat, smooth copper disc looks almost mangled out of shape, but it has now been hollowed out by a few inches. He grabs the *sarkhi* again and uses it to smooth out some of the dents. Once the end cap has taken the hemispherical shape he is looking for, he picks up a scribing compass and marks the centre of the end cap. He needs to make a two-inch hole in the centre and uses a smaller scribing compass to draw this circle. With a small steel chisel and a hammer, he knocks out the centre circle, and using a hammer flares out the end. Flipping over the end cap, Kanvinde cuts off the excess flash with a pair of metal shears and files the edge with a half-round metal file.

In observing the process, at first glance, the gestures of the body, actions of the limbs, and movements of fingers appear to be highly repetitive. However, careful examination reveals that there are micro adjustments that the *tambats* make while working, depending up the condition of the tool, the unique properties of each copper circle, urgency of work, and so on. In addition, these movements are continually refined and updated over time. As Marchand explains, this repetition is not exactly repetition. Every time an action or a technique is repeated, its next iteration occurs in a newer context in which conditions may have changed, more learning has occurred, dexterity may have improved, and the craftperson's social status may be different (Marchand, 2018).

Kanvinde takes the end cap over to the blower furnace to heat it up and soften the metal. Once it gets red hot on the fire, he picks it up with a pair of tongs, immerses it in water to quench it, and brings it back to the *adi*. The small centre hole must be widened, and the edges formed outwards to the same diameter as the *koti* so that they may be joined together. He picks up the *kholnya* again and starts hammering around the edges of the hole. The newly softened copper is pliable and responds well to Kanvinde's hammer strokes. After five minutes of hammering while spinning it around with his feet, the hole gets larger, the edges create a collar, and the hemispherical *budchaki* is significantly deeper. As the copper hardens due to the hammering, Kanvinde softens it by heating it several times to make it easier to form it, but also to ensure that the metal does not rip. He keeps a *koti* at hand and places the *budchaki* on it intermittently to check that the centre hole reaches the correct diameter, and once they match, he sets it aside. Kanvinde now starts the process of making the second end cap, the lid (*jhakan*) in a similar fashion by starting to hollow out a 15-inch disc of copper. While the *budchaki* has a collar in the centre, the *jhakan* has a collar around its edges which then close on to the main body of the *bamba*. In this case too, after a certain amount of hammering, Kanvinde walks over to the furnace, heats up the copper and softens it to reverse the effects of work hardening. Once the *jhakan* achieves an overall shape, he walks over to the *kharvai*, places the *jhakan* on the edge and starts evening out the collar of the lid. Once the collar of the lid has been flattened and straightened out, he goes back to the *adi* to even out some of the roughness on the dome shaped section of the lid. At this stage, the *budchacki* and *jhakan* are ready to be handed over to Palekar so he may assemble them with the rest of the *bamba*.

The *chaîne opératoire* reveals with clarity that the making of the *bamba* is intensely physical work which involves a series of specific body positions, sets of unique movements of all limbs, and careful application of physical force that the *tambats* learn over time from their parents, relatives, and co-workers. The dynamic coordination of one's physique along with these precise gestures is critical in the development of skill (Ingold, 2013; Marchand, 2018). "Crafts - like sport, dance and other skilled physical activities - are largely communicated, understood and negotiated between practitioners without words, and learning is achieved through observation, mimesis and repeated exercise" (Marchand, 2008, p. 245). As exemplified by Palekar's statement that he had probably made thousands of *bamba* in his life, the *tambats* have decades of experience and it is through this bodily practice that they have this embodied knowledge of making and doing (Naji & Douny, 2009). Each of the *tambats* making the *bamba*, even while using very similar sets of tools and working on the same material, have their own uniquely individual gestures. And it is through these gestures that they communicate and transmit their knowledge beyond themselves.

3.6.2.3 *Kholkam*, *Jalkam*, and *Vijavne*: Shaping sheet copper into overall forms and brazing forms into components continued (Nathuram Palekar)

Palekar's next task is to attach the *budchaki* to the *patta*. He cuts notches into the larger edge of the *budchaki* with metal shears and bends them upwards. He turns the *patta* over, aligns the *budchaki* on it so that the notches interlock the two parts, and then hammers down the *date*. However, the joint is not yet secure, and he takes the assembly over to an upright anvil called the *ubala*. He situates the seam on the edge of the *ubala* and starts hammering it. He spins the assembly around with his left hand while hammering with his right. The joint is now secure and ready for the seam to be brazed. The assembly of the *nala* and the *koti* (which does not yet have a secure joint) is also placed on the *ubala* and hammered to ready the seam for brazing.

Palekar now has to make a hole in the *jhakan*, large enough for the flue to come through, and create two raised steps on the top surface. In order to do so, he starts by marking the centre of the *jhakan*, simply by scratching three or four arcs with the tip of the half-round file by holding its other end on the collar. He then marks three circles on the outer and inner sides of the *jhakan* with a scribing compass. He takes the *jhakan* over to the *kharvai*, places it on the edge, and starts hammering the top surface near the collar while rotating it with his feet, creating an even raised step along the perimeter. Palekar repeats this process by creating a second raised step along the large circle that he has marked. Once both these steps have been given an overall shape, he takes the *jhakan* off the *kharvai* and takes it over to a metal block called the *airan* to even out the edges of the steps. He then starts creating the centre hole as well as the peephole in the *jhakan*. Having done this for years, Palekar does not need to mark the peephole; he places the *jhakan* upside down on the *khod* (a block of solid wood partially embedded into the factory floor) and knocks out the elliptical shaped peephole with a chisel and a hammer. In a similar fashion, he chisels the centre hole but uses the markings he had made earlier to get a perfect circle for the flue to come through. He flips the *jhakan* over and cuts the edges of both holes, evening and flattening them out using a small metal shear for the peephole and a larger one for the centre hole. He then takes the *jhakan* over to the *airan* to flange out the edges of the centre hole and then over to the *kharvai* to sink in the edges of the peephole. Both edges, of the centre hole and the peephole are smoothed out with a half-round metal file. The collar of the *jhakan* is then evened out with a mallet on the *kharvai*, and finally its top surface is straightened out on the *airan* to remove any dents.

The next steps involve brazing the seams between the *budchaki* and the *patta* as well as the *nala* and the *koti*. He walks over to the blower furnace, turns it on and mixes the brazing paste. He applies it first to the main body assembly, and then places it on the fire for three to four minutes. Next, he applies the paste to the flue assembly, and places that on the fire for three minutes as well. The heat serves to dry up the brazing paste, preventing it from running off the seams. Once the main body is off the fire, he picks up a wad of steel wool and scrubs of any excess paste that may have dripped onto the *patta* or the *koti*. Palekar dons a hat to protect his head from flying embers, adds more coal to the furnace, and places a steel ring-shaped support (*gada*) on the furnace. The main body is then placed on the *gada* in such a way that the seam comes in direct contact with the fire. The copper turns red hot, and he spins the body around with a pair of tongs (*sandshi*) and a poker (*dhani*) so that the entire seam seals, creating a watertight surface. He carefully observes the changes in colour of the seam as it heats up. The leading edge is white hot and if the body is not rotated at the correct speed, it is likely to get too hot and ruin the seam. Once he is satisfied that the brazing has been done, he picks up the body and immerses it in water to cool down the metal. The main body is set aside, and the flue assembly placed on the fire. This too must be rotated at the right speed for the seam to be appropriately sealed and then dunked into the vat of water. The furnace blower is turned off, and both assemblies placed on the coals for a minute or two to dry off the excess water.

Palekar now grabs both assemblies and takes them over to the *ubala* to knock off flux residue, flatten the seams with a hammer, and then to remove any dents with a mallet in a process referred to as *patkam*. He takes the flue assembly over to the *kharvai* to flatten out any bulging of the metal that may have occurred below the seam during the firing process. In order to check whether or not the seam is entirely sealed, Palekar holds the flue assembly at an angle, pours water from a glass down the inside seam, and then gently runs his fingers over the outside to ensure that there is no leakage. The flue assembly is now ready to be attached to the main body. He places the flue assembly upright on the floor, slides the main body over it so that the brazed seams are aligned, and then places the lid on top. The three pieces fit perfectly, and he now has to curl the bottom edge of the *budchaki* over the *koti* as the final step in his work. This is quick work, in which he leans the *bamba* over, and with a few blows of the hammer curls the outer edge of the *budchaki* over the *koti* to hold the final assembly in place.

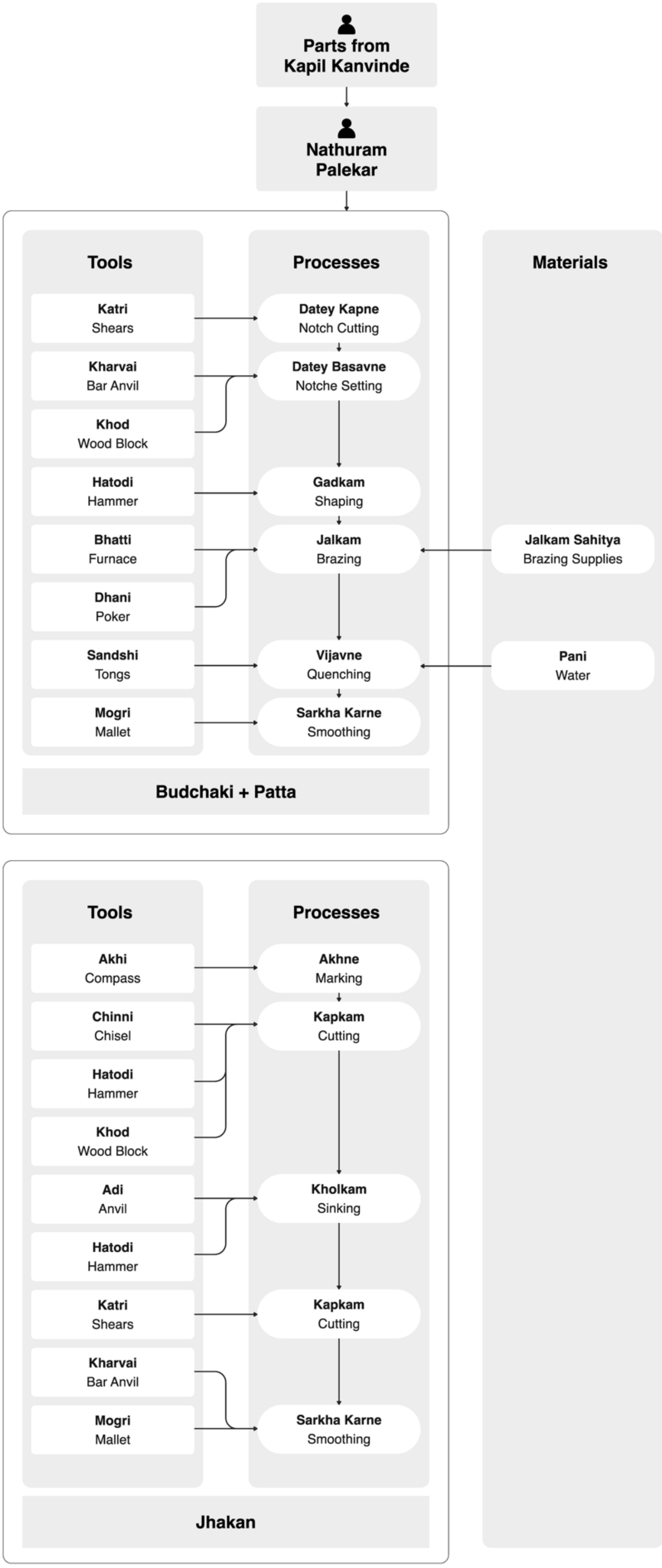

Figure 3.9: *Kholkam*, *jalkam*, and *vijavne* of the *bamba chaîne opératoire*
(Diagram by the author and Amethyst Saludo)

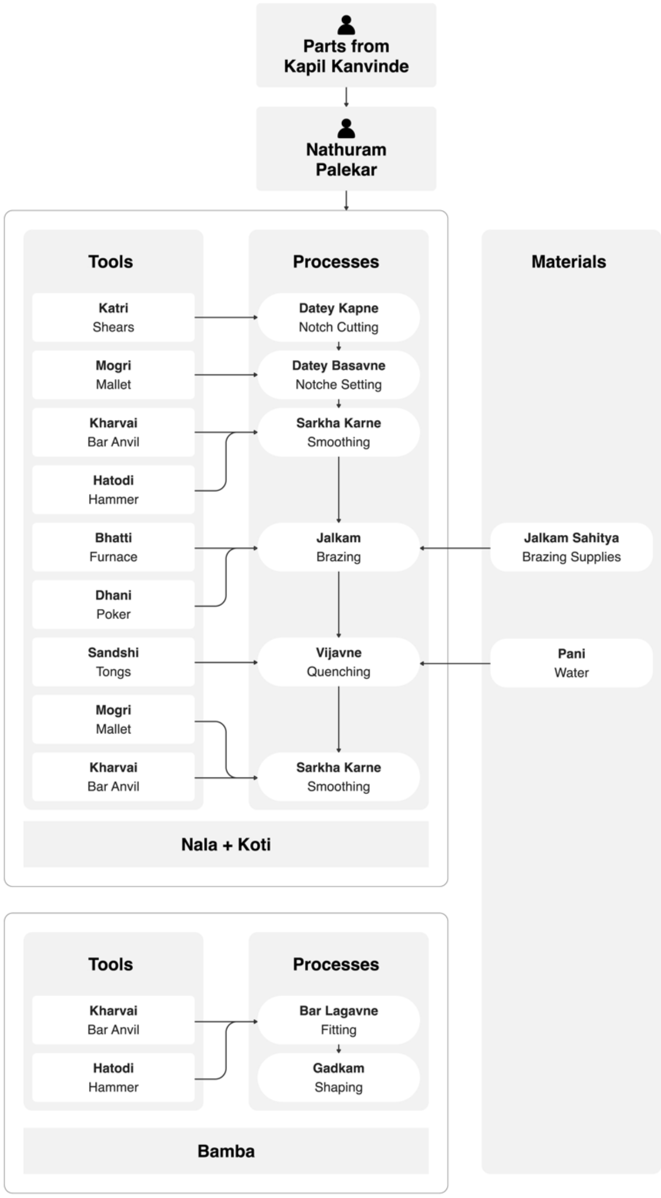

Figure 3.10: *Kholkam*, *jalkam*, and *vijavne* of the *bamba chaîne opératoire* (Diagram by the author and Amethyst Saludo)

3.6.2.4 *Kholkam*, *Jalkam*, and *Vijavne*: Shaping sheet copper into overall forms and brazing forms into components (Ramesh Waghmare)

The bamba is now handed over to Ramesh Ramachandra Waghmare, who sets up the head of the *kharvai* low and close to the ground by moving the *khod* further upfront. He slides the *bamba* on the *kharvai* so that the bottom end can be hammered while the top end is supported on a wooden box. He tosses jute bags in the cradle, settles down, and with repeated strokes of the hammer on the section where the *budchaki* and *koti* overlap, Waghmare seals the bottom collar. Once the collar is hammered, he stands up, slides the *bamba* off, and adjusts the *khod* so that the head of the *kharvai* is much higher off the ground. The *bamba* is now placed on the side of the *kharvai* and the edge is flanged out. Once the flange is half an inch in size, Waghmare readjusts the *kharvai* to its original lower position, and once more hammers the base collar to even out any dents. The bottom collar and flange are now ready to be brazed. He applies the brazing paste to the inside as well as the outside edge of the bottom collar and adds borax powder on top to make the paste less runny. He walks the *bamba* over to the furnace and sets it upright on the coals. This furnace has a manual blower and Waghmare cranks it to create a small but roaring fire. He grabs a pair of safety goggles and slips on a cut up leg of an old pair of jeans on his arm for protection. He scoops up some coals and drops them down the flue to ensure that the inner edge gets as hot as the outer edge. As he continues cranking the blower, the fire melts the brazing compound, and he keeps spinning the *bamba* around to ensure that it is evenly hot all around the bottom edge. After about three minutes, he picks up the *bamba* and brings it out into the narrow lane outside the factory, as some of the cleaning work is done outdoors. Once outside, Waghmare pours a glass of water into the *bamba* to ensure that the joint he just brazed is watertight. Once he confirms this, he picks up a wire brush, cleans off the flux residue from the inside and outside of the base collar, and gets it ready for the next stage in the process called *ujalkam*.

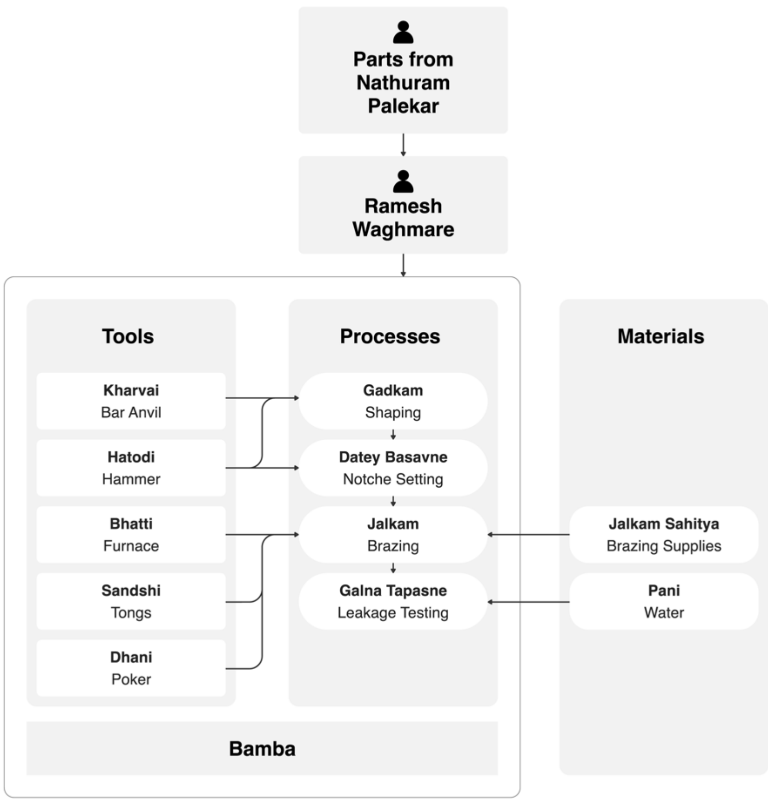

Figure 3.11: *Kholkam*, *jalkam*, and *vijavne* of the *bamba chaîne opératoire* (Diagram by the author and Amethyst Saludo)

3.6.2.5 *Ujalkam*: Finishing the components (Pavan Waghmare)

Pavan Ramachandra Waghmare is Ramesh's younger brother. He takes over from his older brother and starts the process of *ujalkam* (loosely translated as brightening work) of the *bamba*. He grabs a small jute rag, soaks it in diluted sulphuric acid, and applies it all over the *bamba* ensuring that all the blackened, oxidized areas are cleaned, and pure copper appears through. Waghmare scrubs sections that are particularly dark with steel wool soaked in the acid. Throughout the process of making the *bamba*, all the copper sheets have been dull, blackened, greasy, steaked and stained. However, it is during this process of *ujalkam* that the natural colour of copper starts to emerge from underneath these outer coatings. Once the acid has been applied thoroughly to the entire surface, he pours water over it, and then rubs it with tamarind paste. The tamarind is soaked in water overnight to create this paste, and it plays the role of halting the reaction between the acid and the metal. Tamarind itself contains tartaric acid which helps clean the copper and bring out the shine in the metal. Waghmare dips steel wool in tamarind and scrubs the entire outer surface of the *bamba*, starting with the base and the edges, and following up with the main body.

Figure 3.12: *Ujalkam* being done on the *patta* (Photograph by Rushikesh Bapat)

The sheets of copper with which the *tambats* begin their work are almost always grimy and covered in black stains. This gets worse as they heat and cool the material repeatedly during their processes of making. Waghmare does not wear gloves or any protective gear for this task, and dips his bare hands in the acid, which he refers to as *tejav* (brightness). He says the acid does not bother his hands at all. "We do not use the *tejav* unless it is mixed with water. It is alive", he says, referring to the energy and chemical potency of pure, undiluted sulphuric acid. Substances like sulphuric acid serve as catalysts in speeding up the process of cleansing the copper, and the application of tamarind arrests the action of the acid. While the acid degreases the copper, deoxidizes impurities, and reveals the purity of the metal, it has the opposite effect on the bodies of the *tambats*. Though they say that the acid is too dilute to affect them, when I dipped my fingers in it, I felt a burning sensation immediately. The substance scars their skin, but they say they do not "feel anything". They place their bodies between the acid and the copper, allowing it to inflict damage on their bodies, while protecting the material. The tamarind, on the other hand, is harmless to their hands, but it actively arrests the continued action of the sulphuric acid on the copper and halts further corrosion. Tartaric acid, present in tamarind, is often used along with sulphuric acid for corrosion resistance in the aerospace industry for aluminium. Coal, which is used to provide the heat needed to soften copper too is dangerous as working close to it exposes the *tambats* to red hot flying embers. The *tambats* use fire and water also as agents in managing the malleability of the copper. Once heated, the material softens, and once quenched in water it stops the process and maintains that malleability. The substances used by the *tambats* interact with each other in arresting as well as accelerating the flow of the technical actions. In other words, the temporal flow of the process is efficacious in and of itself. The variety of substances that they touch on a daily basis—namely, enduring metals like copper, steel, brass and the consumable materials like the acids, borax, and tamarind—has not only aided them in shaping the things they make but also their own bodies and gestures.

The *bamba* is rinsed with water, more tamarind paste applied to it, and washed once again with water. Finally, Waghmare takes a few dry cloth rags and wipes the entire *bamba* to remove any excess water. However, as even small quantities of moisture, especially in hard-to-reach crevices can lead to corrosion, Waghmare goes inside, gets a few dying embers from the furnace and drops them into the *bamba*. These will generate sufficient heat to dry up any excess moisture left inside.

Careful examination of the *bamba* makes it very clear that this is a hand-made object. The extreme precision of machine cut edges or the clarity of surfaces polished and cleaned by power buffers is not visible here. The top edge of the bamba is wavy and a few stains caused by fingers are still visible after *ujalkam* is complete.

Figure 3.13: Main body of the *bamba* after *ujalkam* showing finger stains (Photograph by Rushikesh Bapat)

Now with the *ujalkam* completed for the main body of the *bamba*, Waghmare repeats this process of application of acid, tamarind, scrubbing, washing, and drying with the lid of the *bamba*. Here too, the acid-soaked steel wool starts to reveal the shine of the copper, which is the true purpose of *ujalkam*.

Figure 3.14: *Matharkam* on the *jhakan* (Photograph by Rushikesh Bapat)

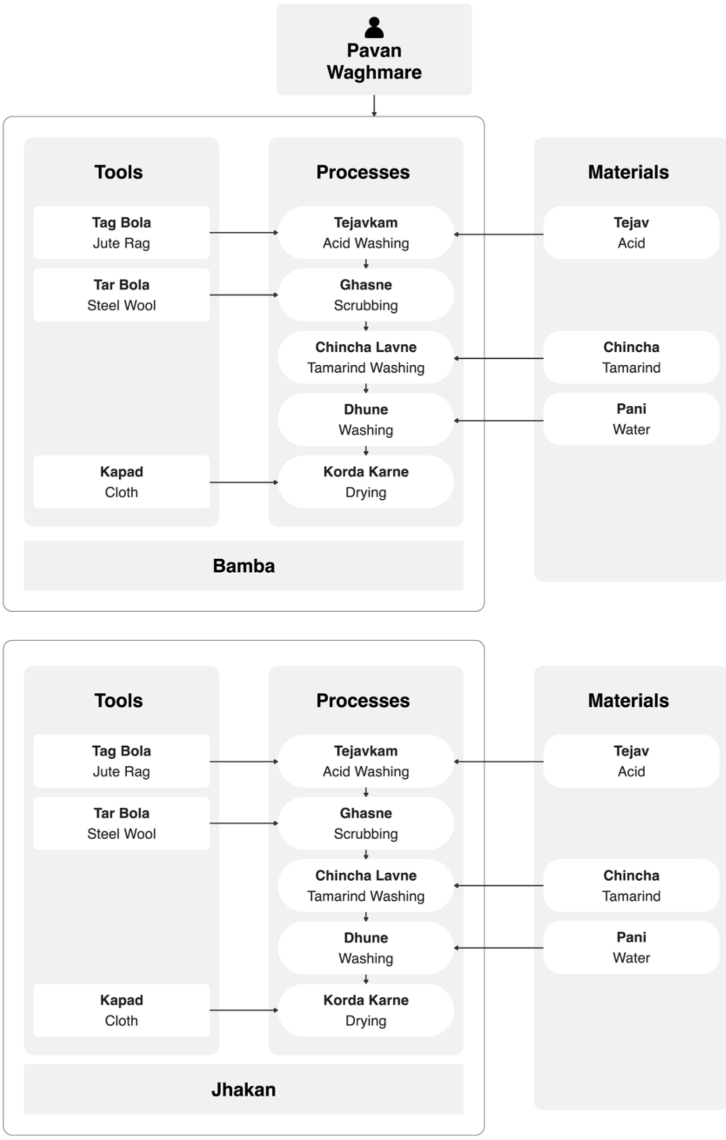

Figure 3.15: *Matharkam* and *jadavkam* of the *bamba chaîne opératoire* (Diagram by the author and Amethyst Saludo)

3.6.2.6 *Matharkam* and *Jadavkam*: Hammering the *bamba* and making the accessories (Ramesh Waghmare)

The older Waghmare now starts making the lid to the peephole. He cuts a 20-gauge sheet of copper into an elliptical shape with a pair of small metal shears. Using a cast iron, hexagonal swaging block with a hole in the middle and a hammer, he raises a step in the lid, much like he did with the larger lid of the *bamba*. Waghmare goes back into the factory to start the next step of *matharkam*. He sets up the *kharvai* to the right height so as to fit the *bamba*. He applies a small amount of polishing wax on a piece of cloth and then rubs the hammer across it to create a mirror-like surface finish on it. In order to create the shiny indentations of *matharkam*, the hammer face has to be highly polished without any irregularities. In order to protect his legs from any burrs, especially those on the brazed joint, he wraps pieces of cloth between his knee and ankle as well as on his left thumb. He rubs the *bamba* with some dry steel wool to remove any last-minute stains that may have appeared on it, before starting the process of hammering. Supporting the lower side of the *bamba* between his toes, grasping its upper side in the fingers of his left hand, and with the hammer in his right hand, he bangs row after row of the hammertone texture on the surface. Each row takes him a little over a minute and with thirty rows per *bamba*, this process takes about 35 minutes. Finally, he uses the wooden mallet to even out any deformities on the top edge of the *bamba*.

Each of the processes that Palekar, Kanvinde, and the Waghmares go through in the making of the *bamba* have specific sounds associated with them—the high-pitched sound of a hammer hitting a sheet of copper on a *kharvai*, the duller and lower pitched sound of the mallet, the hissing and popping sounds of the blower furnace, and the scratching sounds of steel wool being scrubbed against copper. The *tambats* know by sound whether the blow of the hammer has landed where it should, and whether it will get the result they are looking for. And when the hammer doesn't land right, they know, again by sound, that it will result in the metal being dented and deformed. This is a learned acoustic ability that develops over time. Similarly, while doing *ujalkam*, knowing where and how much acid and tamarind to apply so that the pure copper shines through, how to see dents and dings in the body of a *bamba* by reflections on its surface, and how to polish the head of a hammer so that it creates the kind of texture they are looking for, are all visually learnt skills of how to read the metal. The sheen of the metal is capable of creating not only an emotional response (Douny, 2013), but it also plays a critical role in learning the craft.

The main body of the *bamba* has two brass handles which Waghmare now attaches to it. Though these handles were made in *tambat ali* years ago using casting (*otivkam*), they are now bought from a supplier. He places the *bamba* on a different *kharvai* which has a flatter head. After marking the location of the handles with a scribe, he creates two holes for each handle with a small punch and die set. The force of the punch dents the *bamba*, which he flattens out with the hammer. Copper rivets are then used to attach the handles on the *bamba*. After both handles are attached, he deftly measures the distance between them and then hammers the seal of the workshop, their trademark, on the *bamba*.

Figure 3.16: The tools used in making the *bamba*
(Photograph by Rushikesh Bapat)

Finally, he evens out dents on the top edge of the *bamba* with the hammer. The *bamba* is now done and Waghmare picks up the lid for hammering. He first scrubs it with a wad of dry steel wool, and then places it on an angled *ubala*, an upright anvil, the other end of which has been embedded into the ground. He first picks up a hammer called the *chavarshi*, which has an oblong shaped head, and hammers out single rows just below the stepped sections on the lid. This evens out and hides any of the defects that may be visible at the stepped edge. He then grabs a textured hammer called the *charyachi hatodi* and creates two rows just below the steps. And then a third hammer, the *nakhi*, is used to create regular circular dimples over the rest of the lid's surface. The entire surface of the *bamba's* lid is covered in some form of a texture.

Waghmare finally removes any dents with the wooden mallet and drops the lid on to the *bamba* to make sure that it fits well. He now picks up the lid of the peephole and creates three different textures on it, like the larger lid of the *bamba* using the *chavarshi*, *charyachi hatodi*, and the *nakhi*. He now punches two holes in the peephole lid, one in the centre for the knob and the other closer to one of the edges for the hinge. He then attaches a brass hinge with steel rivets to the lid. He places a small copper plate underneath the centre hole before riveting the knob in order to ensure that it stays tight and does not loosen over time. The peephole lid is now ready to be attached to the main lid of the *bamba*. Waghmare moves over to the *airan* and punches holes where the hinge for the peephole lid will be attached. The lid also has two brass handles similar to the main body, and he marks as well as punches holes for them. Finally, he attaches the handles with copper rivets and the hinge with steel rivets to the lid. Waghmare's work on the *bamba* is done.

Figure 3.17: The *kharvai* used in *matharkam* (Photograph by Rushikesh Bapat)

The brass handles, hinges, knobs, and rivets on the *bamba* are standardised components which are easily interchangeable, making processes of assembly faster and easier (Ledderose, 2000).

However, a few other components, like the hook-shaped legs are not. Interestingly, these hook-shaped legs of which three are required on each *bamba*, are perfect candidates for standardisation, but the *tambats* make them from scrap copper, thereby exhibiting a different form of economy of material use. The *tambats* used to make the brass accessories themselves in their workshops using scrap copper left over from cutting sheets into circles. In Karulkar's father's workshop, they had a special furnace that got hot enough to melt copper and zinc. At that time, they would use 60% scrap copper and 40% zinc to create the brass themselves, as it was significantly cheaper for them to do so. The moulds were made from a mixture of a type of locally available yellow mud and coal tar.

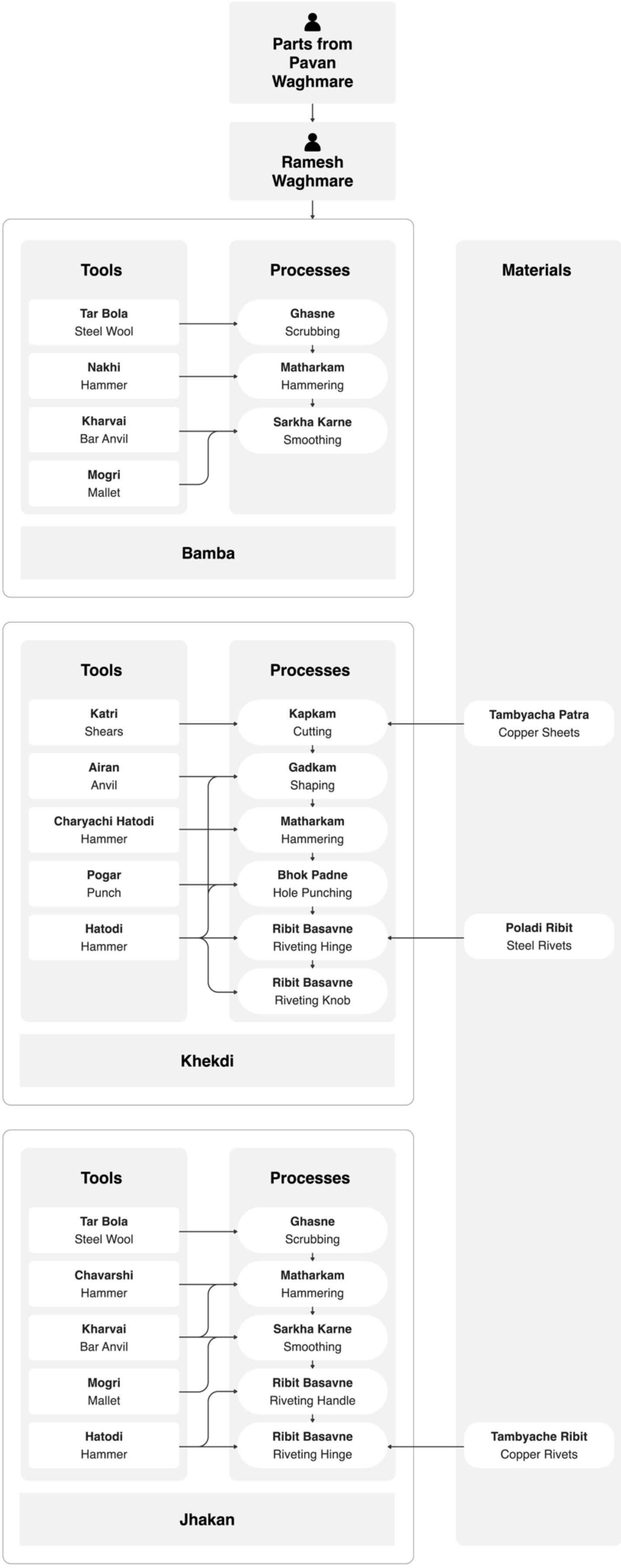

Figure 3.18: *Matharkam* and *jadavkam* of the *bamba chaîne opératoire*
(Diagram by the author and Amethyst Saludo)

3.6.1.7 *Jadavkam*: Making the accessories (Kapil Kanvinde)

Kapil Sadashiv Kanvinde makes the last accessory for the *bamba*, the ring (*kanpyachi patti*) with three hook-shaped legs (*kan*) that is attached to the bottom and holds the mesh, and typically made from scrap metal that emerges from the process of making utensils. Kanvinde starts with a rectangular sheet of copper that has been pre-measured and cut from a template. His task is to fold this sheet twice over itself to give it an added thickness and therefore strength, and he does this on an *airan* with a wooden mallet. He sits down, holds the copper sheet in such a way that a third of it extends beyond the *airan*, and starts hammering it to bend it along its long edge. He does the same on the other long edge, thereby bringing the long edges closer to each other. The flat sheet now has a cross section of the letter C. He then continues hammering it so that the top and bottom edges of the C fold down on to itself creating a narrower but thicker, double walled strip of copper. The template that he used to measure the length and width of the sheet also has five holes in it which he uses to mark the copper strip with a scribe. He then punches five holes in this sheet; three will be used to attach the legs and two will hold a nut and bolt to attach it to the *bamba*. He grabs three other smaller sheets of copper to make the hook-shaped legs, similarly folds them over on the *airan*, and punches a hole at one of their ends. He then picks up the longer copper sheet and bends about an inch and a half of both ends by a 90-degree angle on the edge of the *airan* with a hammer. He bends the ends of three smaller copper strips similarly. The three legs now are in the shape of the letter L.

He places the Ls on a small hollow steel cylinder and hammers them a couple of times to create a second bend in the opposite direction of the first 90-degree bend making the final hook. The legs are now ready. He picks up the longer copper strip and by placing it on an *adi*, starts hammering it to bend it in the form of a circle. This results in an extremely rough circular form, and to reshape it into a better circle, he attaches the nut and bolt into the flat 90-degree bends, takes the strip over to the *kharvai*, and works on it with a mallet while rotating it till it gets the ring shape he desires. The three hook-shaped legs are then attached to the ring with steel rivets on the *kharvai*.

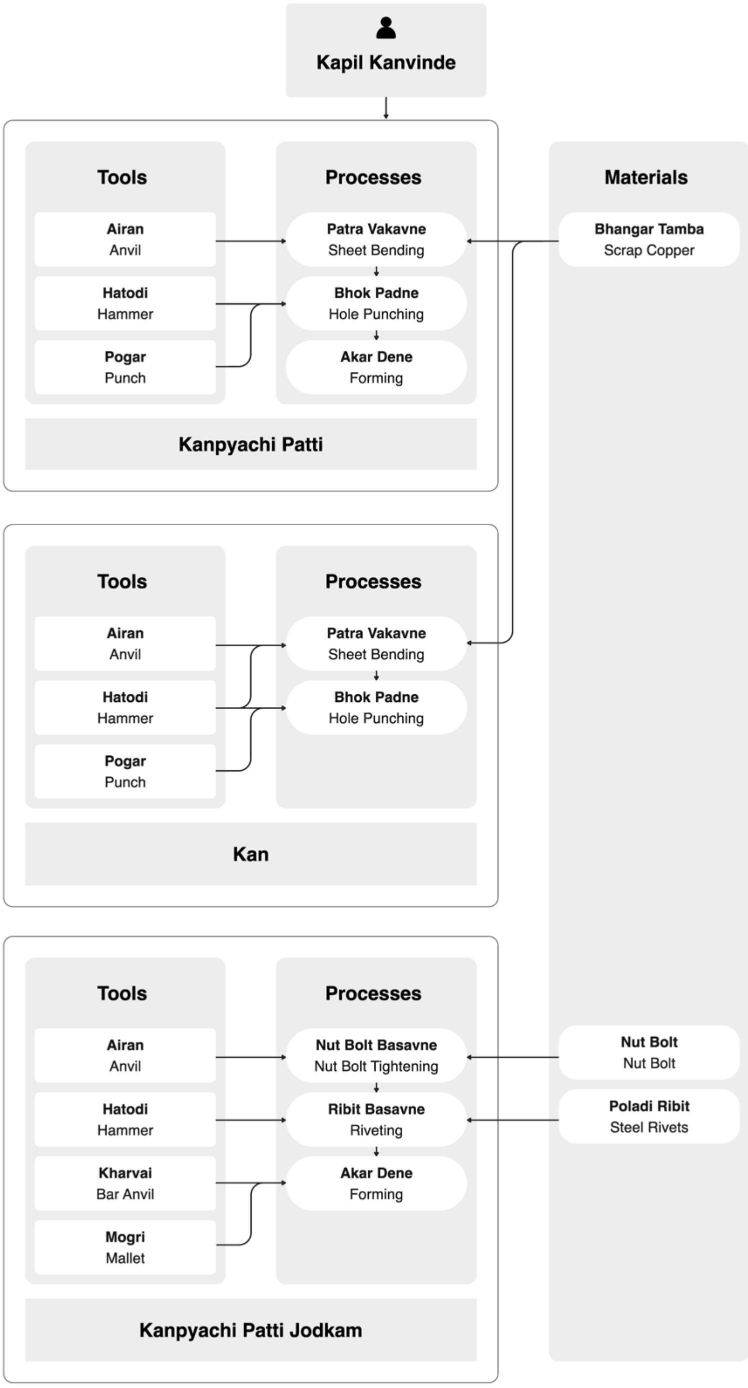

Figure 3.19: *Jadavkam* of the *bamba chaîne opératoire*
(Diagram by the author and Amethyst Saludo)

3.6.2.7 *Jadavkam*: Assembling the *Bamba*

Finally, Kanvinde examines the overall shape of the ring and the legs, and hammers them in a few spots to get the final shape just right so that it fits on the base collar of the *bamba*. This serves to hold a wire mesh on which the coal is placed inside the flue. Once the ring is attached, the *bamba* is placed on a wrought iron stand (which is not made by the *tambats* but bought by the purchaser in the store), and the iron mesh inserted just above the hook-shaped legs.

The final step of attaching the tap to the *bamba* is generally not completed in *tambat ali* but done by shopkeepers in the store when the purchase is made. There are a variety of sizes and shapes of taps available, and buyers can choose what they prefer. Also, it becomes difficult to transport the *bamba* with a tap attached, as it is likely to get bent and, in the process, damage the copper body. These taps are also made of cast brass and are not manufactured in *tambat ali.*

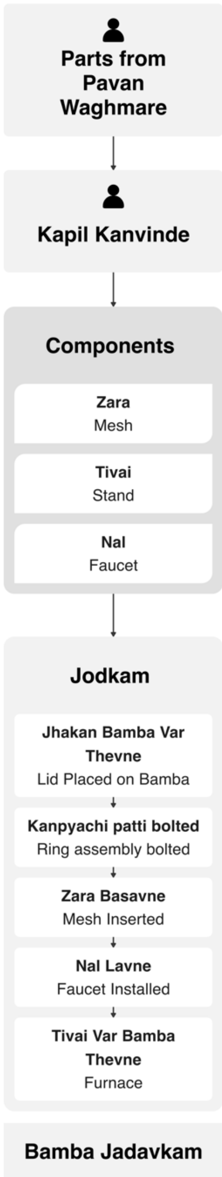

Figure 3.20: *Jadavkam* of the *bamba chaîne opératoire*
(Diagram by the author and Amethyst Saludo)

Figure 3.21: The finished *bamba* (Photograph by Rushikesh Bapat)

Ledderose identifies seven principles of modularity in ancient Chinese production systems: "large quantities of units, building units with interchangeable modules, division of labor, a fair degree of standardization, growth through adding new modules, proportional rather than absolute scale, and production by reproduction" (2000, p. 6). Some of these principles are visible in the making of the *bamba*, but not all of them. Interchangeability of components is evident; there is clear division of labour between the tambats regarding who does *matharkam*, *ujalkam*, and *kholkam*; components like the accessories are standardised; and each *bamba* is a reproduction of an original that the *tambats* know. However, it is worth examining the other three principles of quantity, new modules for growth, and proportional scale. The first one regarding large quantities does not apply here as the manufacturing volumes of the *bamba* have been in decline over the past few years. In regard to the second principle of growth, production increases in *tambat ali* do not seem to happen through modules. As the making of each *bamba* involves a significant amount of manual labour, the primary means of growth is by hiring more people or reducing time taken to make each *bamba*. More people can clearly increase production, and the one means the *tambats* found to reduce time taken is to outsource the making of accessories. The brass handles, hinges, knobs, and copper rivets are now bought from another crafts community that does sand and clay casting. This has reduced time and sped up production. Ledderose's third principle of scale can be seen as an interesting combination of the proportional and absolute scale, which I would like to refer to as a *reference* scale. In the production of the *bamba*, the diameter of its main body is used as a reference against which the proportions and dimensions of the rest of the components are determined. For the "Number 15 *Bamba*", the reference dimension is 15 inches. Therefore, the large sheet from which the main body is made is 15 by 45 inches, and the two end caps are made from copper discs whose diameters are also 15 inches. A smaller *bamba*, the "Number 12", has a reference dimension of 12 inches and its components are accordingly proportioned. Therefore, the reference serves as an anchoring absolute to which all other relational elements are proportionately tethered. These principles of the reference, absolute, and proportionality can be extended to *tambat* society. As the reference dimension determines the form of the *bamba*, so does the materiality of copper determine the form of *tambat* society. Copper serves as that absolute reference on which their society depends; it is the material that determines their relationalities.

3.6.3 *Chaîne Opératoire* of the *Budchaki*

In addition to the overview of the entire process of production of the *bamba*, the next few pages show a more detailed examination of making a single component called the *budchaki*, the lower end cap of the product. As the legend shows, these diagrams list the strategic tasks, decisions, gestures, body movements, tools, materials, and energies involved in one specific occurrence of the making of the *budchaki*. As it is only one component of the product, it shows the actions of one of the actors (Kanvinde) inside the workshop. The strategic tasks are critical actions and none of them can be skipped during the process, while the technological choices that the *tambats* make along the way include moments when they decide to change tools, assess the temperature of the copper to stop heating and start quenching, gauge sizes so that mating parts fit well with each other, and so on. The tasks and choices are essential in the "transformation of a material from an initial state to an intended (or aimed at) result", in this case converting copper into the *budchaki* (Coupaye, 2009, p. 441). This material transformation also involves other non-human actors such as other materials like water and coal, a variety of tools, as well as such forms of energy as the intense heat of the fire and impact of the hammer.

Critical throughout these hammering, chiselling, cutting, and filing processes are gestures, positions of the body, movements of both arms, as well as actions of the feet. Kanvinde's toes play an extremely important role in holding, turning, and indexing the parts. In his discussion of making, Ingold suggests that "concentrated in skilled hands are capacities of movement and feeling that have been developed through life histories of past practice" (2013, p. 115). However, in case of the *tambats*, skill is distributed throughout the body, though it appears as if it is directed into and emerging from their hands. Ingold (2013) and Sennett (2008) both discuss the calluses that craftspersons develop on their fingertips on account of the constant friction and pressure between tool and hand. As one might imagine, the *tambats* develop these calluses on their fingertips as well as their toes. And as we have seen before, the past practice that Ingold refers to is not by any means a memory of a fixed set of actions, but a continually evolving repertoire of gestures that make up their sensate knowledge.

The *chaîne opératoire* is a description of a specific instance of making the *budchaki*, and I realised that it is incredibly difficult to truly capture with detail everything that happens when a *tambat* rapidly fashions an object out of a material. The complexity of actions, related nature of techniques, and the fact that nothing is isolated but part of a larger project (Coupaye, 2009) are some factors that make the task difficult, but it is exactly those reasons that also make the *chaîne opératoire* useful. It was clear to me that essential to *tambat* knowledge is an understanding of the interactions among all the elements involved in making which includes tools, materials, energy, gestures, place, etc.

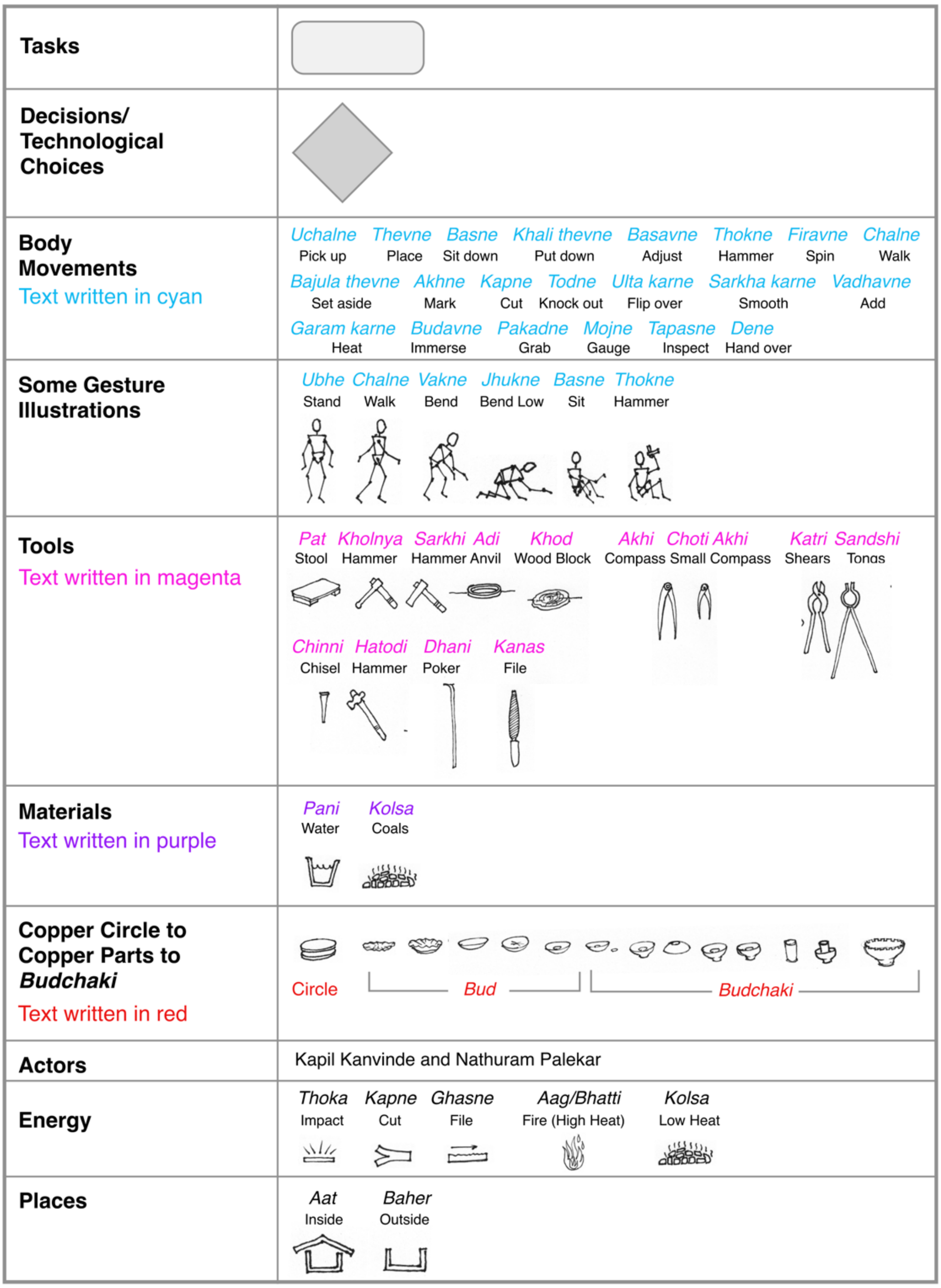

Figure 3.22: Legend for the *chaîne opératoire* of the *budchaki* of the *bamba* (Diagram by the author)

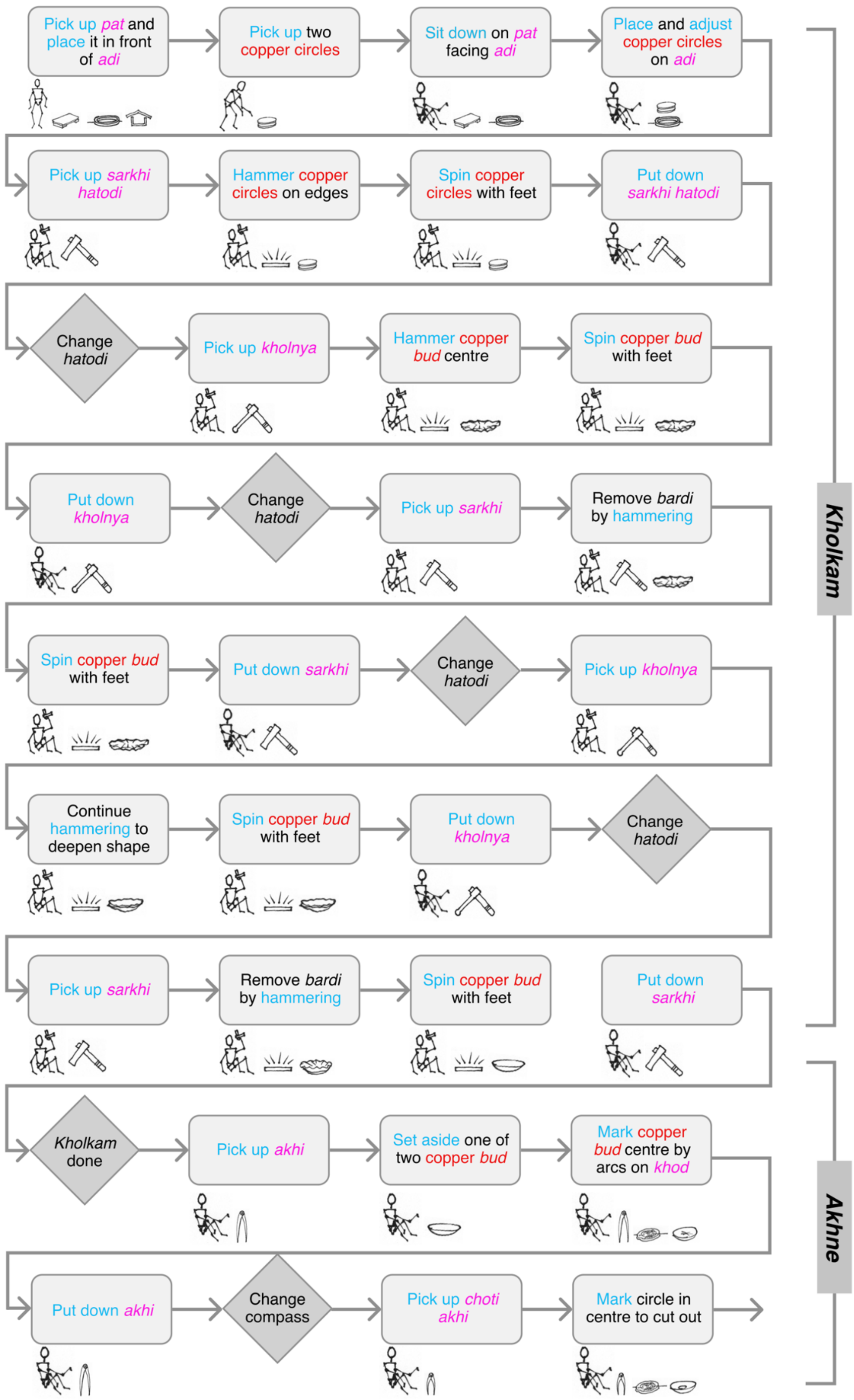

Figure 3.23: Part 1: *Chaîne opératoire* of the *budchaki* of the *bamba*
(Diagram by the author)

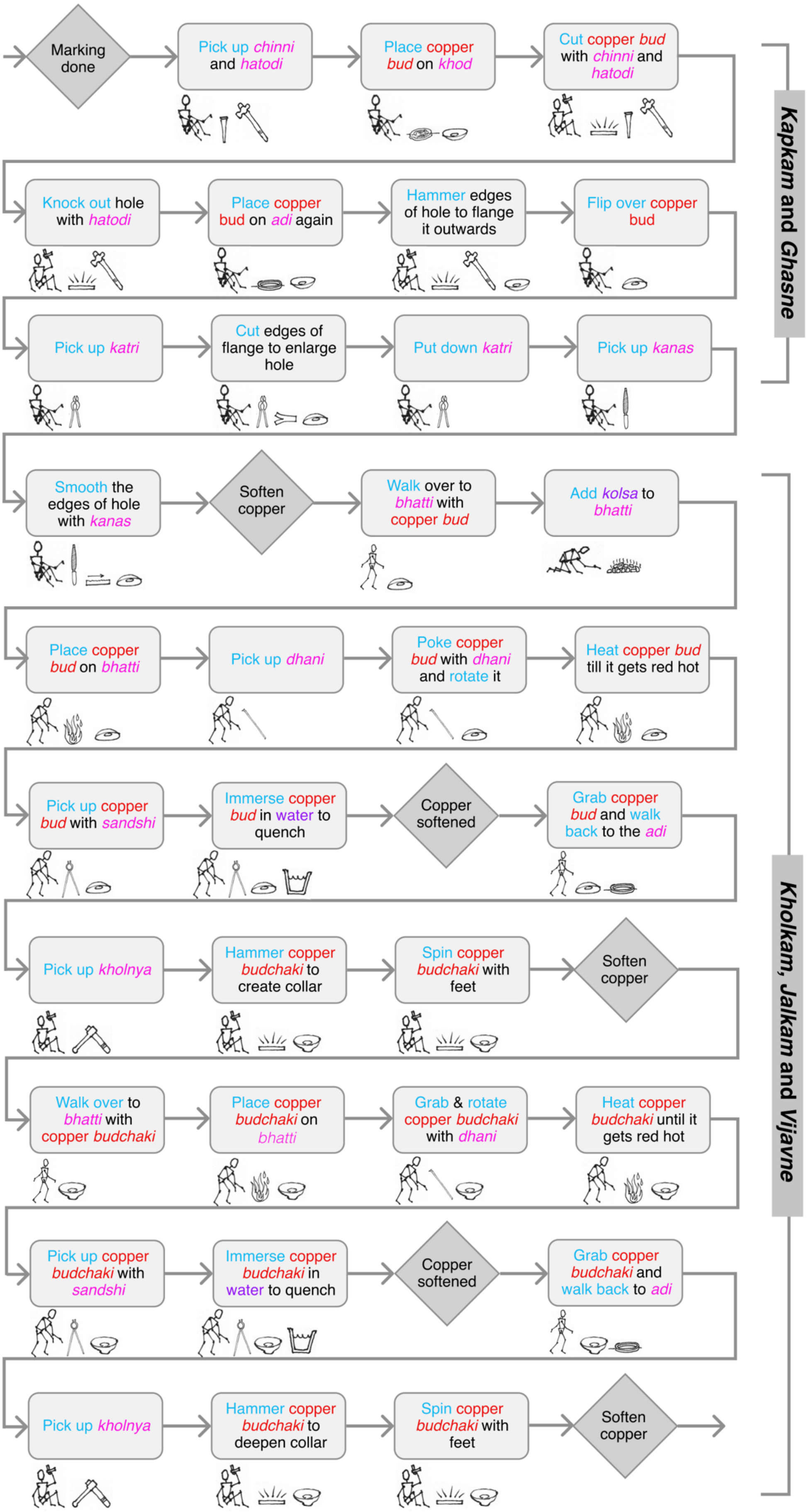

Figure 3.24: Part 2: *Chaîne opératoire* of the *budchaki* of the *bamba*
(Diagram by the author)

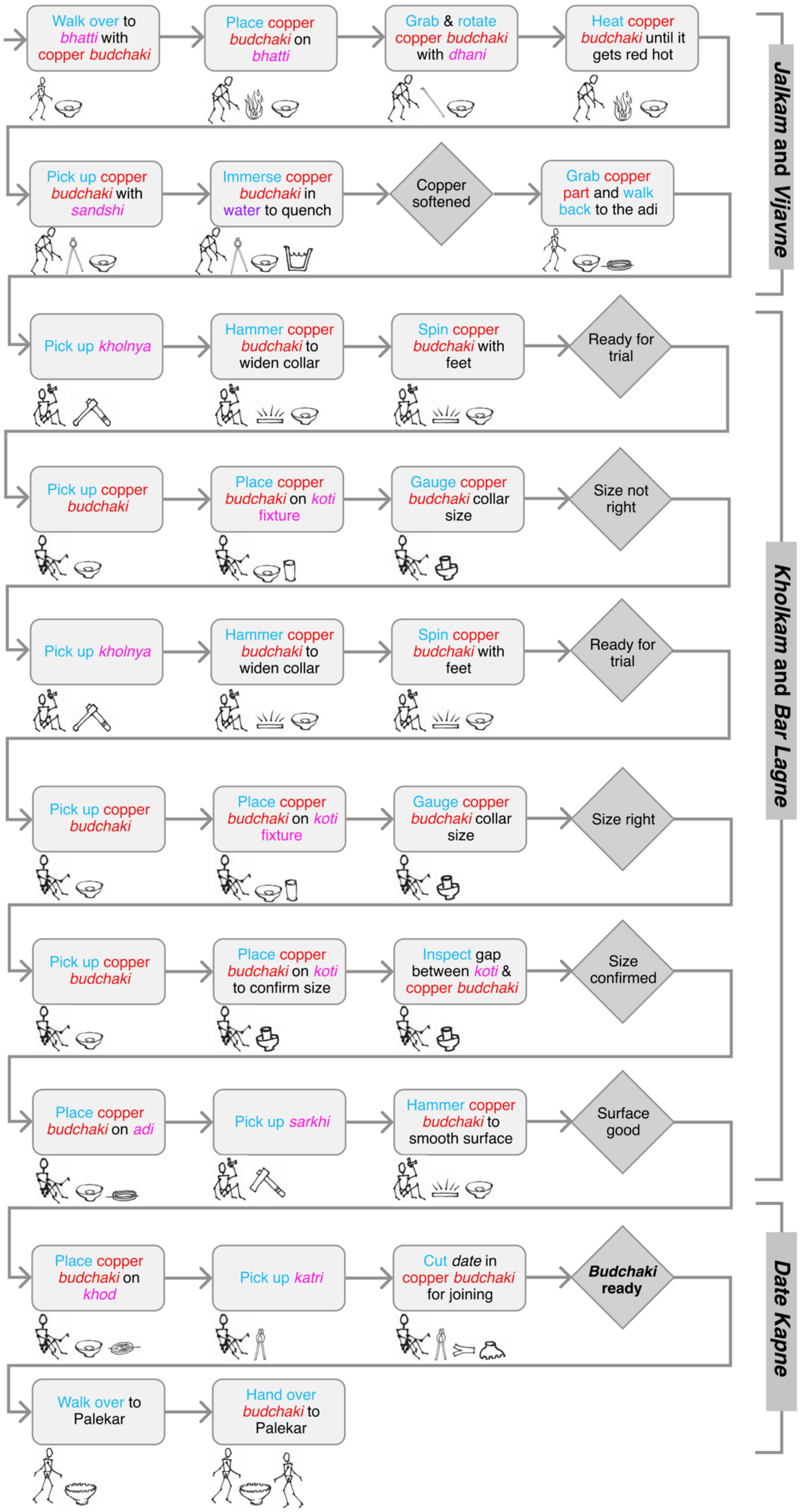

Figure 3.25: Part 3: *Chaîne opératoire* of the *budchaki* of the *bamba*
(Diagram by the author)

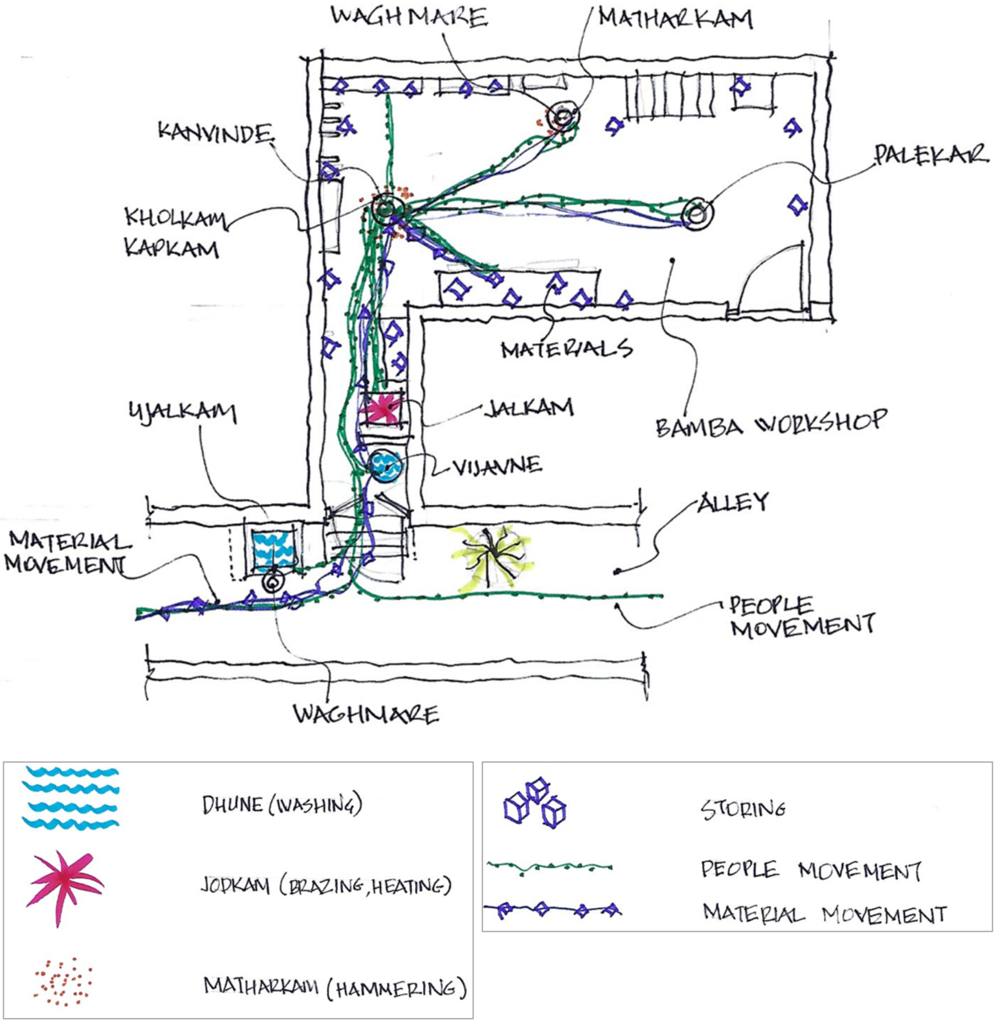

Figure 3.26: Actions and movements in the *bamba* workshop with a legend (Sketch by the author)

While Figures 3.22 through 3.25 are representations of the operational sequence, some of Kanvinde's actions and movements in the *bamba* workshop during the making of the *budchaki* are depicted in Figure 3.26 above. In addition, we can see the locations where materials are stored and where *kholkam*, *kapkam*, *matharkam*. *jalkam*, *jodkam*, *vijavne*, and *ujalkam* are done. The map shows interactions between Kanvinde and the space in which he works, as well as the density of his movements as he walks back and forth from his station to storage shelves to the heating and cooling stations. It is clear that the making of a single component of a product is an engagement between actor, tool, material, and place, performed through a set of trained gestures in specific locations in the workshop.

3.7 The Water Bearer

The copper carafe seen in Figure 4.21 designed by architect and product designer Rupali Rane, has a lustrous, hammered exterior, but it starts its life in a workshop in *tambat ali*, not unlike the *bamba*, as a dull, stained sheet of copper 4’x4’ in size.

Figure 3.27: A copper carafe, designed by Rupali Rane and manufactured *in tambat ali*. (Photograph courtesy of Rashmi Ranade)

The product emerges from this flat sheet into the usable vessel through a series of processes that include marking, cutting, cleaning, heating, spinning, buffing, polishing, hammering, and lacquering. Rane works closely with the *tambats*, and carefully considers these manufacturing processes and the skills of the *tambats* while designing the products. While the *bamba* discussed in the previous section did not utilize electric machine tools, this product relies on several, some in *tambat ali* and some in factories elsewhere in Pune. The first step in the making of the water carafe is cutting the large sheet of copper into smaller squares and finally into a 6” diameter circle using a pair of metallic shears. This circular disc is heated on a coal forge blower to soften the material and then submerged in water to quench it. The process of creating the form of the carafe is undertaken over a series of progressive dies that gradually convert the flat sheet into the final form of the vessel on a spinning lathe.

Figure 3.28: The material form during the steps in the creation of the carafe (Photograph by the author)

The dies—devices for cutting or moulding metal into particular shapes—are often made of the wood of acacia trees because the material is hard, durable, and does not distort too drastically over time. Copper hardens when subjected to force through work hardening and therefore it has to be intermittently taken off the lathe and heated on the coal forge to soften it again. The natural hardness of copper that resists bending and shaping at room temperature gives in to the heat, realigns its crystalline structure and becomes more pliable.

Once the final shape has been achieved, the spinner forces a curled edge (referred to as a bead) on the top of the carafe to facilitate easy pouring and drinking. The tapered neck of this carafe requires the use of a special, collapsible die that can be extracted from the vessel after it is processed on the lathe. The lid, which serves as a drinking cup, is similarly spun on the lathe with a different die. During the process of spinning, a significant amount of lubricating grease is applied on the copper and, therefore, once the final shape has been formed, the carafe is washed with dilute sulphuric acid and tamarind paste to clean the surface. It is dried again and polished to a shine on a buffing wheel. The carafe is now ready for hammering.

Figure 3.29: The cup in one of its primary shapes during the manufacturing process (Photograph courtesy of Rashmi Ranade)

Though most of the tambats do *matharkam*, a few of them are known to excel in their ability to create an extremely dense and uniform hammertone texture on the surface of the products. It is critical that the rows of indentations are parallel to the top and bottom edges of the carafe and evenly hammered without deforming the product's overall shape. Doing this requires deep knowledge of the material, familiarity with the tools, significant strength, and years of practice. In other words, it takes a lot of skill to do *matharkam* well. The carafe is positioned on the *kharvai*, held in place with toes of both feet, indexed (rotated) ever so slightly with one hand and hammered with the other, row after row, until the entire surface is fully covered with the burnished marks. Sadashiv Apte, one of the most skilled craftsmen in *tambat ali*, has over thirty years of experience doing this work, and has a unique gestural technique of *matharkam*. The dimpled marks on the copper between his toes and under his hammer spill out with remarkable fluidity on everything he makes. His arm does not descend vertically down on to the surface of the copper; he moves his right arm in a fluid ellipsoidal motion striking the metal almost in a swiping action, indenting the surface while simultaneously burnishing it. Once the hammertone is created, the product is cleaned again, buffed, and the outer surface brushed on with a clear coat of polyurethane lacquer to protect it from corrosion. The inner walls are untreated so that pure copper can come in contact with and transfer its *guna* to the water filled into the carafe.

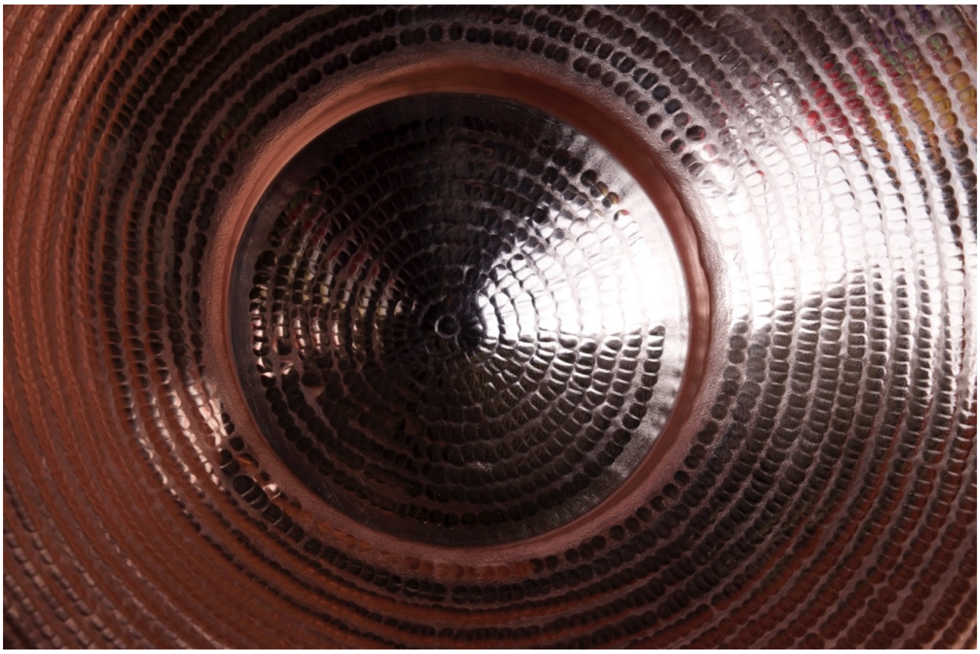

Figure 3.30: Hammertone texture on a *ghangal* (Photograph by the author)

The various definitions of skill in the literature tend to focus on notions of practice and experience, attention and concentration, and embodied knowledge of materials and more. For Sennett, it is very simply “trained practice” which contrasts “sudden inspiration” (2008, p. 37); for Marchand it is explained in terms of “attention, discernment, and movement” (2016, p. 10); and for Law, it is “embodied knowledge of technical process” (2016, p. 97). Clearly, all of these are essential for *tambats* to be able to do the work they do. However, these are not the only conditions that lead to the development of skill. The place where the *tambats* do their work and the presence (and therefore guidance and support) of other *tambats* with whom they work are also critical factors that shape skill. Critical to the development of skill is also opportunity. Recognising an opportunity to be able to create something, seeing potential, and being afforded the possibility of realising it are also essential factors in building skill.

Chittra Bajpai, co-founder and director of finance and operations for Atelier Metalworks talks about the time when she went to *tambat ali* and met the craftspeople for the first time. Having previously worked as a managing director in a company, she had experience running a factory and overseeing production routines. Therefore, she had ideas in her mind of improvements she thought the *tambats* could make to their process. Bajpai says when she first went to *tambat ali* and saw the craftspersons working, "I started giving my opinion… one of them said, I don't remember who it was… I think it was Sadashiv… he said, you sit here and do this beating work, and once you've that correctly, you can advise, otherwise don't." The cutting retort to Bajpai's suggestion is indicative of the *tambat* sense of confidence the designers often speak about. While the *tambats* are clearly aware that it takes tremendous skill to do the work they do, the phrase "skill", which in Marathi translates as *kaushalya*, is never heard in *tambat ali*. When referring to someone who may be particularly skilled in *matharkam*, the *tambats* may say "this is art", or that "not everyone can do it like this". Though it is evident that the object with its striking precision of the hammered dimples is only possible for a skilled *tambat* to make, the skill itself is not spoken of in the community.

This is not unusual in craft communities as Clifford Collard discovers with weavers in a community workshop in Ghana. Skill is "like the ground that supports our feet beneath us, taken for granted" (Collard, 2016, p. 160). This raises the question of where *tambat* skill actually resides; while the object clearly emerges from and exhibits skill, the skill itself is invisible. For Ingold, skill "is a property not of the individual human body as a biophysical entity, a thing-in-itself, but of the total field of relations constituted by the presence of the organism-person, indissolubly body and mind, in a richly structured environment" (2000, p. 353). It is undeniable that body and mind as well as the environment and place are essential in development and expression of skill. While Ingold's definition is expansive in its reach and includes "a field of relations", it still is focused on the individual craftsperson. However, in *tambat ali*, while skill is expressed in individual techniques of the body, its foundation relies on a broader enclosing of relations that also includes other *tambats*. As we have seen with the making of the *bamba*, the *tambats* engage with material, and also with each other; knowledge is embodied, and it is shared. As Bunn explains, "it is not merely the environment that shapes solutions to the problems of its inhabitant, nor the inhabitants in social interaction alone, but rather solutions are found through our engagement in skill *with* the environment and *with* one another" (2016, p. 143, emphases in original).

In addition to imparting a unique sense of beauty to the product, the process of hammering serves another important role. It strengthens the material, and the texture plays a role in hiding defects and flaws on the surface. As we have seen earlier, copper's unique properties prevent it from vanishing once it is transformed into a thing. In addition to the material, the hammertone texture highlights what copper can do, and in this process, it works as an agent in preventing the material from disappearing into the thing. Copper transforms through the mechanical processes to which it is subjected, but it does not lose its identity. The *tambats*, through their techniques, amplify those properties of copper that are unique to its materiality in the objects they make. *Tambat* skill, though visible in individual technical actions, is founded in shared, embodied knowledge.

3.8 Conclusion

This chapter, with its focus on production, showcased the techniques employed by the *tambats* in making objects that demonstrate their unique skill, collaborations with other *tambats* and designers, and deep knowledge of material, tools, and process. The techniques of the *tambats* though, should not be perceived as purely material; they are, as Lemonnier reminds us, "first and foremost social productions" (1993, p. 3). It was evident in the *chaîne opératoire* of the *bamba* that people, materials, tools, instruments, mental actions, bodily gestures, places, energies, etc. work together cohesively and compatibly in order for the object to emerge. In this process, the materials which the *tambats* use interact with each other in arresting as well as accelerating the flow of the technical actions in a form of temporal efficacy. *Tambat* skills are grounded in and emerge from their relations to other *tambats*, to the designers, to place, and the world of materials in which they are immersed. The *chaîne opératoire* reveals the significance of the sensoriality of materials, the embodiment of knowledge, the rhythmic nature of the phases of operations, and the critical need for the *tambats* to work together.

Chapter 4 that follows will focus on place, where copper's transformative materiality is seen playing out in the workshops, design studios, and the marketplace through which this material travels.

Chapter 4
Place: The Workshops, Market, and Design Studio

4.1 Introduction

While in the previous chapter we examined the techniques of production by which the *tambats* transform copper, this chapter focuses on place, the environments where these transformations take place. The presence of the *tambats* has given this place a unique identity that is marked by the brilliance of the material and the rhythmic sounds of work. The goal of this chapter is to offer a description and analysis of the neighbourhood, streets, workshops, studios, and markets where the work done by the *tambats* is made visible, audible, and tangible during processes of design, making, exhibiting, and selling; and how these transactional relations among people, place, and products help in assembling a sense of community. I will describe how each of the spaces has been created and used in order to enable the kinds of material flows and transactions that are part and parcel of life here. In these places, the *tambats* live and work with each other, engage external designers, interact with copper as well as other substances, and wield a variety of tools and machines in creating not only artefacts of labour, but also their society, the Twashta Kasar Samaj.

From raw material (unworked sheets of metal) to finished product (packaged goods ready for the market), copper travels through these spaces in a variety of forms. The locations through which the *tambats* and their *tamba* travel may be imagined as *places of assembling*, where the transactional relations between people, materials, energies, and ideas unfold. The practice of assembling serves as an appropriate metaphor and a dynamic lens through which to understand place. Here, I suggest that we consider *assembling*—imagined as a verb and not a noun—instead of assemblage (DeLanda, 2006; Dovey 2009; Deleuze and Guattari, 1987). This also extends the notion of the place from being a container performing the functions of containing (Aristotle 1999, Casey 2000) into an active place of *assembling*, thereby foregrounding the actions and transactions that activate social life in *tambat ali* and its environs.

4.1.1 Space and Place as Location of Culture

The critical examination of the meanings of landscapes, cities, homes, workplaces, and in-between spaces has a long history in anthropological research, and this field of study has borrowed from philosophy, cultural geography, political theory, art history, and psychology. Anthropological studies have highlighted the significance of space and place to human culture, suggesting that people's living environments are an essential part of their social life (Durkheim, 1965; Mauss, 1979). Anthropologists have also recognized that the meaning of place cannot be reduced to a certain location. Not only do we move, migrate, and travel through spaces, but place itself is a transportable and flexible concept that cannot be pinned to a single location on a map (Appadurai, 1988; Jiménez, 2003; Rodman, 1985). Therefore, space has been conceptualized as embodied and not static, able to be located physically but also able to be transported (Low, 2016; Low & Lawrence-Zuñiga, 2003). Anthropologist Setha Low has created a conceptual framework that she calls "spatializing culture", describing it as an approach that brings together "aspects of the material setting with the phenomenological and symbolic experience" of place (2016, p. 7). She suggests that it is

Heidegger's work on dwelling—which he describes as the human activity of place-making through building and thinking—that lays the foundation for understanding place as the basis of human ontology (Heidegger, 2001; Low, 2016). Ingold further builds upon Heidegger's notion of dwelling by focusing on the activities, skills, movements, and practices of the body as it inhabits a place. "The forms people build, whether in the imagination or on the ground, arise within the current of their involved activity, in the specific relational contexts of their practical engagement with their surroundings" (Ingold, 2000, p. 186). While there is indeed a direct involvement between bodies, minds, and the environments in which they exist, it is not an essential condition for what people do and build. While human imagination draws from its surroundings, it is also capable of transcending it, especially during acts of creation. *Tambat ali* is a place of design, creativity, and innovation, and people who live and work here are inspired by much more than the structures of their tradition or the immediate geography of their surroundings.

"Space is often defined by an abstract scientific, mathematical, or measurable conception while place refers to the elaborated cultural meanings people invest in or attach to a specific site or locale" (Lawrence-Zuniga, 2017, para. 1). It is difficult to make a reasonable distinction between space and place based upon this description, as there truly is no environment, indoor or outdoor, open or occupied, large or small, unbuilt or built, rural, urban or suburban, that may be considered devoid of cultural meanings. It is in these places that persons, objects, ideas, memories, and meanings assemble, and it is here that people's lived experiences unfold. Phenomenology, which focuses on consciousness and direct experience, has served as a philosophical foundation in theorising place, suggesting that "the body is the primary locus of being, and that continual engagement between body and environment produces an ongoing sense of place" (Marchand, 2018, p. 10). The body engages the environment as it moves through it, experiencing it through all its senses, creating meaning, and building memories along the way. Merleau-Ponty describes the body as phenomenal rather than objective, and it is through the senses that our existence is grounded in the experience of the world (1978). Bateson extends this notion to include the mind in addition to the body in its experience of place; and in doing so, blurs the divide between mind and body in a phenomenological understanding of place (1979). In his Marxist critique of power in the built environment, Foucault discusses how specific types of spaces created by architectural and engineering forces can control, transform, and change human behaviour (1997). Foucault's concept of heterotopia—real spaces of crisis and deviation that may be found in all cultures—has been used in the analysis of a variety of environments including craft traditions in India, which are presented as utopian imaginations that are actualised and sustained through social engagements between elite and marginalised communities (Venkatesan, 2009). De Certeau also places an emphasis on power and the politics of place, in an explanation of how the body behaves in place with tactics that contravene and contradict structures of power put in place by institutional strategies (1984). While the focus of much of the discussion has been on how place is experienced by individual bodies, it is important to recognise that the world is also experienced relationally through sharing and social engagement with other bodies (Schütz, 1976). For Ingold, places are delineated by movement, but not by any of its outer limits. By conjuring images of wayfaring and paths of travel, Ingold builds an activity-based understanding of place, where inhabitants are guided by memories and knowledge (2011). As a place, *tambat ali* is a collection of neighbourhoods, streets, verandas, workshops that enable and support transactional relations among the people and the products, and in this process, they help in assembling a sense of community.

Scholarship generated by the French social theorists on space and place emphasizes the role of power and political control (Bourdieu, 1977; Deleuze & Guattari, 1987; Foucault, 1972). Bourdieu's concept of habitus refers to our habits, skills, inclinations, and their role in shaping our perception of the world around us as well as how we act in it. His notion of social space attempts to explain how groups conceptualize themselves and take form in society (1972, 1977). For him, physical space is "reified social space" (Bourdieu, 1997, p. 134). For Foucault, power and control are expressed through space, architecture, and politics, and these forms work together in subjugating people (1975). Deleuze and Guattari (1987) focus on how people create resistance to structures of power and discipline in their own ways through mobility, spontaneity, and forms of political action. In studies of everyday life, where the examination of routines of working, living, thinking, and doing is paramount, space is theorized as embodied with meaning, and as actively participating in the production of social life (Lefebvre, 1991). In addition, individuals and groups are presented as agents who, through their "ways of operating" in the world create and recreate appropriate spaces (de Certeau, 1984, p. xiv). Power, in this case, is enacted by people through countertactics that they deploy as a form of resistance and contestation of the powerful strategies of government.

Moore (1986) builds on Bourdieu's theory of practice to explain how spaces take on gendered meanings. While men and women may operate on similar cultural models, their positionalities lead to different interpretations, effectively gendering them. This focus on the gender of the individual experiencing place raises the need to recognize the importance of voice and multiplicity of meaning. Rodman, in her work in Vanuatu, presents notions of multivocality, multilocality, and polysemy, concepts that accommodate multiple points of view as well as the connection between places (1992). She offers multilocality as a means of actualizing Nancy Munn's call to construct "regional worlds in experience" (1990, p. 1). In other words, instead of accepting Western creations of place, anthropology should amplify voices, meanings, and experiences of the people who actually live in these places.

Places have also been studied by anthropologists from the perspective of the sensory experiences they afford, including sound, smell, and touch. Roseman (199) and Feld (2012) have explored the role of sound and acoustics in people's relationship with the environment in which they live and work. As we shall see later in the chapter, it is sound that circumscribes *tambat ali* more than anything else. In the archaeological analysis of place, it is often landscape that is discussed, perhaps in more expansive ways than space or place. Tilley sees landscapes as "relational places linked by paths, movements and narratives", a system that produces social relations and a "cultural code for living" (1994, p. 34). This notion is further developed in the examination of landscapes in terms of values, memories, and identity (Stewart & Strathern, 2003). Understanding human experience in the built environment requires an examination of materiality of place, and therefore a study of architecture, construction technologies, buildings, etc. also falls within the realm of the analysis of place (Buchli, 2013; Marchand, 2018). When place is examined from a material culture lens, it foregrounds the role that architecture, design, and the built form in all their diversity and variety play in making people and society. The layouts of the *tambat* workshops with their living spaces, verandas, open courtyards, and closed storerooms demonstrate how they serve the community in building memories, sharing knowledge, and passing on traditions of making from generation to generation.

It is clear that the critical examination of place is a multidisciplinary, fragmented effort in which individual and disciplinary groups of scholars focus on specific approaches to understanding the physical and social dimensions of the environment in which we live.

4.1.2 Place as Containing

For Aristotle, place is "a kind of surface, and as it were a vessel, i.e., a container of the thing"; and he further describes it as the "innermost motionless boundary of what contains" (Casey, 2000, p. 184). As a boundary surface, place contains the thing in a tight embrace within it such that the outermost boundary of the thing is coincident with its innermost surface. Aristotle's metaphors of containers, tight fits, and motionless boundaries suggest places that are fortresses and gated communities with impermeable and unscalable walls, prisons from where no departure is possible. *Tambat ali*, however, is not such a place. It is an urban area which is not clearly demarcated by boundaries or walls. The *tambat* workshops are scattered across this densely populated area among a loose collection of row houses, temples, shops, gymnasiums, schools, courtyards, trees, open spaces, and wells accessible by narrow streets and even narrower alleyways, some which one can only reach on foot. You are likely to easily walk in and out of *tambat ali* and not even know whether you are inside or outside. It is not a place that is contained; it is a place that seeps and stretches into the broader region of Kasba Peth. Its perimeter is not circumscribed by walls, but instead by sound; it is when you can no longer hear the rhythmic beating of the hammers is when you know you have left *tambat ali*.

4.2 Pune, Kasba Peth, *Tambat Ali*

With a population of over three million residents, the city of Pune in the state of Maharashtra is featured in the list of the top ten largest cities in India.

Figure 4.1: India and the city of Pune in the state of Maharashtra
(Survey of India, Department of Science and Technology, Government of India)

Copper plate inscriptions found in the region appear to be from 758 CE, and they suggest that early settlements around Pune trace back to the 8th century and the rule of Rashtrakuta king, Krishna I (Kantak, 1990). The Rashtrakutas were followed by the rulers of the Yadava dynasty from the 9th century until early 1300s, and the Khalji and Tughlaq dynasties from 1317 until the 1600s (Mahajan, 2000; Munde, et. al., 2017). During the Maratha empire that followed, Pune grew in size and significance until the early 1800s. In 1818, the Marathas lost the Battle of Khadki fought with the East India Company, and Pune fell under British rule. After India's independence in 1947 and the establishment of the Pune Municipal Corporation in 1951, the city has seen enormous growth and rapid industrialisation. However, the centre of the city—the old part of Pune—has remained unchanged in many ways.

4.2.1 Kasba Peth

The word *peth* in Marathi refers to ward or a region in the city, and eighteen such areas were created in Pune by the Peshwas who ruled from 1713 to 1817 during the Maratha empire. Kasba Peth is the oldest and perhaps the busiest of these eighteen wards. "The earliest *peth*, as also the earliest settlement, began to be called Kasba from the thirteenth century. A very crowded *peth*, it grew slowly after 1765 when it had 923 houses; in 1819, during the first British census, it had 1048 houses" (Diddee & Gupta, 2003, p. 111). These *peths* were organized with the purpose of encouraging economic growth and development, with an emphasis on artisan trade. Communities of tradespersons and craftspeople emigrated to the *peths* from surrounding areas, bringing with them their unique professions, skills, and cultures of making to the city. Over time, each of the *peths* developed their own character, each tightly packed with homes, shops, marketplaces, manufacturing facilities, temples, and outdoor gathering spaces. For example, Bhavani Peth houses many timber and steel traders, Raviwar Peth's *Bohri Ali* is famous for hardware stores, and nestled within Kasba Peth's tight streets are *shimpi ali* (tailor alley), *kumbhar wada* (potter area), *bhoi ali* (fisherpersons' alley) and of course, *tambat ali*.

4.2.2 *Tambat Ali*

Tambat ali is distinctly recognizable for its labyrinthine network of narrow alleys that periodically widen up into open *chowks* (street intersections), *pars* (stone platforms around trees for social gatherings), and unbroken lines of aging one and two-storey, wood and brick row houses. On many of the houses, the columns, beams, windows, and doors visible from the street level appear to be made of solid teakwood, in some cases covered in blue, yellow, or green paint that was once vibrant but is now fading and peeling off. The plastered walls too were once painted in primary colours, but they have softened and dulled over the years. The plaster is crumbling away in some places, exposing the brick-and-mortar underneath. The second floors on most of the buildings have wrought iron balconies supported by brackets, some of which are made of intricately carved teak. The roofs are corrugated and galvanized steel, many layered with blue tarp and held down with large rocks. Several of the houses are on raised plinths, a grim reminder of the devastating flood waters that rushed through the city when the nearby Panshet dam burst in 1961. Walking through *tambat ali*, one also encounters newer buildings. Many of the *tambats* who live here still maintain their workshops in the older buildings, but have moved their families to newer apartments nearby.

Figure 4.2: A street in Kasba Peth (Photograph by the author)

Traditionally, the living and working quarters of the *tambats* were either adjacent to each other or on different floors. However, as these traditional homes started getting older and unable to be outfitted with newer amenities, living quarters were converted into storage rooms for copper sheets, coal, other raw material, and tools. Several *tambats* continue to work in these spaces through the day, but they go home to the newer apartments at night.

4.2.3 The Workshops

The rhythmic and clanging sound of hammers striking metal drifts up from the workshops of the *tambats* and seems to get louder and quieter as one meanders through *tambat ali* because there are five pockets distributed across the area where small clusters of coppersmiths work together, some out on the street outside their workshops and some indoors. These workshops are called Bakkhal, Vangewadi, Dakhwe Wada, Palekar's workshop, and Bajirao Karulkar's workshop. Of these five, Bakkhal and Vangewadi are the largest with approximately twenty craftspersons in the former and fifteen in the latter. The other locations house ten or fewer *tambats*. A few other smaller workshops are scattered across Kasba Peth.

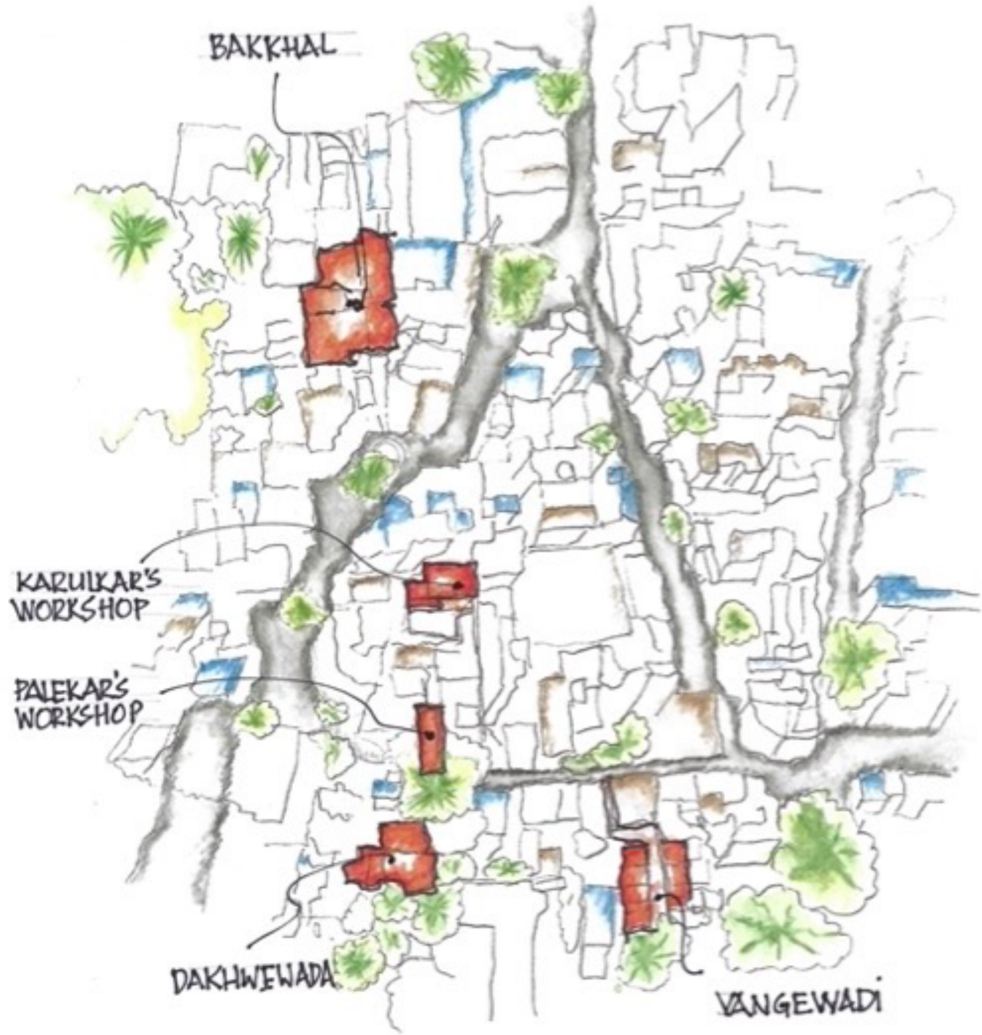

Figure 4.3: Locations of copper workshops in *tambat ali*, Kasba Peth
(Sketch by the author, based on an image from Google Earth)

In his discussion of the relationship between place and memory, Casey lists three forms: horizon, pathways, and things (2000). "And as horizons and pathways delineate movements in places, so things bring about fixation and focus there" (Casey 2000, p. 204). These three elements serve the functions of defining the nature of place, circumscribing movements through it, and attending to the features that are unique to it. Walking through *tambat ali*, it is the pathways that first grab one's attention. Navigating between the various workshops requires ducking in and out of narrow alleys, some of which are almost hidden among the densely packed buildings of the neighbourhood. The roads that lead from workshop to workshop branch quickly from being just wide enough for cars to drive by each other to slim walkways through which only one person can pass at a time.

Figure 4.4: Road in *tambat ali* between workshops (Photograph by author)

Everything is close by, and the near presence of the built structures affords very little sense of distance. The horizon—if imagined as the boundary between earth and sky that we see in expansive landscapes—is nowhere to be seen; this is predominantly a vertical world. While Casey does suggest the notion of internal horizons created by the immediate limits of the smaller, inside spaces, it is pathways and things that dominate the feeling of space in *tambat ali*. The sense of closeness is enhanced by the density of things. Edges of roads are often crammed with parked bicycles, scooters, motorcycles, and rickshaws, making them narrower than they actually are. Smaller alleys that lead into the workshops also have vehicles, potted plants, clotheslines, and a variety of copper things laid out to dry. As one walks into the workshops, the compactness of spaces increases, the density of things rises, and the profusion of vehicles and other outdoor things seen on the roads gives way to an abundance of materials, tools, and products. Visitors are invited to walk right into the workshops and the *tambats* gladly and proudly talk about their work. There isn't a counter or desk beyond which one may not pass into the inner sanctum. These are open spaces through which the *tambats*, their family members, designers, and visitors walk through freely.

Figure 4.5: Alley leading to Vangewadi (Photograph by the author)

For decades, it is in these workshops that *tambat* knowledge has been created, shared, and passed on to the next generation. The architecture of these spaces enables the apprenticeship model, making it possible for the children of the coppersmiths to observe, learn, and participate in the making of the products.

When he was a boy, Bajirao Karulkar's father owned a factory where *bamba* were made. He remembers taking on simple tasks like working the bellows of the furnace, washing components with water, and helping some of the other *tambats* who would at times give him a little pocket money for his efforts. Younger children typically helped in simpler tasks that required no tools, and as they got older they started to take on additional responsibilities and learning more complex processes. *Tambat* knowledge is embodied, and through observation and practice, it is passed on through generations. And these experiences of starting small, failing and repeating, learning, and perfecting—all means by which the *tambats* achieve their skill—unfold in specific places and over time. "As embodied existence opens onto place, indeed takes *place in place* (italics in original) and nowhere else, so our memory of what we experience in place is likewise place-specific: it is bound to place" (Casey, 2000, p. 182). The *tambats* carry with themselves, in their minds and bodies, the memory of places through which they move and the things with which they interact. They traverse between rooms, through passageways, up and down stairs, inside and outside, with a sense of confidence and fluidity that can emerge only from years of familiarity. These places have been deeply imprinted on their minds and bodies. When I first walked around here ducking in and out of workshops, I found myself hesitating, pausing, getting lost, backtracking, and going around in circles, often unsure of which way to turn or where to go. Over the years as my familiarity grew, I too started to sense some of the fluidity of navigating through these spaces that seemed so natural to the *tambats*.

4.2.3.1 Bakkhal

Bakkhal (which in Marathi refers to an open space) is a settlement developed on land owned by the community's social organization called the Twashta Kasar Samaj, for use by the *tambats* for workshops and residences. The idea of the Bakkhal dates back to 1906, when the notion of creating this special location for *tambat* work and life was floated by the community. The *tambats* had expressed a need for housing, and at the same time, there was need for a location somewhat removed from the dense population of Kasba Peth as this is a noisy occupation. The community owned this piece of land, and a building fund was raised to start the process of construction. A pamphlet was published in 1938, and to obtain financial aid, members of the committee engaged in a door-to-door fundraising campaign. They requested all caste members to cooperate, to recognize the importance and significance of the work, and render every bit of help possible to build on this site. Once sufficient funds were collected, the foundation was laid and construction started in 1940. The appearance of the Bakkhal has not changed much since, though its use has evolved over time. One of the entrances is through a dark, narrow, and winding path that opens up into an open, square, central courtyard with individual workshops organized around the periphery.

Like other buildings in Kasba Peth and *tambat ali*, the Bakkhal is a teak and brick construction with plastered and painted walls. And as with other structures, this too is in some state of disrepair. When it was first established, there were more than forty craftspersons working and living in this location, and today, there are about twenty of them actively continuing to work here, with less than five families that continue to live here now. Most of the structures are single level, but five residences are built on the second level. In its early days, each of the *tambats* had a one-room residence with an open veranda in the front where they did the work; but many of the living spaces are now converted into storage rooms. Activities such as cutting, heating, shaping, and hammering the copper continue in the open veranda in front of the single rooms or out on the street.

In the centre of the courtyard is a water tank with several taps on which the *tambats* rely to clean tools, wash the products being made, and dilute acids used in the process. This is also where women from the families who still live there wash their clothes and utensils. The tiled pathway that runs around the water tank also serves as storage for plastic buckets and containers, sacks of coal and other raw materials, rags used in cleaning, and several of their bigger tools. Large copper utensils from restaurants that are often brought for repair and re-tinning are also stored here.

Figure 4.6: Bakkhal (Photograph by the author)

One of the primary products manufactured in Bakkhal is the *bamba*, but a variety of other products, including some designed by local designers are made here as well. While most of the work involves copper, a few of the *tambats* also do embossing and repoussé work in silver and gold.

Figure 4.7: A copper craftsman making utensils for water storage in Bakkhal (Photograph by the author)

4.2.3.2 Vangewadi

While Bakkhal is organized around an open courtyard, Vangewadi is structured in a linear fashion along a central open artery, with workshops on both sides. Fifteen *tambats* own workshops in Vangewadi, and they do a variety of work, shaping and hammering new utensils and fixing or repairing old copper and brass containers. Here too, as in Bakkhal, some of the *tambats* (like Yashwant Pansare) do embossing and repoussé work on copper, brass, silver, and other metals. The structures here are primarily made of wood and brick, and have corrugated sheet metal roofs. The central passage serves not only as a pathway through Vangewadi, but also as a place for storing raw materials, rags, sacks of coals, vats of chemicals, and newly made products. The *tambats* work in the open verandas and use the rooms behind them for storage.

Figure 4.8: Vangewadi (Photograph by Alex Velasco)

4.2.3.3 Dakhwe Wada

Dakhwe Wada, which has six craftspersons, is a small square cluster of open workshops with slender wooden columns and corrugated sheet metal roofing. These open workspaces have enclosed rooms on two sides which serve as residences. This area is owned by Sardar Sawant, who has leased the land to the *tambats* for their work, and therefore this workshop is also referred to as Sawant Wada.

Figure 4.9: Dakhwe Wada (Photograph by the author)

4.2.3.4 The Palekar Workshop

On the opposite side of the road that leads to Vangewadi and Dakhwe Wada is the Palekar workshop. Kapil Kapre, one of the elder statesmen of this community and once chair of the Twashta Kasar Samaj, and four other craftspersons work with Palekar in the workshop. Within this structure is a newer workshop set up by Murli Palekar, which is entirely indoors unlike some of the older spaces where the *tambats* work. The products made here include a wide range traditional utensils like *kalshi* and *ghangal* as well as new products like *masala dabbe* and votive lamps. Hira Palekar is Murli Palekar's wife, and she handles the workshop's financial matters, accounting, and contracts. Some of the work emerging from this workshop is shipped to several locations outside the city of Pune. The main workshop is a two-storey structure with one room per floor, each measuring 10 feet by 21 feet. The ground level room has spinning lathes, buffing machines, several manual tools, a furnace, and this is where much of the making of the basic components of the products happens. On the top floor is storage for finished goods, a lacquering station, as well as a meeting area, and that is where Hira Palekar, Murli Palekar, and Kapil Kapre work.

Figure 4.10: Murli Palekar's workshop (Photograph by Alex Velasco)

4.2.3.5 Bajirao Karulkar's Workshop

Seventh generation copper craftsman Bajirao Karulkar owns a workshop on the opposite side of the main street across from Dakhwe Wada and Vangewadi, and his family has been involved in this trade in this location for centuries. Over the past several years, many craftspersons have worked in Karulkar's workshop, including Nitin Karulkar, Sadashiv Apte, Govind Lele, and Anil Chauvhan. While Lele and Apte are experts in the process of hammering, Chauvhan focuses on metal spinning, and Karulkar (Nitin) performs a variety of tasks in the workshop including cutting, buffing, lacquering, annealing, etc. While Karulkar (Bajirao) takes on several custom projects involving the design and fabrication of temple finials, architectural installations, religious event decorations, furniture, and other products, Rane's products are also manufactured here. The workshop is on the ground floor, and Karulkar's family resides on the first and second floors above. There is a small office at the entrance to this workshop where client meetings are held. On the wall in this office is a framed photograph of Gagangiri Maharaj, a brass embossing of Ganesh (Karulkar's first attempt in doing repoussé work), and on the desk several albums of photographs of products, drawings, and a few copper artefacts. The main room behind the office is full of machines, partially finished products, moulds and dies, copper sheets, and an assortment of tools.

Figure 4.11: Bajirao Karulkar's workshop with a craftsman on the spinning lathe (Photograph by Alex Velasco)

The primary work being done in the room behind the office is metal spinning on two lathes. Much of the primary form-giving for the products being made here is done on these lathes. Adjacent to one of the lathes and against the wall is a shelf stacked with old wooden and steel dies and patterns. Next to the lathe is a grinding wheel used primarily for sharpening the tools used on the lathe. A shelf above holds an assortment of unique brass, copper, and bronze artefacts that Karulkar had collected over time. Hanging from the ceiling is a large read metal weighing balance, and next to it, on the floor, is a digital weighing scale. While the digital scale is the one used on a regular basis, it is the large metal balance that the *tambats* pray to during rituals. This older balance that no longer has utility value still has significant symbolic value. A few sacks of coal sit nearby, next to a small manual press used to give rough form to copper sheets that would then be converted into finished products on the lathes. The second lathe is on the opposite side of the room with bins of copper shavings and filings next to it. All metal remnants of processes of making are collected and stored in these bins for recycling.

4.2.3.6 Kawthicha Wada

Kawthicha Wada is a place that exists only in memory. This workshop, like Bakkhal described earlier, was a place where several *tambats* lived and worked. Architecturally, it had a similar structure—a series of single rooms for residential use with verandas in front where the *tambats* worked. Gajanan Palekar, who was born in Kawthicha Wada, remembers his father and grandfather doing *tambat* work when he was a child. He recalls his grandfather asking him why he went to school when he could easily pick up this skill and start earning money. And he also recalls his father telling him not to, and instead go to school to get formal education. Palekar followed his father's advice and got a bachelor's and master's degree in commerce. He recently retired after working as a general manager at Telco, a telecommunications company. He tells the story of the decline in copper work that he witnessed while growing up. As stainless-steel utensils and plastic containers started to enter kitchens, the need for copper and brass vessels started diminishing, leading to a significant drop in the amount of work for the *tambats*. As the shopkeepers saw a drop in the demand for copper products and were no longer able to sell the quantities the *tambats* were able to make, work started drying up. As the quantity of work in *tambat ali* dropped, many of the *tambats*, including Palekar's father, joined Bajaj Auto (which previously used to be Vespa of India), a manufacturer of scooters, motorcycles, and autorickshaws where their expertise in working with sheet metal could be useful. Incidentally, this is a company where I too worked briefly as an industrial designer.

Though the *tambats* were no longer doing copper work in these companies, they were using their experience with sheet metal to remove dents from scooter components. As a large number of the *tambats* started working at Bajaj Auto, Tata Motors, and other companies that needed sheet metal expertise, the need for workshop space dwindled, and Kawthicha Wada was demolished. In its place, an apartment building was constructed, and that is where Palekar still resides. "Recollection does not cease when there are no longer any traces of what is to be remembered, but draws its force from this absence" (Küchler, 1999, p. 59). At times, the force of absence that Küchler refers to can drive people to find ways by which to materialize memories, and Palekar has created a small exhibition of *tambat* products where Kawthicha Wada once stood.

Figure 4.12: Exhibition of *tambat* products by Gajanan Palekar
(Photograph by Girish Potfode)

4.3 Place as Assembling

“It is the stabilizing presence of place as a container of experiences that contributes so powerfully to its intrinsic memorability” (Casey, 2000, p. 186). In *tambat ali*, place does not only contain and stabilize; in fact, it also activates and assembles. As a *chaîne opératoire* (operational sequence) in Chapter 3 on production helped visualize, it is here that things like *bamba*, *ghangal*, and *pimpa* become what they are; it is here that components are assembled into products. And while place itself can be imagined as an assemblage (DeLanda, 2006; Deleuze & Guattari, 1987; Dovey, 2009), it is when we think of it as *assembling*, that it opens up new ways of thinking about how the whole is assembled from parts through interactions among them. When the *tambats* are making a *bamba*, they ensure that each of the components that need to be assembled together are designed and made with appropriately mating surfaces, interlocking edges and matching details, so that they may interact with each other and lead the way in the creation of a finished product. Their work involves the constant making and assembling of these parts that constitute the whole.

It is through these processes of making and assembling that the *tambats* are also assembling themselves and each other into their community, the Twashta Kasar Samaj. In their workshops, as they bend and shape copper sheets with their bare hands, as they bring their hammers down on the anvils, as they assemble components into finished products, they are becoming who they are—a community of skilled coppersmiths. As they gather around in their families to discuss whether the children will undertake formal education or learn *tambat* work, they are becoming *tambats*. As they assemble in the Kalika Devi temple for naming ceremonies of *tambat* children, as they gather together to create decorations for the Ganeshotsav (celebration of Ganesh), they are building community.

4.4 Memories of Place

"Through its active intentional arc, the lived body traces out the arena for the remembered scenes that inhere so steadfastly in particular places: the body's maneuvers and movements, imagined as well as actual, make room for remembering placed scenes in all of their complex composition" (Casey, 2000, p.189). Casey explains that the relationship between place and memory is realized "*through the lived body*" (italics in original). The place where Murli Palekar grew up in *tambat ali*, sketched in the architectural plan in Figure 4.13, is where he spent years watching and learning from his father and his uncles, picking up the skills he uses now, one hammer stroke at a time. That place is his workshop today. Memories of learnt gestures were created here; the transactions in which he has engaged since he started working occurred here; and the techniques of his body are practiced here. While several of Murli's lived experiences and memories were created over time, new ones are being continually added. This form of embodied, sensate knowledge is tied to this place. Not only are the memories complex in their composition, as Casey suggests, but these workshops themselves are also complex, dense, and compact environments where people, machines, materials, and products jostle each other and fill up the space.

The workshop, sketched in the architectural plan in Figure 4.13, shows the spaces on the ground floor along with their primary functions of working, storing, washing, heating, and residing. While Bala, Subash and Anil Palekar work in the rooms that are closer to the road, Murli's workshop is set further back. As is typical of architectural plans, the rectangular and rigid representations give a sense for overall areas and volumes of the rooms, and of the relative proximity between the spaces.

Architectural plans are often laid out on principles of orientation (north vs. south, east vs. west, front vs. back), rhythm (repetition of elements), balance (between spaces such as open and closed, or indoor and outdoor), symmetry (between features), proportion (relativity between spaces), scale (sizes of various spaces), white space (open and empty areas), and movement (flow through space). These architectonic principles often give no sense for how the spaces are lived and embodied; they do not show the nature of actions and transactions; and there are no representations of the flows and ebbs that occur between people, materials, things, and ideas in the spaces. This is an asocial representation of space, a collection of empty voids. And it is when we start imagining the activities of everyday life, the assembling that occurs here, memories and knowledges that are created and shared, that it starts appearing as place rather than space.

Bourdieu (1979) presents a plan similar to Figure 4.13 of the Kabyle House, identifying the walls, threshold and backdoor, as well as locations for all materials including food, water, equipment, and other supplies. He also orients the house in terms of oppositions: east-west, north-south, summer-winter, wet-dry, light-dark, and so on. Bourdieu sees these oppositions in the house as reflective of larger oppositions in the world. While the *tambat* workshop plan presented here does show some oppositions such as wet-dry, hot-cool, and light-dark, these do not seem to be the defining principles of the place, and neither are they representative of larger oppositional schema of their worlds. Instead, transactions that play out in these places involving the movement and exchange of materials, tools, objects, knowledge, and memories seem to be a lot more significant.

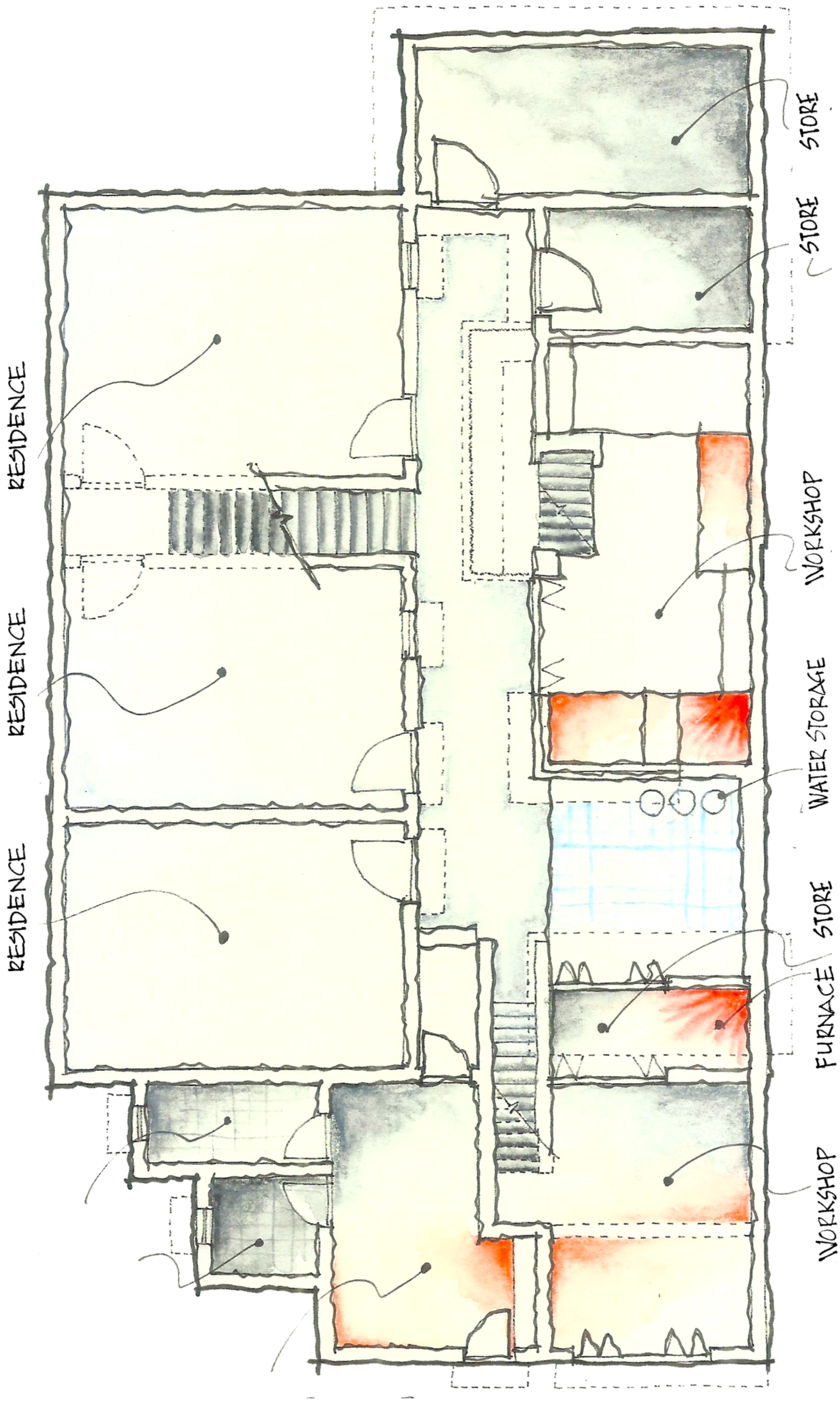

Figure 4.13: The Palekar workshop (Sketch by the author, with help from Priyanka Kengar and Manisha Boradkar)

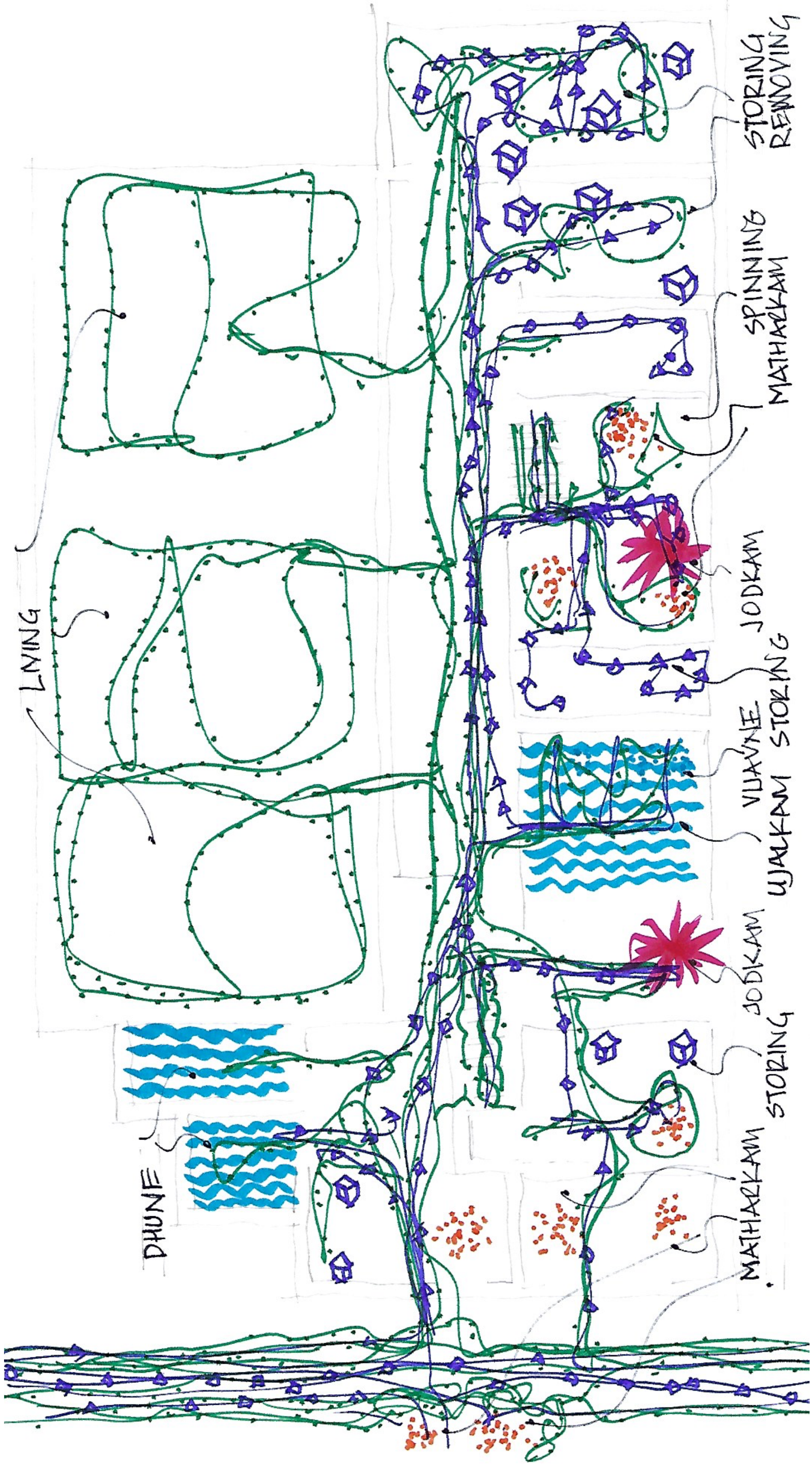

Figure 4.14: Murli Palekar's workshop activities (Sketch by the author)

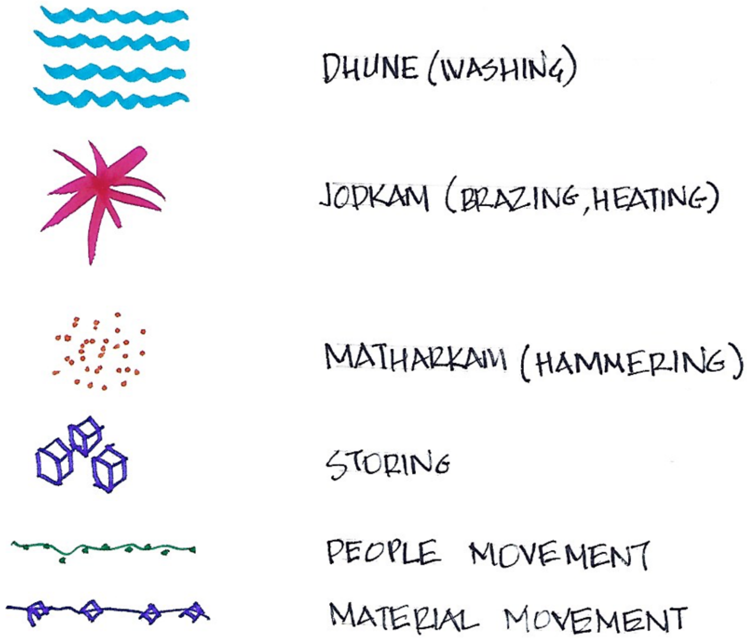

Figure 4.15: Legend for illustrative devices used in Figure 4.14

We can imagine a new set of principles that are based upon social, technical, and material activities of the *tambats*. These could be privacy (areas where visitors can enter freely and those where they cannot), openness (open to sky for light and air vs. roofed for protection), collaboration (areas to facilitate working together), exchange (locations where products, tools, money can change hands), temperature (locations for furnaces and heating copper vs. locations for cold water and quenching copper), moisture (places for washing and those for drying), storage (lockable areas for materials), display (places where objects can be demonstrated), and equipment (places where machine tools and hand tools can be situated). The working areas of several *tambats* are often in close proximity to each other; they work collaboratively, sharing knowledge and often passing components back and forth between them; and their work requires machine tools and manual tools, fire and water, as well as wetness and dryness. When these new sociomaterial principles are taken into account, we can re-present place diagrammatically in new ways and this becomes more appropriate to the *tambat* ways of working and living. Figure 4.14 focuses not on spatial representations of the rooms, but instead on the movements of people and materials, activities of the *tambats*,

A comparative analysis of the two diagrams makes it clear that they serve entirely different purposes. While the typical architectural diagram represents the space topographically where walls, stairwells, and doors are accurately represented, the sociotechnical diagram foregrounds the movement of materials, transactions between the *tambats*, and the technical actions critical to their work.

4.5 Placing Personhood

"Self and place-making involve use of artifacts and place-based stories in narrative constructions that delineate particular areas of intense familiarity that organize and make surroundings meaningful" (Hoey, 2010, p. 251). The *tambats* were invited to settle in Kasba Peth and undertake the work of creating artefacts from copper for the community; and this has become their home, their office, their workshop. The objects they make in these workshops, their *vastu*, are stories; they are plots that reveal the chain of events that they go through in their lifecycles alongside the lives of the *tambats*. It is therefore entirely understandable that they are attached to this place. It is in these homes and workshops that generations of *tambats* have lived and worked, built memories, created and shared embodied knowledge, and made the remarkable objects for which they are known. "Place attachment is the symbolic relationship formed by people giving culturally shared emotional/affective meanings to a particular space or piece of land that provides the basis for the individual's and group's understanding of and relation to the environment" (Low, 2016, p. 165). *Tambat* personhood is therefore not only tied to the material; it is also tied to place. These are dynamic places of imagination and creation, of collaborative relationships, of becoming rather than simply dwelling.

4.6 *Les Lieux des Chaînes Opératoires*

In his work on the techniques of production, Lemonnier identifies five components of the *chaîne opératoire*- tools, matter, gestures, knowledge, and energies (1992, pp. 5-6). The actions and transactions that activate these five components of the production process and are recorded in the *chaîne opératoire*, all unfold in specific places that are designed for the purpose they serve. The open space outside the workshop is demarcated for acid work and washing. A section of the hallway where a small wall has been constructed to prevent drafts of wind blowing in from the outside is the precise location where the furnace is situated. Tools are placed on shelves by the wall for convenience and easy access. The efficient production of *bamba*, *pimpa*, and other products relies on the notion of 'a place for everything and everything in its place'. The tools must be ready-at-hand when needed, not earlier and not later. If the *tambat* is forced to go searching for the tongs or the poker which with he needs to spin a *patta* (a component of the *bamba*) that has been placed on the furnace for brazing, the part is likely to overheat, distort, and get ruined. The *tambats* rely on their memory of place and the objects within it in order to make. During critical moments of production when technical choices are being made, anything that is 'out of place' can reduce efficacy, extend the time taken, delay deliveries of goods, and increase cost. This does not mean that everything in the *tambat* workshops is neatly arranged, situated on a grid, and organized in perfect rectilinear rows and columns. The workshops look chaotic rather than ordered, messy rather than clean, unorganized rather than organized. However, it is their memory of place that aids them here. Introducing a sixth component—place—to Lemonnier's five can help add detail to the process, assist in uncovering *where* (in addition to how) critical choices are made, and better visualize the *chaîne opératoire*, not only temporally but topographically as well.

4.7 The Shops

Every evening, when Govind Kapre has finished making his daily production of the *pimpa*, *ghangal*, and other products, he loads them up on his motorcycle and drops them off at one of the stores in Shukrawar Peth or Raviwar Peth. Both these *peths* are busy areas in the heart of the city of Pune, not too far from Kasba Peth and *tambat ali*, and have locally owned shops, commercial establishments, public places like temples, and residences.

Figure 4.16: A shop selling copper utensils in Shukrawar Peth
(Photograph by Nandkishor Gaikwad)

Not unlike Kasba Peth, both these *peths* are older areas of the city where streets tend to be somewhat narrow with several narrower branching alleys, and older *wadas* co-exist with new apartment buildings. In both *peths*, commercial activity is thriving, and most shops that sell copper and brassware are located here, but only a very few of them are owned by the *tambats*. The *tambats* say that a majority of the shops are owned by Marwaris, a term that is used very loosely for a migrant trading community originally from the Marwar region of the state of Rajasthan. These shops are rather small in footprint, many less than 30 by 15 feet (approximately 10 m by 5 meters) in total area. Goods are stacked floor to ceiling on tightly packed shelves, and when space is insufficient, several products spill out into the streets. The new copper products sold here that are made in *tambat ali* are not packaged in carboard boxes but simply placed in plastic bags to prevent moisture from getting to them. Older copper and brass utensils are often stacked up without protective packaging or covering of any kind.

Figure 4.17: Copperware, brassware and other goods in a shop in Raviwar Peth (Photograph by Nandkishor Gaikwad)

The Marathi word for shopping areas is *baajaar*, which like bazaar, is derived from Persian. While the *baajaar* in Raviwar Peth and Shukrawar Peth has shops that sell copper products, there is a tremendous diversity of goods sold here that includes plastic things, gold and silver jewellery, clothing, food, and so on. Foot traffic is heavy on these roads, and street corners, shop fronts, as well as footpaths serve as meeting places for groups of people. These areas perform a social role that often supersedes their economic function. People here shop in groups, stop to eat street food, and often sit in small clusters on scooters and motorcycles parked closely together. “The bazaar thus stands for much more than just a place of economic exchange... The prevalence and significance of bazaars articulate the vitality of material life that has long been a part of Indian culture, well before the advent of colonial or even global capital” (Sen, 2015, p. 19).

The shops line both sides of the streets, with footpaths and parking spaces separating the storefronts from vehicular traffic. The layout of these shops is linear, and quite different from the radially laid out rural marketplace described by Gell of the Dhorai market in Bastar, India (1982). The Dhorai market, a seasonal gathering is organised in concentric circles and zones, which geographically reproduce the social system of the caste hierarchy. The higher castes are in the centre selling jewellery and luxury goods, whereas the tribal groups sell cloth and utilitarian craft items along the outer circles. “This hierarchy of people is correlated with a hierarchy of goods” (Gell 1982, p. 480). Such a distribution is not visible in the urban marketplace where the *tambat* goods are sold. Jewellery stores are right next to food stalls, which may share a wall with a store selling cloth. In addition, some of the jewellers carry copper products made by Bajirao Karulkar in *tambat ali*.

In the analysis of bazaars (which one may refer to as traditional, often open-air markets based on informal economies), Clifford Geertz’s analysis of the markets of Sefrou is well known. For him, the bazaar is deceitful, full of ignorance, and a place where men want to “buy cheap and sell dear” (Geertz, 1979, p. 29). He further goes on to describe it as “a distinctive system of social relationships centering around the production and consumption of goods and services (i.e., a particular kind of economy)” (Geertz, 1979, p. 125).

The partnership between the *tambats* and the traders is one that is historically established and goes back several generations, and it is certainly a distinctive system of social relationships. However, though it is often seen as unequal and more favourable to the shopkeepers by the *tambats*, it is certainly not one of ignorance. The *tambats* are aware of how it works, they know the expectations that are made of them, and they are cognizant of how they are paid. Material is received by weight and finished goods are paid for by weight. This works in favour of the shopkeepers if the product is small but intricate, and therefore involving more skill and labour; however, if it is a heavy item that does not take too long to make, it can be beneficial to the *tambats*. In addition, old utensils that the shopkeepers want fixed can fetch the *tambats* larger sums of money. When the shopkeepers sell these new and refurbished items to consumers, the prices too are based upon weight; and while they may vary from store to store, the differences are not large.

While pointing out the unique qualities of the Moroccan market system, Geertz does see similarities with bazaar economies in other parts of the world, including India. The shopkeepers in Raviwar Peth and Shukrawar Peth who sell *tambat* goods have two sets of relationships of exchange. They engage in an economic and material exchange of raw material and finished goods with the *tambats*, and a similar exchange occurs with consumers who buy products from their stores. Some of Geertz's observations from the *souq* can apply to the relations between the *tambats* and the shopkeepers. "A finely drawn division of labor and a sharp localization of markets, inhomogeneity of products and intensive price bargaining, extreme fractionalization of transactions and stable clientship ties between buyers and sellers, itinerant trading and extensive traditionalization of occupation in ascriptive terms do not just co-occur: They imply one another" (Geertz, 1979, p. 125). If in this case we imagine the *tambats* as sellers of what they make and the shopkeepers as buyers, most of Geertz's insights regarding roles and division of labour, the lack of standardization of the goods (as they are handcrafted, each item is uniquely distinct), and the clearly defined roles ascribed to both groups based on their occupational heritage, do apply. However, the exchange between the *tambats* and the shopkeepers is not itinerant and neither does one see large price negotiations and bargaining efforts. What is unique about the system is that it is based upon the notion of material evaluation rather than an assessment of skill. The exchange of money depends upon the weight of the copper, not on the intricacy of the work or the labour time involved. The shopkeepers do not conduct quality control inspections, which is partially an expression of trust in the work of the *tambats*, and partially a lack of interest in their skill.

While the shops where *tambat* goods are sold have some similarities to these traditional, informal bazaar economies, they also form and fit within a part of a larger capitalist structure of the Indian market. "The term 'market' generally refers to the broader institutions and mechanisms that facilitate the exchange of commodities between buyers and sellers" (Endres, 2018, p. 1). Endres makes a differentiation between markets and marketplaces, referring to the latter as those that are spatially bound to a specific location, as we see here. In his analysis, economic anthropologist Karl Polanyi (1945) proposed that markets cannot be understood primarily in economic terms; they need to be considered in social and political terms as well. He differentiates between two kinds of economies—formalist and substantive, the former based on abstract, universal laws of economic behaviour that unfold in a sort of a social vacuum, and the latter more contextually grounded in social relationships and cultural values rather than being based on a centralised economic system. Polanyi suggested that substantive economies were found primarily in pre-industrial societies, but the *tambat* economic system cannot be categorized in those terms. As we have seen before, copper is a global material with local presence. The *tambats* get their raw material either from materials suppliers in Mumbai, design houses, or local dealers. In all cases, the price they pay and what they get paid in return does depend upon how global commodity markets fix the price of the material. However, social relationships do play a role in how the *tambats* get their copper sheets, as access often depends upon relationships built over time. Debt and late payments are also negotiated in social terms. Therefore, the *tambat* exchange and trade of raw material, finished goods, and money can be considered a socioeconomic system with particularities figured out at the local level, but dependent upon global commodity exchange. In other words, their economic system can be seen as a hybrid version of formalism and substantivism.

While working with designers, the *tambats* get paid not by weight of copper worked, but instead by number of pieces made. In addition, the objects they make are not sold through the shops nearby but instead purchased directly by the designers. The products made in Bajirao Karulkar's workshop, Murli Palekar's workshop, and by *tambats* like Uddhav Kaka, Govind Waghmare, Govind Kapre, Arun Parulkar and others in collaboration with designer Rupali Rane are sold through the website of Atelier Metalworks all over India and also in the international market. We see in this situation that the system of economic exchange shifts from weight of the material to the skill of the maker, from copper to the coppersmith.

4.8 The Studio

Atelier Metalworks is a women-owned and managed design firm founded by Rupali Rane, who has been working with the *tambats* since 2005. She started this work initially by doing a few projects, but then established this firm in 2010. Atelier Metalworks has moved locations three times over the past few years, and had to give up the studio space due to economic hardships forced by the Covid pandemic and related lockdowns. The rent for their latest studio on Bhandarkar Road in Pune was high and with production levels as well as sales dropping dramatically since March of 2020, the company could no longer afford to have a dedicated space for design work. All employees of Atelier Metalworks started working remotely and rented a warehouse, primarily for quality checks and packaging of the products before they are shipped to buyers.

While the workshops of *tambat ali* and the marketplace where the products are sold are vibrant, busy, active spaces, the studio tends to be a quieter space. Instead of the tools, machines, acids, and large copper sheets seen in the workshops or heaps and stacks of products for sale seen in stores, the studio environment is minimal in occupancy, with computers, paper, and a few prototypes laying around. Before Atelier Metalworks had to give up its space, it also had a showroom and shop where the products designed by Rane and made by the *tambats* were sold. The showroom too was organized according to a design aesthetic that is markedly different from what one encounters in *tambat ali* or the shops in the city, in Raviwar Peth or Shukrawar Peth. The city shops sell an entirely different set of products (traditional items like *bamba*, *ghangal*, *kalshi*, etc.) than those found in the Atelier Metalworks showroom. While some of the traditional products made by the *tambats* are found here, none of the products designed in Atelier Metalworks are found in the city shops in the *peths*.

Figure 4.18: Atelier Metalworks showroom and shop
(Photograph courtesy of Rashmi Ranade)

While the critical examination of markets, factories, and offices is not unusual in scholarly literature, the study of design studios has largely escaped the attention of anthropologists. If we define design as "conception and planning of the artificial", where the artificial refers to artefacts made of human agency (Buchanan, 1992, p. 14) or as "courses of action aimed at changing existing situations into preferred ones" (Simon, 1996, p. 111), the design studio is one of the places where actions of conceptualising and planning occur. However, "the studio remains a peculiar and remarkable lacuna in our understanding of how cultural artefacts are brought into the world and how creativity operates as a situated practice" (Farías & Wilkie, 2016, p. 1). And while these creative actions do happen within the studio, it is critical to recognize that design activities are not limited to the space contained within the four walls of the studio environment. For Rane, designing with and for copper involves thinking about the properties of copper, reading, sketching ideas on paper, building cardboard mock-ups, collaborating with the *tambats*, observing processes of making, and so on. And while the studio does offer a place with access to the appropriate tools, inspiring examples, and related knowledge, designing can occur anywhere. In other words, while the studio is a place where designing happens, designing can happen in places that are nothing like the studio.

The notion of 'place as assembling' can be extended to studio environments as well. Artefacts of design activities—such by-products of the processes of conceptualising as sketches, prototypes, virtual models, technical drawings, 3d printed parts, exploded views, and more—are expressions of activities of assembling. While for Latour an exploded view may not represent thingness and may be far removed from the thing in the world (2007), for a designer it is an artefact that helps imagine the completeness of things in all their entirety including understanding how all the components come together to emerge from parts into a complete whole. An exploded view can therefore be seen, not as a breakdown of a whole into parts, but instead as an imagining of the assembling of components into things. It is not an explosion; it is in fact a becoming. Conceptualising designs necessitates the bridging of disparate needs of all stakeholders (users, manufacturers, financiers, etc.), of collapsing parts into a whole, and of bringing together bits of scattered ideas into a single concept. These acts of assembling involve collecting sticky notes created during brainstorming, collating sketches from paper napkins and backs of envelopes, creating assembly drawings from components, and so on. These are acts of gathering a variety of two-dimensional artefacts generated during the design process. These efforts also include assembling three-dimensional prototypes from scraps of carboard, blocks of foamed expanded polystyrene, wires, and other materials. It is through such activities of making and assembling that designs come to life in these studio spaces.

4.9 Conclusion

During the processes of production, distribution, and consumption, copper, as raw material, as an idea for a thing, as prototype, and as finished product travels through several places, from the design studio, to *tambat ali*, to the city markets in Pune, and to an online presence for national and international consumers. During these processes, these places serve not as containers where a variety of entities and activities are simply housed, but as active places of assembling, where people and things are constantly becoming who they are. None of the places are tightly bounded by impenetrable walls and barriers; they overlap and intersect across each other's areas enabling a spilling of materials, bodies, and energies among them. There are a variety of social relationships that unfold in these processes of assembling, some of economic and material exchange, and some of shared knowledges and learnings. As active places of imagination and making, we can think of the streets and workshops as the extended minds and bodies of persons. In this sense, place becomes part of the intentionalities of the *tambats* and the designers, and assists them in achieving their goals.

The objects of *tambat* skill that emerge from this place, the *vastu* they make, are the focus of the next chapter.

Chapter 5

Tambat Ali Vastu

5.1 Introduction

This chapter is a critical examination of the products that emerge from *tambat ali*, some that the *tambats* have been making for decades, some that they have recently introduced, and some that are outcomes of their more recent transactions with designers. In speaking of what the *tambats* create, the question arises whether they should be regarded as objects, things, stuff, artefacts, products, devices, gadgets, goods, commodities, or something else like material, substance, etc. Each of these terms carry specific meanings, many of which are supported by deep theoretical foundations developed not only in anthropology but also in archaeology, philosophy, literary theory, design theory, art history, media studies, cultural studies, and more. When the *tambats* talk about what they may have made on a certain day, they typically refer to them by name (I made a *pimpa* and a lampshade today), or by the word *vastu* (I made several *vastu* today). In the local language Marathi, the word *vastu* generally refers to physical stuff, and it means “a thing in general; any article or substance; any affair, business, or matter” but interestingly, it can also be “the main plot (of a play or poem)” (Molesworth, 1857, p. 738). The additional meaning of *vastu* as a plot can serve a useful purpose here in unpacking and framing what the objects made in *tambat ali* mean. The goal here is not to engage the notion of the plot metaphorically and fall into the trap of reducing the sociotechnical actions and transactions of the *tambats* in object creation to text. Instead, thinking of objects as plots may serve to mark as salient the myriad engagements between the persons, places, processes, and products of *tambat ali*. And as plots play out over time in sequences of events, this notion builds upon Küchler's recommendation to consider sequential development as an approach to objectification (2020). In addition, the nature of the relationality between the *tambats* and their objects can be described as substantive; it involves the transfer of copper's *guna* (qualities) from the object to the body. In summary, *tambat ali vastu* can be imagined as objects in visceral, substantive relation with persons; and they can also be understood as plots that reveal the sequential unfolding of events which occur over their lifespans alongside persons.

5.2 *Tambat Ali Vastu*

The *tambats* have been engaged in the making, mending, and trading of a large number and diversity of *vastu* for several generations. This production has spanned multiple generations and has included traditional utensils like the *handi*, *kalshi*, and *pimpa*, ceremonial things like idols of goddesses and gods, new products designed by the *tambats* like *supari dabbe* and *masala dabbe*, as well as architectural installations like temple finials and festival floats. In addition, they have also been making new products such as candle holders, bookmarks, and trinket boxes designed by contemporary designers. Let us consider a few examples: *modak patra* (dumpling steamers), *pimpa* (large water containers), *supari dabbe* (betelnut boxes), *masala dabbe* (spice boxes), wall pegs, and bookmarks. These six products may all emerge from one location, but they can be categorised into three groups as their design stories, sociotechnical processes of creation, intended and actual uses, as well as markets and buyers are entirely different. The *modak patra* and *pimpa* made today are almost indistinguishable in design from their predecessors and they are manufactured using techniques very similar to those used several decades ago. They fall into the first category and we do not always know who may have designed them. The second group includes *supari dabbe* and *masala dabbe*, new products designed by the *tambats* for which they have devised new tools like collapsible dies, and which they make using recently introduced mechanised production methods like spinning. And the third category includes wall pegs and bookmarks that are created for local and international markets by designers who work with the *tambats*. The stories of the three categories of these *vastu* are different and they represent different social and cultural phenomena. It is from the plots of these objects that we learn of copper's material meanings, *tambat* personhood, the value of embodied knowledge, the sociotechnical actions and transactions of making, and the significance of place.

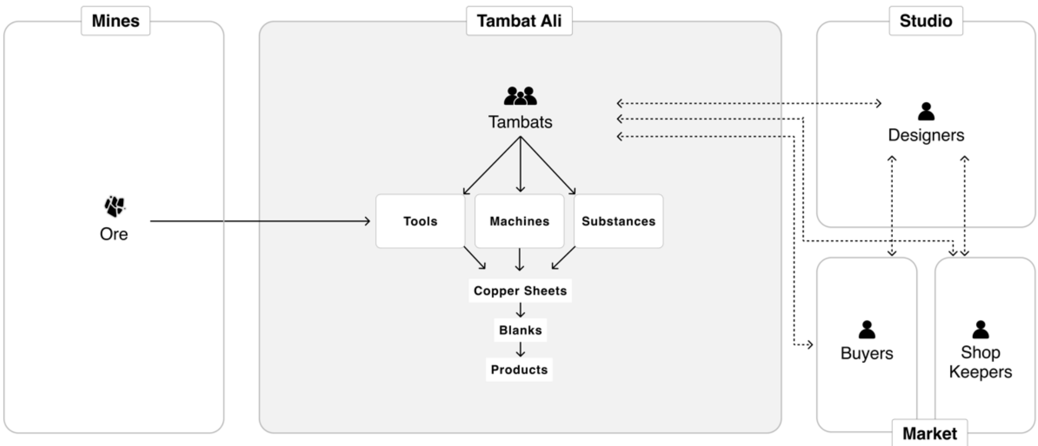

Figure 5.1: Materials, things, people, place, and institutions of *tambat ali*
(Diagram by the author and Amethyst Saludo)

The illustration in Figure 5.1 maps the people, materials, things, places, processes, institutions, as well as the transactions and relations among them in *tambat ali* and its environs. In the centre is the *tambat*, surrounded by the community of other *tambats*, all of whom work together in *tambat ali*. The families of the *tambats* (parents, partners, children, siblings, cousins, etc.), the designers they work with, and the shopkeepers with whom they engage in trade are part of the network of people with whom they have regular transactions. These transactions occur with and through the materials and substances that exist in their lives like copper, acid, wood, tamarind, and water. They employ tools and machines like pencils, paper, compasses, moulds, dies, hammers, anvils, and spinning lathes in order to create all types of artefacts of design such as sketches, drawings, models, prototypes, and finished products. The techniques of production, processes of design, activities of commercial exchange unfold in exterior and interior places in *tambat ali*—out on the streets of Kasba Peth, on the verandas and the interior spaces of the workshops, in the design studios, in the shops of Shukrawar Peth and Raviwar Peth in Pune's busy markets, as well as in the homes of those involved in some aspect of *tambat* work. In addition, places where copper ore is smelted into pure copper ingots and then rolled into sheets, warehouses in Mumbai from where copper sheets arrive, local shops from where the tambats pick up acids, tamarind, lacquer, etc. also are part of the transactional networks. Organisations such as the Twashta Kasar Samaj (community of tambats), Atelier Metalworks (design firm), and New Gnyanesh Akshay Metal Mart (copper utensils shop) are the institutions that structure and help manage some of the transactions between the people, products, and places involved in making copper objects.

5.3 Artefacts of Design

The engagement between designers and the *tambats* occurs through conversations aided by such artefacts as brief notes, annotated sketches, dimensioned drawings, rough mock-ups, appearance models, and functional prototypes that travel between the studio and the workshops, transferring knowledge back and forth. Each of these objects are embodied descriptions of the knowledge that is generated during processes of conceptualisation and materialisation (Küchler, 2012; Mattozzi, 2020). “As an outline of a thought process, such preparatory models are aids to help visualize, explain and predict the appearance of an artwork” (Küchler, 2012, p. 2010). While appearance is clearly important, what is more critical here is the exploration of technical choices (Lemonnier, 1993) and possibilities. Sometimes, what the designers have envisioned is impossible to make exactly as imagined using the tools and materials available to the *tambats*, and therefore choices have to be made regarding variance from the original. Hence, the prototypes go through a sequence of revisions, one after another, as the *tambats* create them in order to mimic the original with as much accuracy and fidelity as possible. However, in many cases, the original is impossible to reproduce exactly as the sketch or drawing, and is replaced with the latest, sequential prototype that is close enough in appearance, is manufacturable, and is one that the *tambats* and designers settle upon as the final. “Originals are followed until their coursings engender their own new creations” (Damon, 2012, p. 187). These new creations are the natural outcomes of the collaboration between the *tambats* and the designers; their relations are reproduced in these emergent objects that are outcomes of the sequential activities of prototyping. The temporal sequences immanent to the process of prototyping are critical to the social system of knowledge and material exchange of design and making (Küchler & Carroll, 2020).

In *Vibrant Matter*, Bennett makes a distinction between the velocities of the becoming of objects and that of the perceiving subjects, and suggests that the former being slower, escapes discernment (2010). All things age, and while their velocities of this journey may be clearly different, it is perhaps for that very reason that objects engage us. In their processes of becoming, aspects and properties of their being emerge into focus, calling our attention. During the acts of making, as objects are emerging into their prototypical stage from the idea of the original, their becoming is evident; in fact, it is the task of design to observe, monitor, and hasten, or retard this journey in search of the intended outcome. Copper—a metal always active in and reactive to the presence of air, moisture, touch, abrasion, and impact—is constantly in transformation. The creep of green oxide, the dulling of its sheen, the appearance of a dent, all occur at different velocities, leaving traces, creating biographies, and generating plots on the bodies of the copper objects. Designers often seek out materials like copper or leather that age gracefully and exhibit changing identities over time.

5.3.1 Design, Agency, and Networks

In June of 2021, Bengaluru based Ulhas Kanitkar worked as a guest industrial designer along with Atelier Metalworks's Rupali Rane in order to create a series of new products to be manufactured in *tambat ali*. The idea for the project came from a need the designers felt to respond to the Covid-19 pandemic. The research they read suggested that the SARS-CoV-2 virus, which can survive for 72 hours or more on other metals, only lives for approximately four hours on copper surfaces. They decided to design a series of products around this unique property of the material.

A large network of humans and nonhumans was set in motion for this project, which included the designers and other staff of Atelier

Metalworks, the *tambats*, die makers, copper sheets, acid, tamarind, spinning lathes, hand tools, dies, buffing machines, sketches, drawings, prototypes, studio spaces in Pune and Bengaluru, the workshop of Suhas Palekar in *tambat ali*, the state government, the Twashta Kasar Samaj—an innumerable listing of people, materials, objects, tools, places, institutions, and in this case, invisible microbes as well. All of these objects and subjects are relationally tied to each other, are equally essential to the project, and can be described as existing in a network.

This idea is fundamental to the actor-network theory (ANT) developed by Michael Callon, Bruno Latour, and John Law in the late 1980s as a social study of technology. According to Law, one of the basic tenets of ANT is that "society, organisations, agents and machines are all effects generated in patterned networks of diverse (not simply human) materials" (1992, p. 380). All actors in the network (people, things, institutions) possess agency and they are what they are because of the dynamic network within which they exist. And all actors in the network are treated as having equal weight and interest. According to ANT, objects are not seen as types of substance with varying properties; neither are they seen as representations of other, unknowable realities. Bruno Latour faults the anthropological approach of thinking of objects as representations of society, and instead presents them as possessing agency. "A key argument in science and technology studies has been that the nonhuman and the human are co-constitutive—together, constitute the world and each other" (Clarke, 2005, p. 63). And as we have discussed earlier, copper has transformative properties that has moulded the community of *tambats* into who they are. The coppersmiths shape this malleable material as they are shaped by it.

Figure 5.2: Antimicrobial sorter pod

Figure 5.3: Antimicrobial wall pegs

(Photographs courtesy of Rashmi Ranader)

Between March of 2020 and August 2021, several parts of the city of Pune, including Kasba Peth, were intermittently in the state of lockdown. The theme of the project initiated by Rane and Kanitkar was inspired by the notion of contact, something that was utterly lost when stay-at-home orders were announced by the government of the state of Maharashtra. And therefore, the design brief for the project was written with the goal of designing products that could potentially help with the process of reconnecting. Kanitkar conceptualized four new products that would serve a utilitarian purpose and align with the contemporary aesthetic language of Atelier Metalworks, under three thematic directions which were named dot, ripple, and reflection. Finally, the one selected was the ripple, which served as a visual driver and metaphor for formal development of the products. A ripple can be imagined as the origination as well as gentle spreading and continuation of an effect, and for Rane, this was an appropriate visual and formal analogy for reconnecting. Two of the products from the series, the sorter pod and the wall pegs are featured in Figures 5.2 and 5.3, both designed to serve as antimicrobial surfaces on which personal items can be placed.

As is typical of any design process, several material agents—sketches, dimensioned drawings, CAD (computer-aided design) models, rough mock-ups, appearance models, and several functional prototypes—emerged during the process of interaction between the designers and the *tambats*. For Latour, agency refers to the capacity of "making some difference to a state of affairs" (2005, p. 53). That nonhumans possess agency is possibly one of the more intriguing and unique propositions of ANT. Latour very simply explains how obvious this is. It is human agency that leads us to drive nails into walls, boil water or fetch provisions—actions generally performed with hammers, kettles, and baskets. Accomplishing these tasks without these things is just not the same, and therefore he describes things as "participants in the course of action waiting to be given a configuration" (Latour, 2005, p. 71), where figuration refers to the form or shape with which actors are endowed. As participants, things do not cause or impose action; instead, they engage in a range of actions, some merely supportive or passive and others more vigorously active. In other words, the agency of things could take several forms; it might "authorize, allow, afford, encourage, permit, suggest, influence, block, render possible, forbid and so on" (Latour, 2005, p. 72). The agency of things also varies over time; what might be extremely passive now can be active later, and vice a versa. During the early stages of design, notes, sketches, drawings, and conversations are significantly more active; on the other hand, tools and machines take a leading role once the designs are finalised and production begins. It is these agents (sketches, prototypes) that serve the critical role of communicating ideas across other agents (designers, *tambats*).

During the design process, the designers also outline the intended use of these products. The sorter pod is designed to serve as an antimicrobial surface on which someone coming back home after being outdoors (and perhaps having come in contact with other people) can drop their keys, wallet, or glasses, and leave them there for a while. The pod then becomes the location where these items are isolated. The wall pegs serve a similar purpose—bags, umbrellas, hats could be hung on them with the hope that any viral matter would not spread in the house but could be destroyed in contact with the copper. Copper's material agency serves the purpose of purification as well as protection here and addresses a health concern through its inherent antimicrobial properties. When word spread about studies suggesting that the SARS-CoV-2 virus survives for fewer hours on copper surfaces compared to other metals, the *tambats* expressed a sense of pride and a feeling of "we knew it all along" about the protection that the metal can provide through its *guna*, for them a fact that they said they have known for centuries. In other words, it seemed to be a matter of fact for the *tambats* that copper has the ability to alleviate some of the health concerns triggered by the presence of the virus.

The Marathi word *vastustithi*, which has its root in the word *vastu*, means matter of fact or reality (Molesworth, 1857, p. 738). For the *tambats*, it is a situational matter of fact (*vastustithi*) that copper objects (*vastu*) have the antimicrobial agency to address specific matters of health concerns and protect them from the virus. Latour suggests that things be considered not merely as matters of fact, but *also* as matters of concern. Building upon Heidegger's use of the word "gathering" he suggests that it might be a promising direction to explore matters of concern. "A thing is, in one sense, an object out there and, in another sense, an issue very much in here, at any rate, a gathering" (Latour, 2004, p. 233). Puig de la Bellacasa (2017) furthers these notions of matters of fact and concern by introducing the notion of care, suggesting that sociotechnical assemblages should be treated as matters of care. She calls on feminist thinking to imagine care as an "ethically and politically charged practice" (de la Bellacasa, 2011, p. 90) that questions the power dynamics and knowledge politics at play in the development of science and technology. In addition, she also urges us to imagine what things might be like if they *generated* care. In addition to matters of care, we can potentially explore the notion of materials of care, wherein copper through its material agency, expresses and exercises a form of care. In a somewhat different interpretation than de la Bellacasa's, copper here exhibits care towards humans by destroying the virus. Clearly, in this case, care is being deployed towards the benefit of one agent at the expense of another, duly noted by de la Bellacasa as a situation in which "caring over here could kill over there" (2011, p. 100). Things, materials, and the praxis of design therefore can be imagined as agents of care when issues of protection and purification are involved, but also when concerns of knowledge and power inequities are addressed. The foundations of the collaboration between the designers and the *tambats* are shaped by care when they are built upon respect toward shared knowledges and restoration of power imbalances between all involved.

Heidegger traces the etymology of the word "thing" and its German form *Ding* to one of its more ancient meanings—assembly or gathering. "A jug 'things' insofar as it holds the 'gift' of wine, and thereby gathers the sky's water, the earth's grape, humanity's production of wine, and the presence of gods when wine is used in religious ceremonies (libation)" (Economides, 2007). Heidegger referred to these four—earth, sky, divinity, and mortals—as the fourfold within which the thing stays united; it is here that "the thing things" or presences (1971, p. 181). Latour extends Heidegger's fourfold within which things are united to "thousands of folds" (2004, p. 235). In other words, he seems to suggest that while things do exist independently, they gather their meanings from the large network in which they exist. In case of products that are manufactured and sold in quantity, these networks are dynamic and always growing. The antimicrobial sorter pods and wall pegs are new objects that have recently been introduced. As sales grow, more of them enter the world, and all relational associations will expand as well. Law suggests that there is an inherent dynamic tension between the centred actors and the distributed networks that are critical to the way ANT works (Law, 1992). These tensions are inherent to processes of design, prototyping, and manufacturing. When the designers, *tambats*, shopkeepers, and other actors within a network are aligned to a certain goal, there is stability in the network.

The forms and properties of the actors (also referred to as actants) are derived from their specific locations and significance in this network. However, these tensions are not always productive or beneficial to all the actors; competing agendas, economic pressures, and technological choices have to be translated and interpreted across multiple locations. Designers push for prefigured aesthetic directions and quality standards informed by their expectations and education; the *tambats* exercise their sensate embodied knowledge of the material and technological choices; and shopkeepers want pricing to support their financial goals. A network, according to Callon (1986) is formed through multiple processes of translation, where actants set agendas, establish connections with other actants, define roles and mobilize actions. These networks are dynamic and in a continuous state of evolution (and at times dissolution), and therefore constantly in need of maintenance. As global conditions change, as new products are designed and older products are phased out, as international commodity markets impact prices of copper, these networks morph and mutate.

5.4 Approaches to Materiality

The examination of materiality has invited various and diverse approaches that may be described and labelled (just to name a few) as return to the object (Küchler & Carroll, 2020), the material turn or nonhuman turn (Bennett & Joyce, 2013; Grusin, 2015), artefact-oriented anthropology (Henare, Holbraad, & Wastell, 2007), thing theory (Brown, 2001), social lives of things (Appadurai, 1986), biographies (Drazin 2021; Hoskins, 1998; Kopytoff, 1986; Schiffer 1972), object-oriented ontology (Harman, 2018), actor-network theory (Latour, 2007), vital materiality (Bennett, 2010), entanglement (Hodder, 2012), and so on, outlined by scholars from anthropology, sociology, philosophy, and cultural studies. Each of these approaches presents new ways of examining the presence of materiality in our lives. For instance, while actor network theory focuses on the relational quality of things, vital materiality urges us to imagine things as forces with trajectories; and while object-oriented ontology emphasizes their withdrawal; artefact-oriented anthropology asks us to think of things and meanings as one. Inspired by this scholarship, my goal in this chapter is to learn what the various forms which *tamba* takes under the deft hands of the *tambats* can tell us "on their own terms" (Henare et al., 2007, p. 1) about what they are, how they relate with other things, how they relate with people, how they shape the structure of *tambat* society, and what is this material copper of which they are made. The critical, theoretical analysis of stuff (Miller, 2013) is in no way new to the social sciences, humanities, or the arts, but there has been a surge of interest in the examination of objects and things in these disciplines in recent years. This is part of the material turn, a somewhat recent groundswell of scholarship about materiality that explores fundamental questions of what things are, how they are made, what they do, how they relate to each other and to us, how should they be analysed, and ultimately, why it is worthwhile studying them.

5.4.1 Stuff

All the places where copper artefacts are designed, manufactured, and sold are replete with stuff. And while the design studio might perhaps be a little less dense in terms of the number of objects per square footage with everything laid out on rectilinear grids, the other two locations are certainly stuffed with all manner of objects seemingly without any clear or visible organisational structure. This density of objects is partly a function of tight quarters within which all kinds of transactions must be accomplished, but it also creates an environment where everything that is needed is efficiently at hand when it is needed. Examining this physical/material reality which surrounds the *tambats*, designers, shopkeepers, as well as the visitors, buyers, suppliers, and many more persons who interact with them is essentially the study of stuff. "Stuff is ubiquitous, and problematic" (Miller, 2010, p. 5). The word "stuff" stands the risk of being imagined as too generic, as a collection or gathering of things without any emphasis on the nature of their relation to each other. If stuff is a mass of items that fills up our world, it is just as important to consider how the individual items may or may not be connected to each other.

Objects occupy a central position in our everyday lives, but their presence in scholarly discourse has been problematised across several academic departments. Disciplines and areas of study such as industrial design, art history, anthropology, material culture studies, marketing, architecture, engineering, science and technology studies, philosophy, archaeology, and cultural studies routinely examine and debate the significance of material objects, but the meanings and values ascribed to them vary widely among these branches of learning. Each one of these disciplines, by examining the material world within which we live, creates a discourse about and around objects. Within this steadily growing body of knowledge, scholars have begun to devote attention to theorising the products of design activity. Increasingly prevalent in the work of design historians is the notion that the meanings of design objects should be situated not only within the context of design and manufacturing activity but also within the circumstance of individual and social activity. This understanding is particularly evident in the work of several design historians who have addressed narratives of objects from perspectives that transcend the aesthetic and technological to include their social lives (Fallan, 2010; Lees-Maffei & Houze, 2010; Margolin, 2017; Sparke, 1998, 2004; Woodham, 1997). The emphasis of this chapter is not on design history, but on an examination of the artefacts of design in order to offer critical ways of thinking about them as much as outcomes of social engagements as they are of technical processes.

The Marathi word *vastu* seems to capture a wide semantic breadth to include much of the terminology used to talk about stuff, things, objects, artefacts, products, devices, or gadgets. In common parlance, all the English words may often be used interchangeably, and they all do refer to the matter of materiality. Though they may be employed to convey similar meanings, they may be distinguished on the basis of specific attributes and disciplinary approaches. Quick examinations and brief etymologies of some of these terms will help differentiate them from one another. The term "artefact," often used in art and design and derived from Latin roots *arte* (by skill) and *factum* (thing made), refers to something that is a result of human labour (often artistic), a "fabricated form" or "specific constructions" of matter (Harvey & Knox 2014, p. 3). In archaeology, the term "artefacts" may be used to refer to products of prehistoric or aboriginal craft to differentiate them from naturally produced ones, and those "implying human intervention" (Knappett, 2010, p. 81). Everything that is made in *tambat ali* involves human labour, and most things are fabricated using a combination of hand tools and machine tools. The *pateli* (cooking vessels), *dabbe* (boxes), *bamba* (wood and coal-fired water heaters), and *pimpa* (water containers) made by the *tambats* were common household items before the advent of stainless-steel utensils, plastic (primarily polyethylene and polypropylene) food containers, electric water heaters, and water filters (ceramic, reverse osmosis, and UV). And while the *tambat* products are still being made, their utility, value, and functions have mutated, and therefore, so has their relation to people. The *bamba*, for instance, is now often regarded as an antique display item in urban settings (though it may still serve its primary function as an outdoor water heater in rural areas). It has travelled from the outdoor courtyard of the *wada* (its traditional use-location) to an interior corner of a home; its use-value shifted from providing hot water to being part of a visual décor; instead of being filled with coal and water each day it sits empty. And now, the qualities it possesses on account of being fabricated by human skill foreground its recognition as an artefact. The term artefact may be contrasted with the term "product", derived from Latin *productum*, which also refers to something produced. A product is the end result of design and manufacturing processes and therefore it is a term actively employed by designers and engineers. As an artistic good, an artefact may often be produced by hand, while products, in most cases, rely on mechanised modes of manufacture. Inherent in this definition of products is the understanding that they exist in identical, multiple copies as they are manufactured in large quantities. And while *tambat* objects do not display the standardisation of mechanisation as each handcrafted item is different, is not unusual to hear *tambats* using the words product and production while speaking about what they make, a possible outcome of their engagement with designers.

A "device" has its etymological roots in the Old French word *devis*, and signifies a thing created or adapted for a specific purpose. This term makes a reference to the technology embedded within it (mechanical, electronic, etc.), which allows it to perform the particular tasks for which it is designed. "Gadgets" are small devices or tools that often possess an ingenious quality. This word, it is believed, is derived from sailors' slang for mechanical parts of ships for which they had forgotten names. Here too, the presence of technology is foregrounded as a defining aspect of devices. The term "goods" finds usage largely in a commercial sense, and refers to property or merchandise, things that may be bought and sold, mostly in large quantities. The “commodity” owes its linguistic roots to Middle French *commodité* and Latin *commoditas*, which mean benefit or profit, and their usage often amplifies not only their mercantile existence and economic function but their presence in Marxist analysis as well. For Borgmann, commodities are “highly reduced entities and abstract in the sense that within the overall framework of technology they are free of local and historical ties. Thus, they are sharply defined and easily measured” (1987, p. 81).

In addition to *vastu*, one other Marathi word, *nag*, which means “an article or item (as of implements, pieces of apparel &c., in numbering them), a piece”, is heard in *tambat ali* as well (Molesworth, 1857, p. 447). This word, which might be likened Borgmann’s measurable commodity as it is employed in the context of economics and exchange, is used when the coppersmiths are paid not by weight (as has been the traditional method) but instead by the number of pieces made. As we have seen before, while traders pay by *vajan* (weight), designers typically pay by *nag* (number of pieces made), and therefore the latter system is more beneficial to the *tambats*, especially while making small, light, intricate items. Both systems of economic exchange exist in *tambat ali* today, and many *tambats* seamlessly negotiate between the two depending upon who they are working with. It is not unusual for a *tambat* to hammer a few *pimpa* in the morning for a shopkeeper and be paid by *vajan*, and then spend the afternoon creating other products for a designer and get paid per *nag*. *Vastu* made and paid by *nag* are expressions of a certain standard of quality; more care goes into their making, and the hammer strokes on them are often denser and more evenly mapped across their surfaces.

5.5 Objects and Things: Dualisms

And finally, we can turn our attention to "objects" and "things", perhaps two terms that are the most contested and have received the most theoretical, critical attention from anthropologists. "Objects" and "things" are semantically expansive terms often used in philosophy, anthropology, design, science and technology studies, etc. Their labels do not amplify any one of their attributes, thereby facilitating multiple interpretations of more or less equal value. "Object" is derived from Medieval Latin *objectum*, which means "thing put before" and it is often explained in binary terms as it stands in opposition to the subject. Objects have been posited as both inferior to and in service to subjects—to words, ideas, and the mind, or non-material entities—in an object-subject polarity, creating a dualism. There is a significant amount of theoretical diversity as well as disagreement among anthropologists regarding the meaning of objects, so much so that they have been described as "sites of intellectual dispute" (Harvey & Knox, 2014, p. 4). This discourse of objects and their relation to subjects is an active and lively subject area that has demonstrated sustained interest over the last few decades (Buchli 2002; Beaudry & Hicks, 2012; Candlin & Guins, 2009; Carroll, Walford, & Walton, 2021; Coupaye, 2020; Harvey & Knox, 2014; Henare, Holbraad, & Wastell, 2007; Küchler & Carroll, 2020; Miller, 2005, 2013; Tilley, 2006).

In the increasingly prolific field of material culture studies, several publications and ideas have been considered as landmarks and keystones in the evolution of the discipline, and in shaping how we think of objects. In his introductory chapter to the edited volume *Materiality*, Miller (2005) offers two approaches by which to theorise materiality. The first approach considers things as artefacts and the second takes on the problem of tackling the object-subject dualism. He further explains two issues that are critical to material culture studies: one, “the tendency to reduce all such concerns with materiality through a reification of ourselves”, and two, viewing “material culture as merely the semiotic bedrock of social relations” (Miller, 1998, p. 3). In other words, objects cannot be seen merely as standing in for, or signs of something or someone else; they have to be considered in their own right. And therefore, any critical inquiry should start with the object; we examine of what it is made, what properties it possesses, how it comes into being, and how it builds relations with other objects and people. The material turn suggests that objects have a voice, an agency, and they need no longer be deemed secondary to subjects. It asks a crucial question, moreover: if contrast with subjects is no longer a defining characteristic of objects, how do we reconceive objects in their own right? “For practitioners of the nonhuman turn, what is problematic about these dualisms is their insistent privileging of the human” (Grusin, 2015, p. xi). And if this privilege is taken to its extreme, says Grusin, it strips the world of any agential status (2015). New investigations that question the object-subject dichotomy have moved toward “the erasure of the familiar conceptual distinctions between the natural and the social, the human and the non-human, and the material and the cultural, divisions that are all in the first place, predicated on the immaterial/material divide” (Bennett & Joyce, 2010, p. 4).

Contemporary theories push for the agency of things and reimagine the roles of material objects in social systems by questioning the object-subject polarity. In tackling this polarity, Henare et al. present a new methodological approach in which “rather than accepting that meanings are fundamentally separate from their material manifestations (signifier v. signified, word v. referent, etc.), the aim is to explore the consequences of an apparently counter-intuitive possibility: that *things might be treated as* sui generis *meanings*" (Henare, Holbraad, & Wastell, 2007, p. 3). In other words, meanings of things should not be imagined to exist separately from the things themselves; meanings are not to be applied to or contained in things; but they are one and the same. Bennett (2010) refers to nonsubjects as vibrant matter, suggesting that they have a certain vitality that goes beyond agency, an action that dissipates the binaries of life vs. matter. This is not a life force that supplements matter, but instead a form of vitality that is intrinsic to materiality itself.

Appadurai suggests that "persons and things are not radically distinct categories", which then might suggest that the dichotomy between the two could be a non-issue (2006, p. 15). Or at least if the categories are not distinct, the boundaries between them overlap. The age-old practice of drinking water stored in copper vessels recommended by practitioners and believers of Ayurvedic medicine and followed by many of the *tambats* serves as an interesting example. As one of the *tambats* mentioned to me, "I fill up a large copper vessel with tap water at night and let it sit so that some of the impurities settle down to the bottom. The next morning, without disturbing the sediment, I pour the water into my filter." This filtration unit is made of two cylindrical copper containers stacked on top of one another. The cylinder on top has a ceramic filtration candle inside through which water trickles down to be collected in the container below. Being a *tambat* and able to fabricate anything out of copper, he had this filtration unit specially made in his workshop for his home. In addition, because he is no longer able to use a *bamba* in his home and has an electric water heater installed in the bathroom, he uses a copper bucket in which hot water is collected. He also uses a copper tumbler for his bath, ensuring that the water comes in contact with several copper utensils before it touches his body. It is through the water that he uses for drinking and bathing that he says, "copper's *guna* descend into my body". He also mentioned that he feels he does not have any problems with his skin because he bathes with water from a copper bucket and that as someone who works with copper every day, the contact with the material plays a role in helping him maintain good dermatological health. This is a form of a transfer of substance from one body to another; an exchange that can be regarded as an expression of a substantive, visceral relationality that goes beyond the abstract in an instantiation of Appadurai's notion of persons and things not being radically distinct categories. Interestingly, *guna* also means "product in multiplication" or "multiplied by" (Molesworth, 1857, p. 238); in effect, these properties of copper are *substantially* multiplied through this form of use, from the metal to the water to the human body. The properties of copper become the properties of the person.

While objects are described in relation to subjects, things are not. The word "thing" has a wide range of meanings that can be traced back to the fourth century to several languages including Old English, Old High German, Old Dutch, and Classic Latin. In philosophical and anthropological scholarship, things have been presented as independent, immeasurable, discrete, finished, and so on. Heidegger makes a clear distinction between things and objects. Things, to him, are self-supporting and independent, while objects exist in opposition to subjects. In a somewhat similar vein, to

Dant, “things are objects available to our senses as discrete and distinct entities which do not count as other beings or other objects” (1999, p. 11).

It is difficult to imagine the independence of any of the matter in *tambat ali*. All *vastu*, through their plots and rewritable biographies, exist in relation to others. It is difficult to imagine things in *tambat ali* as self-sufficient or relationally unconnected to anything else; their presence is inextricably tied to and arises in transactions with people, tools, material, and place. While the material turn did recognize the significance of materiality, it also decontextualised it by its focus on the ontological model of things. The plethora and abundance of all forms of materiality in *tambat ali* does resonate with Borgmann’s suggestion that commodities are measurable (as *nag*), but “things engage us in so many and subtle ways that no quantification can capture them” (1987, p. 81). For Ingold, the object is a “fait accompli”, a “congealed”, finished entity hermetically sealed from the world, incapable of interaction; but a thing is a “going on” that can “leak” and discharge through its surfaces (2010). *Tambat vastu* defy Ingold’s portrayals; they are active and protean, incessantly in interaction with the very air we breathe, the tiniest amounts of moisture, a few drops of acid, and the touch of the human hand. And these objects are able to transform themselves and others through use, disuse, and misuse. For instance, when used and regularly cleaned, copper can maintain its colour and surface finish to a certain extent; when left to disuse and neglect it can develop a patina of oxides and sulphates, and when misused by dropping or damaging in some way it can discolour, dent, or rupture. This variety of copper objects is seen all over *tambat ali*, in all states and stages. Accounting for this variety in explanations of what things are, Attfield confesses that they have effectively dodged an exacting definition in spite of the attention of philosophers, and defines them as "objects of human production and exchange with and through which people live their everyday existence" (2000, p. 11).

Brown asks if we can lift things above the object/subject fray—if we can take them beyond theory—through a new expansive form of object studies, suggesting that things be understood as artefacts with their own substantive currency, and that they be evaluated for more than just their cultural exchange value (2001). Objects are what we "look *through*"; things are what we encounter. Brown equates objects to windows through which we peer to learn what we can about ourselves, our society, our culture, our histories. Things, on the other hand, cannot be looked through; in our encounters, they establish and assert their physicality upon us (as we get "bopped on the head" with them) (Brown, 2001, p. 3). Brown's approach, however, still seems to look past objects as if they are transparent and themselves do not alter what we see; neither do they seem to reflect anything back. It is difficult to reconcile this notion with *tambat* objects. When a *tambyachi vastu* (copper object) has transformative properties that affect other objects and persons, when as a protean material it is constantly in atmospheric interaction with and relation to the places where it exists (atmosphere understood here in all its meanings), when it travels as substance through other objects and persons, and when it itself is a plot, it cannot be looked through. However, Brown offers an interesting concept by which to consider the abundance of stuff that exists in *tambat ali*. In his book *Other Things*, he further develops the notion of things and explains it as "unorganized material field or some unorganized amalgam or mass—*a field of things from which both subject and object precipitate in and as their relation*" (Brown, 2015, p. 22, emphasis in original). We can imagine all the copper sheets, discs, and filings, the hundreds or thousands of hammers and anvils, all the *tambats*, their families, designers, shopkeepers, in *tambat ali* as a *field of things*. In a sense, this notion can serve as a means of understanding what place means in *tambat ali*; a field from which subject and object emerge. Interestingly, the notion of field emerges in Coupaye's discussion of technical objects as "a locus of exchanges between humans and their milieus, as physical and/ or sensory mediators." (2020, p. 49). Building on Simondon's and Leroi-Gourhan's work, Coupaye describes milieu as a field with which the object interacts and in which it is immersed. As we have seen before, the *tambats* are immersed in a world, not only of objects, but of materials as well.

5.5.1 Categories and Biographies

The presence of copper in all its forms makes it clear that it is a material forever in transition and transformation. The objects are results of specific practices and techniques of the *tambats*. As we saw earlier in the chapter, there are three large categories by which we can classify *tambat* objects based upon their designs: those that were designed by *tambats* many years ago and for which the designers are mostly unknown, those designed more recently by known *tambats* who continue to make them, and those designed by non-*tambats* but manufactured in *tambat ali*. The practices of making these share some similarities but also significant differences, each resulting in distinct categories of objects. In his monumental *Outline of a Theory of Practice* (1977), often cited as a foundational text in anthropology, Bourdieu proposed that practices take on objective meanings, and classification schemes are embodied in the world of objects. The orders and placements of objects ground social orders such as gender, class, etc. Here, in *tambat ali*, the classification schemes applied to the *tambat* products reveal unique practices as well as relations. While the first two categories of objects involve a series of internal relations and design transactions among the *tambats*, the third category brings in external engagement. Each of these objects traverses a unique life journey and follows its own particular plot (*vastu*).

Appadurai, in another seminal text of anthropology, suggested that objects, not unlike subjects, have social lives themselves, and as we have seen before, that people and things should not be considered as entirely distinct categories (1986). While what Appadurai is suggesting is an attempt to overcome the chasm between objects and subjects in general, the notion takes on interesting meanings when the objects being considered are actually made by the subjects, as in *tambat ali*. The relationality between people and things is a lot more intimate and intense in such situations; the lives of both object and subject are closely braided together as they co-evolve. These, however, are not one-to-one relations; multiples of objects (several categories and individual things) and subjects (*tambats*, designers, shopkeepers, buyers) are entwined through life's twists and turns that can be uncovered through their biographies (Drazin, 2021; Hoskins, 2006; Kopytoff, 1986).

People often bring old copper products that may be dented, dull, or ruptured and badly in need of repair to *tambat ali*. The *tambats* are able to transform these things by cleaning them with acid and tamarind, scrubbing them with steel wool, heating them on the furnace, polishing the surface, and re-hammering them. These processes of transformation erase past histories and traces of prior use; they wipe out biographies and replace them with new plots of rebirth written by the skilled hands of the *tambats*.

5.5.2 Design Things

In their discussion of the process of design and the outcomes of its activity, the collection of writers under the pseudonym A. Telier (Binder, De Michelis, Ehn, Jacucci, Linde, Wagner, 2012) poses a problem. In the design process, how may designers reconcile or make sense of the two kinds of things that emerge: the object of design and the socio-material assemblies, the latter being drawings, models, prototypes, etc. created during design activity? Their examination of the design process leads them to the conclusion that the (designed) thing emerges at the end of the process—it is the thing that is delivered to the clients or customers for whom it was designed. The clients who experience the design do so on their own terms, and in that process make it an object—a different object from the object of design. The authors focus extensively on the design process and objects that play a role in the studio; in a sense their conclusion simply means that each subject experiences the object differently. "*Things* are not carved out of human relations, but rather of sociomaterial "collections of humans and nonhumans," through which the objects of concern are handled" (Telier, 2011, p. 6). Following the footsteps of Heidegger and Latour, the authors present things as events of thinging in the life of the community where they gather human beings. For them, as designing progresses, the things being created bring out the qualities and features of the thing to be delivered at the end (Binder, et al., 2012, p. 26).

As we have seen earlier, there are three categories of *vastu* created in *tambat ali*, and for each one, the *tambats*, designers, die makers, and other participants structure their work around a series of sketches, drawings, prototypes, notes, and other artefacts that together create heterogeneous assemblies. These things that emerge during the making process are attempts at codifying and representing design intent. And as the community involved in creation together progresses towards actualising a final design thing, it has often come a long way from the original intent. These emergent, sociomaterial things appear sequentially during the process, and each sketch, each drawing, each prototype is an iteration of its previous version. It is important to recognise that this process, though sequential in the larger sense of the word (simply because it is temporal in nature), involves going back and forth in terms of the evolution of the idea. The original may be riddled with problems making it difficult to produce in copper as designed on paper. It may have a form that may be difficult to manufacture on a lathe or under a hammer. In other words, the prototypes may prove that the design is un-makeable as designed. In such a case the design does not progress; instead, it regresses with the creation of each prototype. These prototypes push backwards on the original intent, which then is modified before everything can progress again.

These sociomaterial assemblies of humans and nonhumans travel through spatiotemporal journeys, inspiring a suggestion that the process is best referred to, not as sequential or even iterative, but "itinerative" (Payne, 2018). In other words, the itinerary is what should be considered carefully, rather than temporality or repetition. The design process is often described and visualised in ways that explain its iterative nature, while emphasising (and dramatizing) the fact that while there is a lot of back and forth, it is not truly repetitive. Designer Damien Newman has conceptualised the design process, not in stages or steps, but as a “squiggle”, suggesting that it is a tortuous and convoluted journey.

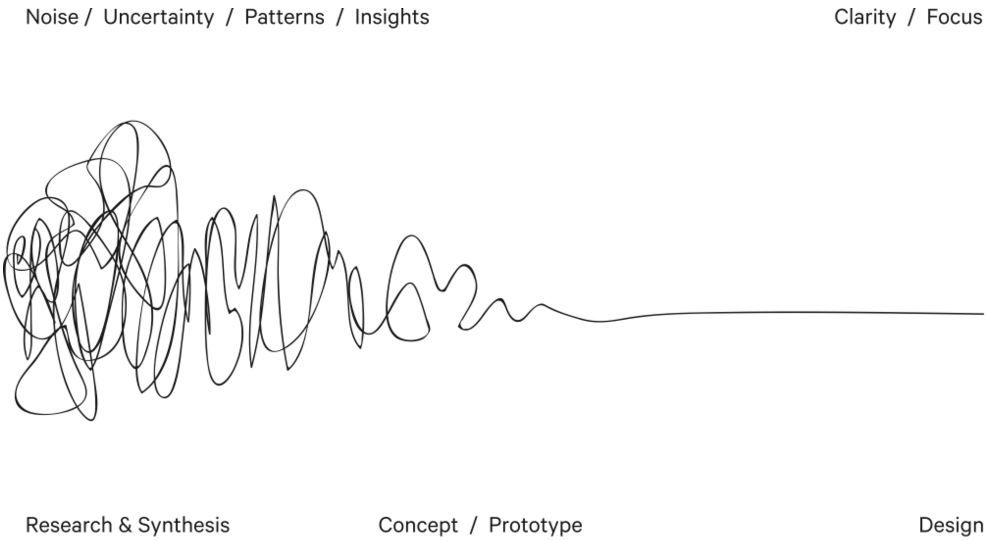

Figure 5.4: The Process of Design Squiggle by Damien Newman, thedesignsquiggle.com

Processes of making (designing and crafting) are never repetitive. A series of progressive and regressive prototypes (often referred to as alpha, beta or T0, T1, T2 prototypes, which together make up the sociomaterial assemblies) push the process along, often with two steps taken forward and one step behind, until a final design is delivered. These casualties of the design process lay strewn in the *tambat* workshops. In Karulkar’s workshop, it is not uncommon to see things (broken moulds and dies in corners, copper prototypes that somehow ruptured on the spinning lathe, drawings thrown away in the dustbin) that were once part of some itinerative process and are now part of critical knowledge for the *tambats* and the designers.

5.5.3 Art Objects and Design Objects

> Art objects are the only objects around which are *beautifully made*, or *made beautiful*. There seems every justification, therefore, for considering art objects initially as those objects which demonstrate a certain technically achieved level of excellence, 'excellence' being a function, not of their characteristics simply as objects, but their characteristics as made objects, as products of techniques. (Gell, 1992, p. 43).

Objects that emerge from processes of design are clearly "products of techniques" as well. These techniques, if one is to consider the entire design process, include their planning and conceptualisation, sketching, computer-aided modelling, prototyping, and manufacturing. To perform each of these techniques, the people involved are required to have specialised skills, extensive training, and years of experience. However, techniques that produce art objects are unlike (though in some ways like) techniques that products objects of design. The typical design process involves an iterative but somewhat linear process of a) identifying problems and opportunities, b) developing concepts, c) testing solutions, and d) manufacturing products. This process can vary depending upon the designer, object, industry, budget, etc. but the stages typically involve research, ideation, and production. In case of industrial design, which involves industrial scale mass production of goods, several domain knowledge experts are actively involved throughout the process. And their engagement is essential to ensure that the objects being designed are not only "made beautiful" but also made functional, manufacturable, comfortable, saleable, affordable, sustainable, and so on.

“The power of art objects stems from the technical processes they objectively embody: the technology of enchantment is founded on the enchantment of technology” (Gell, 1992, p. 44). The objects that emerge from the skills of the *tambats* similarly embody the power of the process that went into their making. This process, explained in the *chaîne opératoire*, is invisible to those outside the *tambat* community. This invisibility of the techniques of making of the *tambat* objects enhances their magical quality, power, and enchantment. Gell says, “technical processes are construed magically so that by enchanting us, they make the products of these technical processes seem enchanted vessels of magical power” (1992, p. 46). This enchantment is doubly enhanced in the copper objects emerging from *tambat ali*, because for the *tambats*, copper possesses powers other metals do not. Made of enchanting material and produced by enchanting means, the power of *tambat* objects (*guna*) is multiplied. While gold and silver are recognized as valuable, copper is valued for being beneficial. As the price of copper has gone up in global commodity markets, the objects made by the *tambats* have gone up in price and have become less accessible. They have started disappearing from homes, replaced by stainless steel pots and plastic boxes. The dwindling numbers of *tambats* working in *tambat ali* making utensils have made these objects even more inaccessible.

However, this has not necessarily made the objects more desirable, but certainly more invisible. Interestingly, some of the jewellery stores in Pune, that have traditionally sold only gold and silver things (earrings, necklaces, objects required for religious services, etc.) now carry copper as well. PNG Jewellers now has a section in their store called Tamra (*tamra* is another word for copper), where they do brisk business selling featured products from Bajirao Karulkar's workshop in *tambat ali*. And as Karulkar says, "when you see copper objects in the company of gold and silver, they become a lot more affordable". The positionality and relationality of materials that Maniglier refers to is evident in the perceived value of copper in relation to gold and silver.

5.5.4 Affordances and Properties

The *tambat* environment is replete with copper in a diversity of forms—sheets, discs, prototypes, objects, scrap, and so on. The *tambats* see them in their varied states of being and becoming and know/imagine what they can do with them; they determine whether all this copper should be transformed into components of a *bamba* or something else, whether it should be melted and reshaped, or what other potentialities can be actualised depending upon what its material properties afford. American psychologist James Gibson (1986) proposed the neologism "affordance", a made-up noun from the verb to afford, to explain (a) what animals perceive in the environment, and (b) what kinds of actions they may perform with what they perceive. For instance, when we see a bell, we know it may be rung and therefore its affordance is ringing. Similarly, a book's affordance is reading, a pen's affordance is writing, and so on. This concept of affordance has inspired thinking in design (Krampen, 1994; Maier & Fadel 2009; Norman, 2013) as well as anthropology (Coupaye, 2021; Ingold, 2000, 2011; Knappett, 2007; Küchler & Carroll, 2021; Tilley, 2007). For Gibson, "an affordance is neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of objective-subjective and helps us to understand its inadequacy" (Gibson, 1986, p. 129). Ingold takes issue with position, referring it to as

Gibson's inability to properly resolve the matter of objectivity/subjectivity of affordance. Instead of "inhering in a relation between a living being and its environment" Ingold says that for Gibson affordance points only one way from the subject towards the object, from the environment to the animal (2011, p. 79).

Perhaps we can imagine affordance in terms of relationality, not as a property of the object or of the subject, but as relation activated by the interaction between them. And as interactions between people and things are incredibly diverse, so are affordances. A book not only affords reading, but it also affords supporting the short leg of a table, hiding money within its pages, hurling it at someone, and so on. A chair affords sitting, but also affords climbing to be able to reach high shelves, the ability to hold a door closed, and so on. In addition, as interactions can be shaped by people's condition or state of being at different moments in time, so can affordances. The more tired someone is, the more objects are likely to appear chair-like; in such cases even a box, a window ledge, or the floor can afford sitting. In their everyday work, the *tambats* interact and transact with copper and with other *tambats* constantly. These interactions, inspired by the properties of the material as well as the embodied knowledge and situations the *tambats* might be in, can give rise to several affordances. "These affordances, when met with a person of virtuosity, become realised and enacted" (Küchler and Carroll, 2021, p. 155). Sadashiv Apte, a highly skilled craftsman whose body has been shaped by thirty years of interaction with copper in *tambat ali*, has said to me that he can create practically any shape out the material. His body is as much acting upon the material, as it is acted upon by it. To Apte, copper affords unlimited options of form, shape, texture, and surface finish. And it is this relationality between his virtuosity and what the material affords that enables the creation of a wide array of objects.

5.6 Complexity and Multiplicity

"Each object, then, unique and total in itself, is also the complex composite of gestures, images, and intertextual and interartefactual relations" (Küchler & Carroll, 2020, p. 3). The copper objects of *tambat ali* embody the sensate knowledges and the sociotechnical actions of the coppersmiths. In these actions, the *tambats* activate their imaginations, images of the original, gestural virtuosity, memory of place, sense of ease with the materials, and their relations with everybody and everything around them. Each *bamba*, *pimpa*, and *kalshi* is a sort of a complex aggregate of a range of thoughts and movements including the actions and transactions between the *tambats* themselves, those between the *tambats* and their tools and materials, as well as all the interchanges among components, materials, and substances present in the workshops. An intricate complex of signs and relations is immanent in the copper objects. And as dynamic, everchanging entities, these objects mutate, travel, and transform relationally, and they reveal that they are essentially unsettling (Harvey & Knox 2014; Küchler & Carroll 2021). Here, they "reveal the ontological instability of things" (Harvey & Knox, 2014, p. 9).

Building upon the notion of multiplicity, Küchler offers a new approach to objectification by shifting our attention from systems of classification to temporal sequences which objects go through and of which they are part (Küchler, 2021; Küchler & Carroll, 2020). "The object is a temporal thing whose endurance and biographical development is done in tandem with that of its human counterparts"

(Küchler & Carroll, 2020, p. 3). This notion of temporal sequentiality is seen in the production of each object, when *tambats* coordinate their individual as well as collective actions. These sequences have to be orchestrated just right for efficacious production. Imagined on a longer time scale, objects and subjects endure through entire lifespans alongside each other where embodied knowledge systems are observed, learnt, practised, and passed on, sequences of action through which the *tambats* and the things they make shape each other. And imagined yet again on an even longer time scale, sequences unfold through generations of *tambats*, where entire families of objects appear, persist, and disappear, as do the persons who make them.

5.7 Conclusion

"There is a fundamental scheme transfer, applicable, I suggest, in all domains of our production, between technical processes involved in the creation of a work of art and production of social relations via art" (Gell 1992, p. 56). This is evident in *tambat* society, as the community was invited to settle in Pune primarily to set up their workshops and create copper products. As they settled in Kasba Peth, their identity was created around the techniques of producing copper objects. The region where they live and work is referred to as *tambat ali* for that reason, and this shaped their relation to the city and residents of Pune. Objects such as the *bamba* and *pimpa* entered people's everyday lives, their routines, and many of the household activities. *Tambat ali* became a landmark of Pune, and people from around the city and its environs started to gather here to buy copper utensils or to get broken pots and pans mended.

As this activity was, for the longest time, the primary means of subsistence for the *tambats*, copper and techniques of working this material have shaped their lives and the Twashta Kasar Samaj. In this chapter, we have examined three categories of *vastu* (objects) that the tambats have been making daily, over their lifespans, and through generations. While the journeys of the first two categories start in *tambat ali*, the third category of objects is first imagined elsewhere by non-*tambat* designers. Through an itinerative (Payne, 2018) process during which a large collection of such things as sketches, drawings, and prototypes are created, all these *vastu* make their way out of *tambat ali*, some to local markets and some to international ones. Building on the additional meaning of *vastu* as plot, we learned that imagining objects as plots may foreground engagements between the persons, places, processes, and products of *tambat ali*. These plots can be seen as biographical in nature, holding entire arcs of the journeys of the objects through ideation, production, distribution, consumption, and perhaps re-emergence within them; these plots are not only themes, morals, or interpretations one can draw about the objects. As *vastu*, these *tambat* objects and plots hold relations immanent within them; they cannot be seen as generic stuff, self-sufficient things, or items that stand alone without any transactional or substantial engagement with people, other objects, or place. In the next chapter, we examine tambat personhood, as an examination of the question: who is a *tambat?*

Chapter 6

The *Tambats*

6.1 Introduction

The major thrust of this chapter is the analysis of *tambat* personhood as an examination of the question: who is a *tambat*? The word "*tambat*" in Marathi refers to a caste as well as a coppersmith, and this chapter is an enquiry into the relationship between copper, processes of working with the metal, personhood, and caste. Most of the work in *tambat ali* is done by persons of the *tambat* caste; however, there are several craftspersons of other castes working here as well. The numbers of *tambats* living and working in *tambat ali* have been dwindling as more and more sons and daughters of these craft families are receiving formal schooling as well as college-based higher education and are entering other professions. However, they do identify themselves as *tambats* though not engaged in *tambat* work. Therefore, *tambat* personhood cannot merely be defined on the basis of caste or profession. *Tambats* exhibit what I would like to call a 'malleable personhood', configured in part by the nature of copper itself, techniques of the body in which they engage while working with the metal, the history of the community, and the professional mobility of its members. Malleability, described as the capability of an entity to be influenced, shaped, and extended through external forces, is a characteristic property of copper. It is a soft metal that can be easily formed and reformed over and over again into a variety of shapes with the simplest of tools and energies. *Tambat* personhood is similarly malleable; it cannot be described merely in terms of hierarchy (Dumont 1970, 1980), dividuality (Marriott, 1976; Strathern, 1988), or a continuum between individuality and dividuality (Mageo, 1995;

Smith, 2012). The malleability of this form of personhood is multidimensional and fluid; it enables persons to shape and reshape themselves within and without the constraints of caste and profession.

6.2 Being/Becoming *Tambat*

"I am not *tambat* by caste, but I am made *tambat* by work. And the people of this caste have made me one of themselves." These are the words of Sadashiv Apte, one of the most highly skilled craftsmen in *tambat ali*, known for the precision and density of his hammer strokes, and his ability to shape vessels of any form from sheet metal, especially brass and copper. Apte was not born into a *tambat* family, but he has been making copper and brass utensils as well as other objects for over fifty years, of which almost thirty years have been in *tambat ali* in Pune. Born to a family of farmers in the village of Kelane, district of Ratnagiri in 1955, he moved frequently between his hometown and the city of Mumbai during his early years. After completing his second standard in Kelane, third and fourth in Mumbai, fifth, sixth, and seventh back in the village, he finally finished his eighth standard education in Mumbai. By then, his father had left farming and had moved to Mumbai for a job in a textile mill. After passing his exams for the eighth standard, young Apte too started working fulltime and dropped out of school. However, instead of joining his father's trade in the textile mill, he started working for a *tambat* by the name of Purshottam Gangaram Waghmare in Mumbai. His first work involved operating the bellows of the furnace and cleaning around the factory where copper and brass utensils were being manufactured. He did this for six months, but all this time he watched the process of utensil making with great interest. A couple of *tambats* allowed him to practice their techniques, knowing that they could easily correct any mistakes he would make. Copper is forgiving and can be heated and hammered again to fix any dents and rectify any errors. He finally learned the craft himself and started doing the work on his own, unaided by the *tambats*. Within a year, he was able to make a small *tapele*, a *kalshi*, and a *handa*. After working for a few years in Mumbai, he moved to Pune, encouraged by a *tambat* friend who assured him that there was plenty of work there. Apte says that by the time he came to Pune, he had already learnt the skill of making copper utensils and was therefore accepted in *tambat ali*. And while the *tambats* embraced Apte, gave him space to work alongside them, and found a room for him so he could live in the community, they do not refer to him as a *tambat*. When asked, they say "Sadashiv is not a *tambat*."

The *tambats* have organized themselves into a society called Twashta Kasar Samaj, a community that assists its members through a variety of activities and events. The *tambat* origin myth traces the ancestry of the community back to the Hindu deity Vishwakarma, who, in the Rigvedas (ancient texts of Hinduism) is referred to as the divine architect or engineer of the universe. Vishwakarma, the myth goes, had five sons and two daughters. The sons are named Manu (the ironsmith), Maya (the carpenter), Twashta (also known as Kansara, the metal worker), Shilpi (the masonry worker), and Devagna (the goldsmith). The daughters are named Sanjana and Saranya but they do not appear to have been assigned specific crafts. The *tambats* consider themselves to be descendants of Twashta. As is often found in Hindu texts, deities tend to have multiple names, and therefore Twashta and Kansara are but some names, and many more exist. In addition, as these words are derived from Sanskrit, they are spelled variously as well.

The words Tvasta, Twasta, and Twashta are alternative spellings referring to the same son of Vishwakarma. Similarly, the words Kasar, Kansara, and Kasera carry the same meaning and are linguistic variations based upon local languages Marathi, Gujarati, and Hindi respectively.

6.3 Understanding Personhood

In the essay titled "A Category of the Human Mind: The Notion of Person, The Notion of Self", which is often referenced as one of the early, seminal papers in the discussion of personhood, Mauss identifies three different categories of the person. The first, *personnage*, for him referred to the role played by each individual in society; the next, *persona*, suggested the idea of a mask; and the final, *personne*, was the notion of a moral being with consciousness (Mauss, 1985). Here, personality refers to the role that individuals might have to play in the life of the totality of the clan or tribe. "We start with something which we can hardly recognize as a concept of a person at all" (Hollis, 1985, p. 219). In discussing *personnage* and *persona*, Mauss cites as examples Native American tribes, Australian aborigines, as well as Indian (more specifically Hindu) and Chinese societies. He suggested that names were important in the development of personhood, and they did not necessarily refer to an individual but to membership of a society as well as the specific role or position that person might hold in that society. Further, he uses the metaphor of masks and notes that these names might be changeable over time. The third term, *personne*, that Mauss introduces in his essay as "the category of self… identified with self-knowledge and psychological consciousness" refers to a moral, Christian individual (1985, p. 20). Mauss presents these three ideas of the *personnage*, *persona,* and *personne*, along with related examples from Australia, the Americas, India, China, and Europe, as the progression of an individual from playing an assigned role as a member in society, to the idea of the person as a mask performing in a masquerade, to becoming a moral and sacred being. To Mauss, "the end result of this evolution was a conception of personhood in terms of individual consciousness rather than as the embodiment of set social relationships" (Launay, 2005, p. 1741). In other words, persons in non-European societies were defined by their social obligations and presence, while European persons were to be understood as individuals, and therefore more evolved. Perplexingly, Mauss does mention that "India appears to me indeed to have been the most ancient of civilisations aware of the notion of the individual, of his consciousness" (1985, p. 13). However, this Indian individuality is not equated with the notion of a moral being, and therefore set aside. Such comparative analyses of Western persons against ethnographic subjects from non-Western parts of the world such as India (Dumont, 1970, 1980; Marriott, 1976), Melanesia (Strathern, 1988; Robbins, 2001), and Africa (Fortes, 1973; La Fontaine, 1985; Read 1955) have had a long tradition in anthropological literature.

It might be fruitful to reconsider Mauss' notions of *personnage*, *persona*, and *personne* not necessarily as evolutionary, not primarily as steppingstones in a journey that societies take over time, but instead as concomitant. This allows us to imagine personhood as dynamic rather than static, fluid rather than rigid, thereby enabling persons and groups to determine who they are and how they should behave. The *tambats* contextually behave in ways that selectively fronts their roles as members of their community, as dividuals in transactional relationships, as people with specific rights, as descendants of their ancestor Twashta, and as moral beings who belong to the Twashta Kasar Samaj. In his discussion of names, Mauss suggests that in Native American societies they are not necessarily hallmarks of the individual, but references to a fixed role or position within a society. Some of the senior craftspersons in *tambat ali*, Karulkar and Kapre for instance, are referred to by honorific titles due to their positions. No one refers to Bajirao Karulkar by his first or last name; he is Baju Kaka (where *kaka* refers to paternal uncle); and everyone calls Kapil Kapre Nana (*Nana* means older brother). Some of the designers who work with Karulkar address him out of respect as Karulkar Sir (as do I), while *tambats* of Karulkar's age or those older than him call him Bajya as a term of endearment. Karulkar's father, Purshottam Sadashiv Karulkar, a *tambat* and a wrestler, was referred to as Chendya Nana; the word *chendu* is ball in Marathi and chendya is therefore ball-like. This name is a reference to his body and the bulging muscles built through the time spent wrestling and bodybuilding. These names do not change over time; they are relational, and they refer to positions in *tambat* society that these men hold.

The predominant lenses through which concepts of Indian self, individual, and person have typically been examined have tended to be caste and (in)dividuality (Dumont, 1970; Marriott, 1976). However, more recent anthropological analyses have attempted to consider concerns of more contemporary relevance such as urbanism, office work, and class (Ram, 1994). While the terms individual and person are often used interchangeably in common language, they are considered differently in anthropology. "Every human being living in society is two things: he is an individual and he is also a person. As an individual he is a biological organism…

as a person [he] is a complex of social relationships" (Radcliffe-Brown, 1940, p. 194). While the term individual is used to describe people as autonomous units who are in control and can author who they are, the term person is a lot more embedded in society. However, as we will see further in the chapter, the meanings of these concepts vary dramatically with cultural context, and there can be no universals. "Personhood is the attainment of physiological, psychological and social competence as it is defined by a given culture" (Appell-Warren, 1988, p. 6). As individuals go through life stages and participate in the rituals of being part of that society, they are recognized by other members as persons. Though being born in a specific family already bestows a certain form of personhood, this is not a static concept, but a dynamic one that changes over time.

6.4 Caste, *Jaat* (*Jati*), *Varna*

> The very word caste is notoriously ambiguous. Among other things, it may refer to varna classically conceived (for example, as it features in the Dharmashastras); it may refer to jati—jatis either ranked in some vague connection to varna or instead unranked and decoupled from varna altogether; and it may refer to category, such as Scheduled Caste (SC) or Other Backward Classes (OBC). (Rathore, 2020, para. 6)

Varna and *jati* are the two terms that one most commonly encounters in scholarly texts on the Indian caste system. *Varna* is a Sanskrit word that refers to the system of classification from the Hindu text *Rigveda*, which arranges people into four groups—*Brahmins* (priests), *Kshatriyas* (warriors), *Vaishyas* (traders), and *Shudras* (farmers and craftspersons), along with a fifth informal category often referred to as the untouchables (Lee, 2020)[7]. *Jati*, on the other hand, is a Hindi word that also refers to caste, and has several variations in other Indian languages such as *jaat* in Marathi, *kulam* in Telugu, and so on. While *varna* is a term that was used for over two thousand years, *jati* and its variations are more contemporarily used words, both representing caste (Béteille, 1996; Rathore, 2020). *Jati*, of which there are thousands in India, consist of people often grouped by origin myths, endogamy, and traditionally, by a shared occupation. However, *jaat* and *varna*, while often thought as closed, rigid, and hierarchical concepts, are in fact a lot more open, fluid, and horizontal in society. Occupations are no longer defined purely by *jaat* and endogamous as well as exogamous marriages are widely prevalent across castes. In other words, there is flexibility and malleability in how caste is understood in Indian society today.

6.4.1 Caste and Hierarchy

Caste continues to be a preoccupation that, for years, "has bedeviled South Asian anthropology" (Appadurai, 1986, p. 757), making it a "central symbol for India" (Dirks, 2001, p. 3). The scholarship on India's caste system is vast, but a few oft-quoted texts have been central to the evolving discourse on the subject. Appadurai's article, titled 'Is Homo Hierarchicus' is a reference to French sociologist Louis Dumont's famous examination of India's caste system in a book called *Homo Hierarchicus*, while Dirks in his book *Castes of Mind: Colonialism and the Making of Modern India* unpacks the long lineage of writing on the topic of caste from French Jesuit missionary Abbé Dubois and Louis Dumont to postcolonial scholars Partha Chatterjee and Ranajit Guha. Dumont's treatise,

[7] According to Béteille (1996), there is no fifth *varna* and all humankind can be included in four *varnas*.

which is considered a landmark in anthropological studies of India, emphasizes the role of hierarchy based upon notions of purity and pollution as the distinctive and defining features of the caste system and Hindu society. He presents Indian society and culture in contrast to the Western, suggesting that the former is structured around social stratification while the latter on egalitarianism. “As opposed to modern society, traditional societies which know nothing of equality and liberty as values, which know nothing, in short, of the individual, have basically a collective idea of man” (Dumont, 1970, p. 8). Dumont’s views have been critiqued widely as being informed only by the Brahmanical view of caste, of painting an entire society with too broad of a hierarchical brush stroke, for using the logic of inversion to create the Indian person in opposition to the Western person, for being restricted by the limits of a structuralist approach, for not presenting sufficient support from Sanskrit literature and ethnographic evidence, and for failure to consider the Indian subject’s positionality (Appadurai, 1988; Daniel, 1984; Das & Uberoi, 2006; Khare, 1984; Ram, 1991, 1994).

Research suggests that in Indian society caste has continued to maintain salience as a political and symbolic force. According to Rao, “democratization of caste reflects a form of politics that forefronts collective rights and group emancipation rather than individual autonomy” (2009, p. xii). It is thought that Dumont did not intellectually pursue the contributions of Indian thinkers (ancient philosophers or nineteenth and twentieth century academics) in shaping his work (Khare, 2006, p. 13). The reliance on purity and pollution that both Dumont and Marriott exhibited in their analysis of caste were echoed by M. N. Srinivas, who described caste as

> a hereditary, endogamous, usually localised group, having a traditional association with an occupation and a particular position in the hierarchy of castes. Relations between castes are governed, among other things, by the concepts of pollution and purity and generally, maximum commensality occurs within the caste. (Srinivas, 1962, p. 3)

Theories of caste based upon hierarchy, concepts of purity and pollution, and modelled after Vedic texts have been critiqued for being out of touch with the modern, urban India (Béteille, 1996). In addition, whether rituals, dress, forms of worship, and other behaviours are indicators of a social caste-based hierarchy is not known with any clarity (Desai & Dubey, 2011; Gupta, 2000; Kapur et al, 2010; Mayer, 1997). In a volume published in 2006, Indian anthropologists have voiced their agreements and disagreements with Dumont's characterization of caste. Khare, who has written widely about caste, food, and globalization among other topics, critiques Dumont's method and semi-deductive model for not being tested against empirical evidence. While admitting the enormity of Dumont's task, he does take him to task for "incomplete or non-existing information" (Khare, 2006, p. 61). Further, Khare suggests that Dumont's model of a bipolar, unidirectional hierarchy is too restrictive to be effective and comprehensive. Das and Uberoi push this agreement further, and by providing examples from common rituals as well as Sanskrit texts, they clarify that such binary opposites as pure and impure do not explain what is actually happening on the ground in people's lives (2006). They also point to examples of equality and reciprocity, and mention that they fail to understand why Dumont seemed to have clearly recognized them but set them aside as inconsequential. Classifying an entire society as hierarchical or egalitarian is also seen a scientifically imprecise. Dipankar Gupta suggests that castes should be examined as discrete categories, rather than purely as continuous hierarchies, as that can help explain many individual and group behaviours that otherwise appear as anomalies or outright refutations of hierarchy (2006). Doing so reveals that a singular ideology does not function here; instead, there are multiple ideologies around which castes organize themselves, making it possible for them to be discrete and yet relate to each other.

Nicolas Dirks (2001) suggests that the caste system as we know it today is not a remnant of an ancient Hindu civilization or tradition but is a modern phenomenon and an outcome of colonial rule. “It was under the British that ‘caste’ became a single term capable of expressing, organizing, and above all ‘systematizing’ India’s diverse forms of social identity, community, and organization” (Dirks, 2001, p. 5). Dirks explains that regional and local political organisations, kinship groups, and communities existed in precolonial times and caste was never a single category or organising principle. But caste was refigured and re-presented by the British as a *varna*-based, monolithic system with its roots in religion and tradition, without much political significance, thereby making it easier to govern such a large and complex society. Other critiques of anthropological texts on Indian personhood suggest that scholars have focused too much on caste, kinship, and the village, instead of more “modern themes such as class, urbanisation and migration” (Ram, 1994. p. 125).

6.4.2 Caste and Occupation

Dumont also presents an analysis of caste and profession, and links this relation to the notion of hierarchy and purity, two of the themes that are central to his overall project. The idea of purity is also associated with religion through which some professions such as washing are deemed impure, and some professions such as farming considered religiously neutral. The *tambats* have always been involved in making utensils (*tamhan*, *kalshi*, *gadwa*, *pela*) that are used for worship (*puja*) in the home, religious statues of such deities as Ganesh, icons of the Shivlinga, and components of temple architecture such as finials. Dumont further suggests that the link between caste and profession is a matter of status, and the *tambat* association with religious artefacts and production does secure them a certain status in society. This form of work necessitates transactions with religious bodies, representations of gods and goddesses, and recognition in society as facilitators of religious activity. These activities and transactions, as we shall see in the next section, are critical to them as persons.

However, it has also been argued that the relationship between caste and occupation is not as rigid and impermeable as it may have been described in earlier formulations. "Even before independence many castes, and probably most, had more than half their working members in occupations other than those specifically associated with their caste" (Béteille, 1992, p. 40). And after industrialisation, as mass-produced goods from factories started to flood the Indian markets, artisan work started to be marginalised, forcing many of the craftspeople to drop their caste-given occupations and seek other work. This also meant that people unfamiliar with specific craft skills started learning them, simply because it gave them employment. The migrations of rural populations to cities in search of employment, increased formal education of the children of artisans, enhanced opportunities for persons of marginalised castes due to the affirmative action recommendations of the Mandal commission report, have all led to further separation between caste and occupation. Some of this is true with the *tambats* as well. Many members of the *tambat* community consider themselves to be Brahmans. Several of the *tambats* practice Brahmanic rituals, such as the *munja*, a ritual that grants Brahman boys the right and opportunity to study Vedic texts and wearing of the *janva* (sacred thread). According to the decrees of the Ministry of Social Welfare Resolution that acted on the Mandal Commission report in 1993 and the Ministry of Social Justice and Empowerment that acted on the report of the National Commission for Backward Classes (2011), the *tambats* of Maharashtra are classified as OBC (Other Backward Classes). However, it is not known whether the *tambats* consider themselves as OBC, and I have heard that the opinion is rather divided in this matter. Caste and affirmative action constitute extremely difficult and delicate topics of conversation and are not usually discussed openly. While some don't mind, asking someone about their caste can be seen as insolent and impertinent. A group of coppersmiths in Goa who also consider themselves to be descendants of Twashta call themselves Twashta Kasar Brahmins. The coppersmiths of Northern India, on the other hand, have organized themselves under the name Haihaivanshi Tamrakar Samaj, and consider their community to be Kshatriya. In other words, the communities are able to exercise a certain amount of choice in determining their own *varna* or caste.

6.5 Transactions and Inseparability

Anthropologist McKim Marriott describes Hindu culture (and Indian culture in general) as transactional: as a society whose members engage in a variety of different forms of exchange as part of the relations of kinship, work, and worship (1976). These transactions involve the give and take of such tangibles and intangibles as objects, substances, land, knowledge, words, ideas, appearances, and so on. Marriott goes on to describe two other key ideas. First, he suggests that the separation that is assumed in Western cultures between action and actor, law and nature, mind and body, spirit/energy and matter, *purusha* (man/human or consciousness) and *prakriti* (matter or nature), *dharma* (religion or code) and *sharir* (body) is absent in Indian culture. And while the Vedantic school of Hindu philosophy is monistic, the Samkhya school of Hindu philosophy is considered dualistic and regards *purusha* and *prakriti* as independent realities. These terms, as seen above, are polysemic; while *purusha* can also be understood as man, spirit, or subject, *prakriti* can be understood as objective substance or primordial matter (Müller, 1919, p. x-xi). Second, he writes that "actors' particular natures are thought to be results as well as causes of their particular actions (karma)" (Marriott, 1976, p. 109). Marriott here seems to be referring to the notion of *karma siddhanta* (doctrine of actions), which suggests that who we are is determined by what we do—our actions. The doctrine of *karma* (which can be translated as action but also as cause and effect) is found in the Brihadaranyaka Upanishad in which one of the hymns says, "now as a man is like this or like that, according as he acts and according as he behaves, so will he be; a man of good acts will become good, a man of bad acts, bad; he became pure by pure deeds, bad by bad deeds" (Overfield, 2001, p. 70). As individuals act and transact, they are made into who they are.

However, one cannot truly dissolve the notion of an actor and that of action into something inseparable. When Sadashiv Apte declares, "I am made *tambat* by work", he is referring to the decades of actions and transactions in *tambat ali* that have shaped him into who he is today—a *tambat* by work. Designers who have been working with him for years are surprised when they hear that he is not *tambat* by caste. Observing him sitting outside one of the workshops in the street in Kasba Peth hammering away on a copper utensil, a passer-by would take him for a *tambat*. His actions, gestures, and skills—all the techniques of his body involved in making things of copper—bridge the divide between being *tambat* and becoming *tambat*. However, Apte's personhood is not shaped solely and entirely by his actions. He is *maratha* by caste and says that he is. And while his everyday actions of work do not define him as *maratha*, that is a part of his person that does not fade way or get replaced by the *tambat*-by-work person. Apte the *tambat* and the *maratha* coexist.

Categorising and listing transactions in *tambat ali* can be daunting as the exchanges occur in a variety of forms, in multiple locations, among humans and nonhuman actors, across scales, and during specific events. When examined by location, one can see these transactions occurring in the workshop, at home, in the market, in third spaces like restaurants, at the temple, out in the city, in rural environments, in nature, and so on. They can also be examined by type of occasion, such as working, not working, at leisure, on travel, during festivals, etc. The transactions take place among the *tambats* themselves, between *tambats* and non-*tambats*, between *tambats* and things; and the give and take includes tangibles as well as intangibles. Tangible items include the materials (durable and non-durable, mutable and evanescent, wet and dry, solid and liquid, etc.), tools, machines, money, food, clothing, etc. while the intangibles include such things as knowledge, skill, stories, and ideas.

The *chaîne opératoire* of the *bamba* that we saw in Chapter 3 on production not only made the technology of its making visible, but it foregrounded the actions of the *tambats*, and made it evident that it would be absolutely impossible to make the product without the transactions amongst everyone and everything involved in the process. What is also interesting to highlight here is the notion of individuality. While the *tambats* do work together, transactions are possible and enacted only when each one acts as an individual towards a collective outcome. Kanvinde creates the *budchaki* of the appropriate dimension and hands it over to Palekar, who will then braze it to the *patta*, which he made of the appropriate dimension to accept the *budchaki* from Kanvinde. Only when the two components match perfectly that the making of the *bamba* can progress towards completion. The actions of Kanvinde and Palekar are enacted individually, fully informed by their own skill and technique, but also by the knowledge of each other's intentionalities. Therefore, fundamental to the creation of the *bamba* are individual actions and transactions, but of the kind that transform material into a collectively imagined and constructed object.

6.6 *Vyaktitva* ("Person-ness") and *Charitra* (Morality)

In Marathi (and Hindi), the word for person is *vyakti*. In *Camera Indica*, a social analysis of the photographs of Indian men and women in the city of Nagda, India, Pinney describes the term *vyaktitva* as "the signs of being a person" (1997, p. 198). He further explains that "*vyakti* denotes a person, and *vyaktitva* signifies 'person-ness', although it is usually translated as 'personality', ‘individuality’ or ‘self’” (Pinney, 1997, p. 198). Pinney does not discuss the word “*vyakt*”, the Sanskrit root of *vyakti* and *vyaktitva*, which can be translated as “expressed” or “manifest”. And therefore, the word *vyakti* can be employed to describe a person in terms of those aspects of their personhood that are manifest in the world. Pinney’s discussion of *vyaktitva* is a specific version or manifestation of the word that references and relies primarily on visuality. The body (*sharir*) serves as a ground for those physical and visual aspects of *vyaktitva* such as skin complexion, features, and apparel, that are possible to be captured in photographs. In addition, a photograph can also reveal other aspects of *vyaktitva* that may be described as demeanour, social appearance, or role in society. If derived from photographs, *vyaktitva* therefore, is presented as being cutaneous, dependent on external surfaces, and reminiscent of Mauss’ *persona*. However, *tambat vyaktitva* extends beyond the visual to circumscribe those actions and transactions (designing, making, etc.) that are central to the creation of copper things in *tambat ali*. Here, the body is no longer merely a receptacle for the *vyaktitva*, it actually embodies it. The *tambat* body expresses itself in the gestures, postures, and movements that are critical in designing, making, and engaging in all the processes of the creation of copper things.

Pinney also presents the term *charitra*, as that which “photographs are nearly always completely unable to capture… the internal moral character and biography of a sitter” (1997, p. 198). People’s *charitra* is only revealed through their actions, deeds, and moral decisions. Marriott’s notion of the significance of actions and transactions becomes relevant here as expressive of moral character. In other words, it is through their bodies and their movements in relationality to other bodies and movements that the tambats develop and express their *vyaktitva* and *charitra*.

Right across from Mahesh Metals where *bamba* are made, is Agarwal Talim, a traditional wrestling and body-building gymnasium for men. "*Talim*", an Arabic word that means education, has been adopted into Marathi, and in this context, it refers to a place where the body is trained through exercise, diet, and rigorous discipline. *Tambat* culture has had a long tradition of wrestling. Abhijit Palekar and his son Raghuvir Palekar were both *tambats*, *bamba* makers, and wrestlers. Raghuvir trained at Agarwal Talim in the 1930s and was known to have defeated many a famous wrestler at that time. In addition to being an excellent wrestler, he had also gained reputation as an excellent *bamba* maker. He was also known to have trained several *tambats* in the art of wrestling as well as making *bamba*. The education that took place in these *talims* aided the *tambats* in building strength, dexterity, stamina, and endurance—embodied knowledge of the body that was essential in winning wrestling bouts and making *bamba*. While in the *talims* the *tambats* exercised force on other *tambats*, in the workshops they did so on sheets of copper.

6.7 In(dian)Dividual

It was Marriott who first presented the concept of the dividual, the Indian person, as someone who is socially embedded, divisible, and made up of several interconnected components or aspects, in contrast to the individual, the Western person, who is a single, indivisible human being (1976). In an entirely different part of the world, Melanesia, Strathern offered a similar concept of the dividual as a composite being made up of gifts or transactable components of other dividuals in society (1988). In anthropological literature, non-Western persons have been analysed and depicted variously as dividual, divisible, partible, fractal, groupist, distributed, porous, and composite (Gell, 1998; Marriott, 1976; Smith, 2012; Strathern, 1988; Sugimoto, 2003; Wagner, 1991). And the contrasts between non-Western and Western persons have been described in terms of hierarchy vs. egalitarianism, holism vs. individualism, sociocentrism vs. egocentrism, relationalism vs. individualism, and so on (Smith, 2013). Though it is generally agreed that the notion of what constitutes a person varies across cultures, these dichotomous, oppositional views have been critiqued (Busby, 1997; Hess, 2006; LiPuma, 1998; Ram, 1994) and replaced with more nuanced and hybrid expositions of personhood, as well as suggestions that that "all persons are both dividuals and individuals" (Englund & Leach, 2000, p. 229). And if the latter is indeed the case and persons are simultaneously both, perhaps personhood can be situated on a continuum rather than being conceived as oppositional (Mageo, 1995; Smith, 2012). Yet other analyses suggest that a single continuum or spectrum is unidimensional and therefore rather limited and limiting; and what is necessary is a new approach that appreciates and considers the multi-dimensionality and multi-modality of personhood (Fowler, 2016). Fowler's new "relational model" presents several axes or dimensions, such as fractal and monadic, egalitarian and hierarchical, indivisible and divisible, permeable and impermeable, and many more along which personhood lies, depending upon the person, situation and context (2016, p. 403). Here, the question is not whether personhood can be explained as dividual or individual, but instead to what extent and where can it be situated along these multiple axes.

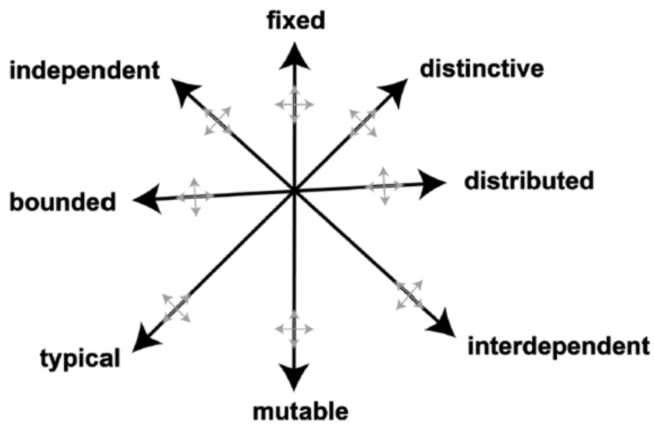

Figure 6.1: Multiple dimensions of personhood (Reproduced from Fowler 2016, p. 402)

It is clear that the approaches presented by scholars towards understanding personhood have evolved from simpler to more complex, unidimensional to multidimensional, and oppositional to inclusive models over time as preceding versions have been found insufficient to characterise new ethnographic data.

6.8 *Tambat* Personhood

As discussed before, members of the *tambat* community say that only a person who is of the caste can be referred to as *tambat*. It does not matter whether they are actively engaged in the profession or not. By this definition, Sadashiv Apte and others like him who are not born into the caste but are fluent in the work of the profession, cannot be regarded as *tambats*. One of the designers, Rane, who has been working with the *tambats* for over ten years too said she felt like she was a *tambat*, while admitting that she could not physically do the craftwork. On the other hand, there are several persons who are *tambats* by birth but do not practice the profession. Practising the profession in *tambat ali* can mean several things that may be broadly classified in the following categories: (a) making, (b) designing, (c) selling, and (d) owning a workshop. One other category that also should be examined is, (e) not engaging in any copper-related work at all.

The first category of "making" clearly includes those who are actively engaged in the profession of creating copper utensils and other objects on a daily basis; this is their primary source of income. As discussed earlier, most of this category is made up of those who were born *tambats*; however there have always been craftspersons in *tambat ali* who are not *tambats* by caste but have learnt the techniques and ply this trade. Over time, there have been many visitors to the *tambat ali* workshops who have spent minutes, hours, days, and sometimes months learning these techniques, but they have not maintained this as their primary profession. The second category, "designing" might be better described as conceptualising. While the process of design can be very broadly circumscribed to include everything from user research to final production, here, I refer to the mental processes of imagining new products and opportunities for copper, but not necessarily (physically) making them. While formally trained designers and architects are the ones that make up this category, *tambats* themselves too engage in this activity. I am yet to encounter *tambats* who conceptualise entirely new products but do not make them, as they all have the means of manufacturing. The third category of selling includes individuals from both groups—those who are born *tambats* and those who are not. The designers and architects who work with the *tambats* either have their own outlets though which they sell goods made in *tambat ali*, or they sell directly to a few clients through contracts. The *tambats* themselves sell products they make through their workshops. Some of the *tambats* work directly with traders who supply raw material in the form of copper sheets or partially made products, and they get paid by giving back fully finished products. Category (d), of those who are owners of their workshops are predominantly *tambats* who have inherited their businesses from their fathers. There have been a few occasions in the past when skilled workers from outside the *tambat* caste learned the skills and started their own workshops.

The final category (e) of those who are not currently engaged in any copper work, interestingly includes, by sheer numbers, most of the members of the *tambat* caste. These are, for example, the sons and daughters of *tambats* who, over the past few generations, have chosen to pursue other professions, many after formal college education. Pari Karulkar is an interior designer by education and has several years of experience designing residential and commercial interiors in Pune and surrounding areas in Maharashtra. She is also the daughter of Bajirao Karulkar, who owns one of the workshops in *tambat ali*. The first time Pari had to think about her caste, she recalls, was when asked to enter it on a form required by her college. She remembers being unable to answer the question and had to come home and ask her parents what she should write down. It was one of the first instances when she had actively thought of her caste as being *tambat*. Though she is not currently involved in her father's profession, she does entertain the probability of engaging in *tambat* work in some capacity perhaps in the future. She has ideas of either designing products and interior spaces with copper, running and managing the factory that her father has owned for over three decades, or exporting copper products to the USA where she lives now. She thinks of herself with pride as a designer and as a *tambat*.

6.8.1 Malleability of the Body, Skill, Person, Community

Materials have unique properties and affordances that enable them to be worked on and worked with in certain ways. For instance, while materials like wood, fabric, and paper are absorbent, metals are not; they do not take in liquids, but instead repel them or react with them. On the other hand, metals can generally take in significant amounts of heat without being affected drastically, but materials like wood, fabric and paper will quickly burn and transform into ash. Copper does not absorb other substances, but it readily reacts with them to form new compounds, and releases ions when it comes in contact with certain liquids. When subjected to heat it softens readily, becoming pliable enough to be coaxed into moulds and dies of a range of shapes; and when put under pressure, it yields and bends with ease, taking on new shapes towards which it is urged. The properties of conductivity and malleability have made copper a desirable material in several industries and in *tambat ali*. This malleability of copper is not contained within the boundaries of the material; it appears to be mirrored in *tambat* bodies, their skills, and their community.

I would like to propose the notion of 'malleable personhood', borrowing from the property of the metal that is such an integral part of the lives of the *tambats*. Malleability, described as the property of a material to be shaped and extended through external forces, to be flattened into sheets or drawn into wires, is a characteristic of copper. It is with the simplest of tools, and at times merely with one's hands, that this pliable metal can undergo transformations when subjected to the right forces. *Tambat* personhood can be imagined to be similarly malleable. As seen in Chapter 3 on production, *tambat* work engages the entire body, especially during such processes as *matharkam*, *kholkam*, and spinning. They need to feel materials and objects directly as they are held between fingers and toes; their ears are tuned for feedback from the material as the type of sound tells them whether the hammer stroke led to an indentation or a dent; their eyes have to be focused to pinpoint the precise location where the hammer head should fall. The bodies of the coppersmiths are attuned to the affordances of the metal, and they are in the workshops day after day, bent over bar anvils, arms in motion with hammers in hand, deeply engaged with the material. Their bodies themselves are malleable, able to bend and flex around the tool and job at hand, capable of applying brute force when needed (in spinning thick sheets of brass on the lathe) but also able to hammer gently and precisely when appropriate (in making small vessels). Calluses from friction, skin burns from acids, backache from sitting on the anvils, arm fatigue from hammering and spinning are all etched on their bodies. Both copper and coppersmith, malleable as they are, shape one another in a reciprocal relation that has endured over time.

Tambat skills too are shaped and fine-tuned by the material in an itinerative process (Payne, 2018) as young entrants into the profession mature into "full-participant status" after years of engagement (Marchand, 2018, p. 6). The division of labour seen in the process enables the *tambats* to not only speed up the production but also to specialise in a unique part of the process, as we saw in the making of the *bamba*, during which Ramesh Kanvinde demonstrated his expertise in *matharkam*, while Pavan Kanvinde in *ujalkam*. However, many of them are able to perform each other's tasks if necessary. In Vangewadi, Govind Kapre does both, *matharkam* as well as *ujalkam*. Each of the *tambats* has developed a unique set of gestures and techniques of the body that lead to distinctly distinguishable hammertone marks when they do *matharkam*. This is a nuanced expression of skill, and it is often possible to identify the *tambat* who did the *matharkam* based upon the shape of the dimples, their spacing and density, and their evenness in each row.

In her study on the island of Gawa in Papua New Guinea, Munn develops a theoretical framework of action, value production, and signification to better understand how a community through specific acts creates value, and in that process makes itself and its social world. “Certain outcomes can therefore be considered icons of the acts that produce them”, and these outcomes can be the body or material things like canoes, kula shells, etc. (Munn, 1986, p. 17). These objects then display qualisigns of the value created by those very acts. Qualisigns can be seen as qualities (in case of the Gawa, Munn refers to lightness, emptiness, heaviness, etc.) that operate as signs and can be applied to various objects. Morphy uses this concept to describe the lightness associated with ancestral power in a study of the Yolngu of northern Australia (1989). In *tambat ali*, the actions and transactions of designing, making, collaborating, which are performed on sheets of copper lead to a series of outcomes, which are the objects the *tambats* make. Qualities such as malleability, ductility, brightness, mouldability are expressed in and through the material. And in an expression of Munn’s framework of action, value production, and signification, the *tambats* act on themselves through the material’s malleability in creating their own personhood as well as that of the community.

The malleability of this form of personhood is multidimensional and fluid; it enables persons to shape and reshape themselves within and without the constraints of caste and profession. Considering oneself to be a *tambat* is clearly not related to being born into the caste, as exemplified by Apte and Rane. Nor is it limited to those actively engaged in the profession. While caste may not be as malleable as profession, in case of the *tambats*, it does not matter because non-*tambats* are recognised and accepted as coppersmiths in and outside the community. The Twashta Kasar Samaj of *tambats* is pliable; it accepted Apte, a non-*tambat* by birth, with ease among them; and Apte, in his own malleability moulded himself into this community.

Some of the *tambats* like Gajanan Palekar are re-engaging efforts in *tambat ali* in new ways. As a young boy, Palekar did learn some of the skills of copper work, but he chose to work in the telecommunications industry instead. All through this time, he continued to live in *tambat ali*, and as we saw in Chapter 4 of the description of Kawthicha Wada, he has now set up a small museum of over four hundred copper objects which he proudly shows to visitors. *Tambat* personhood, therefore, can be imagined not only as a personhood of making, but one that is expansive and malleable enough to include a series of allied activities as well.

"The point is not that 'things' are any more animated than we used to believe, but rather that they are infinitely malleable to the shifting and contested meanings constructed for them through human agency" (Steiner, 2001, p. 210). While Steiner's emphasis is on the notion that malleability of things arises through human agency, we can turn this around to say that the malleability of the material itself of which things are made is agentic in shaping personhood. Copper is indeed infinitely malleable; it can go through endless cycles of heating, beating, cooling, and reheating without substantial degradation in its properties. And these material cycles are also social; they occur in the presence of and with participation of the *tambats*. Hoskins (2006) likens Steiner's idea of malleability to Gell's notion of instrumentality. For Gell, art (and one may include design) constitutes instrumental action and can therefore influence persons to think and act in certain ways. These designed objects of copper during their lifecycles (evidenced in plots of production, distribution, and consumption) are intertwined with lives of the *tambats* who make them, and therefore not only do they inspire actions and thoughts, but they shape personhood as well.

6.9 Conclusion

Strewn about in every workshop in *tambat ali* are parts and components of *bamba*, *pimpa*, water carafes, lampshades, and a host of other products. And when assembled, they transform from individual components into objects. However, copper being a malleable material only changes form; it does not disappear or melt away into something else. Even in a finished *bamba*, it is possible to see the story of its origins; each and every part though now assembled into a whole, is still identifiable. Traces of the hand, tool, machine, acid, steel wool, and fire are visible on the body of the *bamba*. And the bodies of the *tambats* who made this *bamba* also bear traces of the work they have done. The sheets of copper they manipulate, the hammers they hold and operate, the substances they dip their fingers in, the blazing fires and burning coals they get close to each day, in turn shape them into who they are as persons. The transactions among the *tambats* and their materials, tools, energies, other *tambats*, designers, tradespeople, and the actions of assembling that bring a variety of components together similarly shape their entire community, the Twashta Kasar Samaj. Their personhood is malleable, as is the community. Sadashiv Apte and other coppersmiths who were not born *tambats* are accepted and became a part of the community because of this form of pliability and mouldability. People (*tambats* and non-*tambats*) move in and out of engaging in some form of copper work in the community, whether it is designing, making, exhibiting, or selling, out of a sense of pride. Rigid strata of hierarchy (Dumont, 1970), inflexibility of movement, or limitations placed by caste are not visible. These structures are replaced by notions of malleability and flexibility. The binaries of purity and pollution that have existed in analyses of Indian (specifically Hindu) cultures also are not seen here; instead, we see potentiality and possibility. In the next chapter, I will examine the practices of design and craft as understood globally, in India, and more specifically in *tambat ali*.

Chapter 7

Practices of Design and Craft

7.1 Introduction

Processes of thinking (conceptualisation, ideation, etc.) and making (production, manufacturing, etc.) are central to both design and craft activity. And though there are marked differences between design-based and craft-based processes of the creation of things, there are several similarities as well. In *tambat ali*, generations of coppersmiths have been engaged in both—design and craft—through the activities of imagining, drawing, prototyping, tooling, manufacturing, packaging, selling, repairing, and recycling a large variety of copper objects. As we examine the life journeys of the *tambats* and the biographies of the *vastu* (objects and plots) they make, it appears that they are designers and craftspersons immersed in what we can refer to as heterotemporal design trajectories. As we have seen earlier in Chapter 5 on copper *vastu*, what the coppersmiths make can be categorised into three groups—traditional objects like the *bamba* designed by the *tambats* decades ago that have not changed much over time, objects like the *supari dabba* that the *tambats* continue to design, redesign, and manufacture, and objects like the antimicrobial wall pegs designed by industrial designers and made in *tambat ali*. While the work that the *tambats* do unfolds in the present, they are engaged in multiple design journeys that simultaneously span different *temporal* ambits. Some of their work draws upon their past experiences going back generations, while some of it is future-focused and forward-looking. The thrust of this chapter is on understanding practices of design and craft, and analysing how the heterotemporality that inheres in their ways of making makes the *tambats* versatile designers, giving them the ability to traverse through their generational pasts invoking traditional knowledge of form in the creation of such objects as the *bamba*, and simultaneously giving them the means of drawing on processual, material knowledge of copper while working with designers in creating unfamiliar and somewhat alien objects like the antimicrobial wall pegs.

India has a long history and tradition of craft that can be traced back thousands of years; the *tambats* have been engaged in making objects for three hundred years or so; and formal, professional training in industrial design started in Ahmedabad some sixty years ago. Design education has created professionals who generate ideas for new products, create sketches, make drawings, build virtual models, do 3D printing, assemble a few prototypes, but often stop there. The *tambats*, on the other hand, carry the process through to its logical conclusion, which includes not only early ideation, but tool and die making, as well as manufacturing of the final designed product at scale. Though described by all accounts as a community of craftspeople, in this chapter I propose that the *tambats* have always been designers.

The global story (its history and evolution) of industrial design has revolved around figuring out the meaning and purpose of the profession, telling and retelling its history, analysing its products and processes, understanding the role of the influential schools in Europe and north America, outlining its value to business, assessing its impact on innovation, and so on. More recently, the narrative has been directed towards critiquing the impact of design’s activities on social, cultural, and environmental issues and has therefore led to a variety of new approaches labelled as sustainable design, social innovation, transition design, speculative design, adversarial design, etc. that we reviewed in Chapter 1. In India, the story of industrial design was shaped by independence, the arrival of design experts such as Le Corbusier, Ray and Charles Eames, and others from the global North, the creation of the National Institute of Design (NID), the Ahmedabad declaration, emphasis on maintaining India's craft history but also pushing for industrialisation, economic liberalisation, and more recently, the proliferation of local design schools. While social innovation, working with craft, supporting industry, and designing for "the real world" have always been the concern, as design became more recognised and ubiquitous in India, issues of design's value to business became a dominant driver defining design.

All through this, a few designers have continued working with local makers, rural and urban crafts communities, and small-scale industries. Makers from many of these craft communities who are typically labelled as craftspersons have been engaged in the process of design for centuries and should more appropriately be referred to as designers. Formal design education has created designers trained at universities who have learnt a generic design process and who typically work with large industries. On the other hand, we can imagine another group of designers (typically referred to as craftspersons) who have been following a specialised design process which they have learnt over years within their milieu. And of course, these categories are not rigid; there are examples of crossovers and hybrids that clarify as well as merge the boundaries between the professions. These forms of design practice are often referred to as professional design for the former and vernacular design for the latter. However, these labels are inaccurate, as it would be incorrect to suggest that vernacular design is not professional. And clearly, elements of the vernacular (if the word is to be understood for its Latin root *vernaculus* as domestic or native) enter any form of design as it occurs in a specific place. As we shall see later in this chapter, there is no local word for design, and while there have been attempts at neologism in devising a Marathi word (*abhikalpa*), it is rarely if ever used in common language. The story of design in India therefore cannot be told as a single narrative; it is one of multiple paths and ways of working, inspired by traditional as well as more contemporary practices of making. It cannot be classified simply as professional or vernacular, formal or informal, craft-based or industry-driven, and so on.

7.1.1 Making in *Tambat Ali*

Practices of making things of copper have endured in *tambat ali* for centuries. The things the *tambats* have made and the processes by which they have made them have changed gradually over the years, fuelled by their imagination, changes in market demand, new tools and machines, scales of production, requests from designers, and so on. While design and craft are generally described and theorised as distinctly different sociocultural, technical, and economic practices performed by entirely different groups of people, a collaborative model in which both serve to support each other seems to be prevalent in *tambat ali*. Similarly, art and craft are typically defined differently and distinctly from each other, but the *tambats*, who are commonly referred to as craftspeople, think of themselves as artists and designers; and the designers, while acknowledging that artistic ability is essential to design, do not generally (though not always) refer to themselves as artists. While the terms art, craft, design, and innovation are clearly linked to each other by the virtue of their emphasis on material outcomes, practices of making, attention to creative activity, deployment of a skill, and relationship to industry, they do have a set of unique meanings ascribed to them. These disciplines and professions are often separated by types of activity, scales of operation, economic structure, and ideology, and each of them have distinct bodies of literature devoted to their exposition and critique.

7.2 *Tambat* Craft

The *tambats*, in speaking of their work, express pride in their mastery over the behaviour of copper, in their ability to create any form out of the metal, about holding tremendous traditional knowledge through generations, and being able to create a series of new objects for the contemporary market. While the *tambats* value the objects that have history in the community and have been made for decades, they also do not hesitate in adopting a more future-oriented approach and designing new objects that might appeal to newer markets. While they continue working with such organisations as INTACH[8] that promote heritage crafts, they also design and make new products on their own that are sold outside *tambat ali*, and work with designers and architects who seek broader markets. Craft here becomes a vehicle for the actualisation and transmission of their embodied, sensate knowledge, and a material expression of their unique virtuosity. As makers named after a material, it is through their skill that they demonstrate and reinforce their substantial relation to *tamba*. The place they have created for themselves, similarly named after the material, is one of assembling around the

[8] INTACH is the Indian National Trust for Art and Cultural Heritage (INTACH), a registered society founded in 1984 with the vision to create a membership organization to stimulate and spearhead heritage awareness and conservation in India.

making—this is where the *tambats* work with each other, shape the material, collaborate with designers, and transact with shopkeepers; this is where the community gathers and becomes what it is. The *vastu* they make, material outcomes of their craft, are opportunities to create and recreate, tell and retell stories of themselves (DeNicola & Wilkinson-Weber, 2020). Each *vastu* in its being and becoming is a plot; it presents an arc of the story from raw material to object, which then makes its way into someone's life and may perhaps return some day to the very location where it was made. This happens when people bring back old copper *vastu*, sometimes handed down from parents and grandparents that need to be repaired or re-tinned. The biographies of these *vastu* also become biographies of the craft. All the gestures of the body, strokes of the hammer, and actions of the acid that have entered the material as it is becoming an object are demonstrated in the craft. The unique techniques of *tambat ali* have shaped the artefact as well as the *tambat*; they have moulded the identities of both object and subject. And the relationality between the maker and what's made is confirmed, reinforced, and strengthened in the craft.

Tambat craft is also an expression of a sense of 'chosenness' that the *tambats* feel regarding their place in society and in Pune. Based on their origin myth, they consider themselves to be the descendants of Vishwakarma, the divine architect of the universe, and his son Twashta, the artisan metal worker. The *tambats* believe they were chosen to be artisans and chosen to do the work they do. They were invited and supported by *maratha* king Shivaji Bhosale and the Peshwa rulers to set up *tambat ali* in the urban centre of the city of Pune, and that is why they moved from the coastal Konkan region of Maharashtra. As we saw in Chapter 6, theirs is a malleable form of personhood which is defined not only by continuing the legacy of the work itself, but also on account of being descendants of this legacy. The craft plays a critical symbolic role in defining who the *tambats* are as individuals and as a community. It is through this craft that they express themselves as the designers, artists, and craftspeople of copper.

In their process of making, the *tambats* are constantly dealing with issues and solving problems that arise along the way; this happens typically in any act of creation of new things. These issues may be related to inconsistencies in the material (material properties vary even across a single sheet of copper), problems of form (certain forms might be difficult to make), equipment (breakdowns of machines), budgets (insufficient funds to make), disagreements (with designers, vendors, materials suppliers, or other *tambats*), and so on. Recognition of the fact that all craft practices involve dealing with issues that arise during making has inspired thinking of “craft as problem-solving” (Marchand, 2016). Design is routinely described as problem solving (Dorst, 2015; Huppatz, 2019; Jonas, 1993; Rittel & Webber, 1972), but it is not a phrase frequently associated with craft. Framing craft in the context of problems and solutions suggests a scenario of oppositions, in which the maker is seen as constantly lurching between a negative state of unwelcome obstacles and a positive state of resolution. Bunn offers a more nuanced understanding by suggesting that problem solving is not something that occurs only in the form of singular incidents that require makers to stop, solve, and continue, but it is a continuous process that is integral to the improvisatory nature of craftwork (Bunn, 2016). Marchand admits that craftspeople often don’t talk about problem solving, as they think of it as a routine and mundane activity associated with making. Though the *tambats* regularly encounter obstacles in their processes (as do all craftspersons), I have never heard them describe their work as problem solving. Problems exist, but in their experiential, sensate process of making informed by years of embodied knowledge, they are used to dealing with interruptions as well as unexpected twists and turns. The *tambats* are familiar with the inconsistencies and surprises that are inherent to the material. A single sheet of copper may have sections that behave differently, either due to grain structure, rolling processes used to create sheet stock, exposure to weather conditions, and so on. Making for the *tambats*, therefore, can be framed more as a continuous process of dealing with inconsistencies rather than journeys between problems and solutions.

7.3 Designers and Designing in *Tambat Ali*

Throughout the day, it is not unusual to see a steady stream of people walking in and out of the workshops in *tambat ali*. This includes the curious, drawn by the rhythmic, incessant and far-reaching sounds of steel hammers on copper sheets, architects, designers and design students seeking to work on a project with the *tambats*, tourists from India and abroad visiting Pune who take photographs and at times buy a few items, and locals who bring by old copper and brass utensils either to get them tinned, repaired, or sell as scrap. In the larger workshops where several *tambats* work together, the coppersmithing activities continue while the visitors may speak to the owner and observe how things are made. In some cases, the *tambats* pause to answer questions, explain their process, and give a brief history of their work as well as the place. Of the architects, interior designers, and industrial designers who visit, some may come back on a regular basis as they flesh out details of potential projects, discuss plans and sketches, go over costing, and evaluate the feasibility of the work. Designer Rupali Rane, who co-founded Atelier Metalworks, describes her company as a "social impact enterprise". In a conversation in her studio, she explains why. "We are addressing two needs through our project; one, the need to have an inclusive growth for handcrafting artisans in India, that is, to make sure that artisans are brought into the socioeconomic mainstream and the second need is to address the need of customers for high quality handcrafted wares." Interestingly, the word design does not feature in her description of what she does; instead, she highlights the desired outcome of design activity.

Before founding Atelier Metalworks, Rane ran her own design consultancy focused on industrial design and graphic design, doing such products as toothbrushes, telephones, packaging, museum exhibits, etc. A few years into this work, she found that her designs were not reaching people in the forms in which she expected them to. "Our studio was buzzing and yes, we had a lot of work, but for me personally there was something missing. And I wasn't very happy with what went out to the customer eventually in terms of the designing we did. While I was convinced about the work and about the market acceptability of our designs, what I was unhappy with was the actual selection that happened at the marketing level of the companies we worked with." This is not unusual in industrial design activity, in which engineering and manufacturing constraints, budgets allocated to the project, marketing and branding decisions, individual preferences, and a host of other forces can reshape designs after they have left the designer's hands and before they end up on store shelves. Rane's studio at that time was only a few kilometres away from *tambat ali*, and she describes that her love for the material copper is what drew her to working with the craft and the *tambats*. After initially working on individual projects with the *tambats* for a few years, she co-founded Atelier Metalworks in 2014.

Figure 7.1: Atelier Metalworks's office (before the pandemic)
(Photograph courtesy of Rashmi Ranade)

Atelier Metalworks's offices were located in a quiet neighbourhood in the city of Pune, about five kilometres from *tambat ali*. The incessant sounds of hammering that fill up *tambat ali* were not heard here. This was a quiet space where finished products from the *tambats* arrived, and where they were sorted, packed, and shipped to stores and buyers. A small showroom displayed products designed by Rane and made by the *tambats*. Rane's design process involves working closely with the *tambats* before products go into manufacturing. One of the meetings between Rane and coppersmiths Bajirao Karulkar, Kapil Kapre, and Subhash Waghmare took place in the Twashta Kasar Samaj Mandir, a two-storied temple building where the *tambats* gather for prayers, special events, and meetings. Rane had created several product designs which she wanted to discuss with the *tambats*, and she had brought along with her drawings, sketches, and cardstock paper prototypes to discuss the process and feasibility of manufacturing them. She had also brought a sample product, an aluminium photo frame, to discuss the possibility of creating it out of copper. The discussion among them revolved around the thickness of copper sheet to be used, who would make the first prototype, the tools that could be used to create the forms, cost of production, moulds and dies that would be necessary to build, and the various steps involved in the manufacturing process of these new products.

Figure 7.2: A local designer working with copper craftsmen (Photograph by the author)

Rane's process of designing things with the *tambats* diverges from the way industrial design is generally practiced in corporations in India and the way it is taught in most Indian design schools. A focus on the material copper and its properties, direct engagement with the manufacturers in problem-solving and prototyping, small to medium scale production, and an expressed desire to sustain a traditional profession and its people are some of the key factors that guide her process. Industrial design, as taught in design schools, typically starts with the identification of people's needs for which products have to be created. Labelled as human-centred design, this form of designing involves conducting research activities such as in-home participant observations, interviews, surveys, etc. with the goal of uncovering unmet or poorly met needs of people. This phase of the design process is often referred to as the fuzzy-front end of innovation during which new product opportunities are identified. Research conducted in the early stages of the process borrows from ethnographic methods to uncover those very needs that design seeks to address through new products and services.

Design in *tambat ali* starts with material. The question that is asked is not always what user needs can be addressed, but what the material can inspire. In engaging material in this fashion, design becomes a process that is immediately embedded into and emergent from the properties of the material, the place where it is worked on, and the skill of the material experts. In order to develop new design processes that focus on experience, environmental sustainability, business strategy, creativity, and circularity, designers and design educators are exploring the notion of "material driven design" (Bak-Andersen, 2018; Karana, et a., 2015; van Bezooyen, 2013). "A new type of design process is emerging, in which the material is present from the outset and can be seen as the driver of the process" (Bak-Andersen, 2018, p. 12). While these approaches are presented as novel, in *tambat ali*, it has been the norm rather than novelty to design with materials.

Generally speaking, industrial design has to imagine the social life into which a product being designed will be immersed. In *tambat ali*, industrial design has to immerse itself into the social life of a material. If design's role is "to participate in the making of a new culture” (Lindinger, 1991, p. 10), in this case design becomes instrumental in producing and reproducing a new culture of copper and a new culture of design itself. In this process, design ties itself to place, personhood, objecthood, and time in a spatiotemporal journey that extends *tambat ali* beyond its location in Pune and leads to the creation of *vastu* with a range of new qualisigns (Munn, 1986).

7.3.1 Learning Design

Industrial design students at the NID (National Institute of Design) and other design colleges in India are required to conduct craft documentation projects so that they familiarise themselves with some of these little-known traditions of making and small-scale production processes. During my time in *tambat ali*, several students came through the workshops, often taking photographs, asking questions, writing reports, and at times attempting to learn some of the coppersmithing themselves. Most of them express awe in having discovered a new world they had not encountered before or even expected to see in the heart of the city. Few students after graduation end up working in small-scale industries or with craft clusters, with a majority working in larger scale product manufacturing corporations or joining design consultancies. Therefore, creating products for large scale industry tends to be the focus in industrial design education in India. This is not entirely surprising as the educational programs at the NID and IDC have been heavily influenced by the foundation programs at the European schools Staatliches Bauhaus in Weimar and Dessau and the Hochschule für Gestaltung (HfG) in Ulm. While the emphasis at the NID was on the creation of a design school in, by, and for India, the institution was clearly influenced by design experts who visited

Ahmedabad from all over the world. In addition, as design educator and historian MP Ranjan points out, many of the founding faculty members teaching at Indian design schools were educated at Ulm (2005).

The Bauhaus, in its founding charter in 1919, strove to create a unity between arts and the crafts. Walter Gropius, in the Program of the Staatliche Bauhaus published in 1919 in Weimar, summoned architects, painters, and sculptors to return to the crafts (Wingler, 1969). This manifesto proclaimed that there was no essential difference between the artist and the craftsperson, and proficiency in a handicraft was essential to every artist. Therefore, Werkstatt (workshop) instruction held supreme significance, and made up a large part of the students' quotidian learning activities. That the academic title of Professor was supplanted by Formmeister (Master of Form) or Werkmeister (Master of Craft), and "student" by "journeyman" or "apprentice," authenticated Gropius's predilection for the artisanal approach to education. The educational program at the Bauhaus for architects, painters, and sculptors was cleaved into three sections: (1) Craft Training, (2) Training in Drawing and Painting, and (3) Training in Science and Theory. The founding principle of the Bauhaus of the unity of art and the crafts was realised in the preliminary course through the lectures given by the masters on the fundamentals of colour and form theory, and the exercises done by the apprentices and journeymen in the workshops.

Much of the industrial design education in India today tends to emphasise the second section of the Bauhaus agenda of two-dimensional representation of ideas, with less attention paid to the other two. Foundation courses at the first- and second-year levels focus on sketching as a form of rapid visualisation of ideas, rendering as a means of expressing details, and 3D computer modelling as a technique of demonstrating volumetric dimensions of products. This is typically followed by modelmaking, initially using softer materials like paper and expanded polystyrene for exploration, and later, as the design gets more finalised, with wood, plastics, and metals. With rapid prototyping technologies becoming more affordable and accessible, the physical modelmaking practices are being replaced by 3D printing, moving industrial design education even closer to a form of desk-based practice.

Most industrial designers who are formally trained in one of the many universities of design in India pick up their design knowledge through classes and projects undertaken during their two- or four-year educational programs. They learn drawing, sketching, modelmaking, computer visualisation, rapid prototyping, materials science, manufacturing technologies, etc. during this time, and they hone these skills during professional practice. The traditional *tambat* practices of educating that have survived for a long time are different. The transfer of embodied knowledge relies on familial relations, and it travels across generations observationally, orally, and through practice. This form of knowledge builds gradually, often over decades, as children of the *tambats* start helping with small tasks when they are young and assisting with more and more complex activities as they grow older. However, it should be noted that the *tambats* have also been teaching their processes to non-*tambats*, especially in situations when they are unable to find craftspersons from within the community to do the work. For example, of the four people working in Karulkar's factory, two are not *tambats* by caste; similarly, Karulkar's grandfather had employed several non-*tambats* in his factory who he had trained to make *bamba*. In these situations, the learning happens with adults and relatively quickly on the job.

The artefacts *tambats* and industrial designers produce while designing—whether they are research documents, inspirational images, moodboards, sketches, drawings, virtual models, mock-ups, prototypes, tools, finished products, and so on—reflect their ways of working, types of knowledge, conceptual distance between the original and what is being designed, as well as the type and complexity of the objects to be made. When the *tambats* are making *bamba*, there is no need for them to look for inspirations, create sketches, or build prototypes, as they have been doing this for generations. However, that changes when they design and develop new products. A few years ago, Karulkar designed a new copper flowerpot, inspired by a photograph of an ancient Egyptian gold vase that he had seen several years ago. He made quick sketches as well as dimensioned, scaled drawings from his memory of this vase before starting to build tools, dies and the first set of prototypes. Industrial designers almost always start by sketching because they are generally taught to do so, but that does not apply to everyone. Karulkar has been working with graphic designer Zeinab Talib since the early 2000s, and one of the most successful products that has emerged from their collaboration is the *urli*—a circular, shallow vessel that has traditionally been used in cooking and preparation of Ayurvedic medicines in southern India. When Talib first came to Karulkar to speak about this, she had the shape and a rough size in mind but did not bring a sketch or any other visual material. She described it to Karulkar as "tyre-shaped" and gave a sense for the approximate size. Karulkar then drew a sketch and a dimensioned drawing, built a few models, and together with Talib finalised the design. She refers to Karulkar as a "creative designer himself" who knows copper really well and is able to shape anything out of the material.

Figure 7.3: *Urli* designed by Zeinab Talib and Bajirao Karulkar (Photograph by Satchidanand P. Sahasrabudhe)

This is a reversal from the process that Rane typically follows when working with the *tambats*—she creates the sketches, dimensioned drawings, and the models. According to her, "the *tambats* picked up our process of working really quickly. After doing a couple of projects, they knew exactly what we were looking for, and what our process of creation is like." Kapre, who collaborates regularly with designers and has also worked in a large metal utensil manufacturing company in the past, has mentioned that while drawing is not something they are used to doing, it is a practice they are using more frequently as part of their own rituals of making. However, he also said, "a true *kalakar* does not really need a drawing because he has the ability to transform the idea from his head into an object. He can visualise it and make it." This adaptability and flexibility in practices of making, being able to decipher technical drawings while calling upon embodied knowledge built over years, and being able to work with a variety of artefacts of the design process, relates to their comfort with simultaneous and multiple design trajectories of the past, the present, and the future.

Back at the Bauhaus, there was a shift in focus in 1923, exemplified in Gropius' lecture, "Art and Technology: A New Unity", when the Bauhaus embraced the ideals of mass production over craft-romanticism. They were now to train not craftspersons, but collaborators for industry, craft, and building. The workshops were renamed laboratories with the purpose of building prototypes of designs suitable for mass production.

> Although Gropius' initial aim was a unification of the arts through craft, aspects of this approach proved financially impractical. While maintaining the emphasis on craft, he repositioned the goals of the Bauhaus in 1923, stressing the importance of designing for mass production. It was at this time that the school adopted the slogan "Art into Industry". (Griffith Winton, 2016)

The mission had been redefined with an emphasis on technology. Toward the end of its life, the Bauhaus became an architectural school, and it was eventually closed in 1933. The emphasis on mass production, technology, and collaboration with industry that was part of the curriculum at the Bauhaus, has persisted in industrial design education all over the world.

The Hochschule für Gestaltung (HfG), founded in 1951 in the city of Ulm in Germany, expanded the Bauhaus vision. Tomás Maldonado, who led the school from 1957 for a period of 10 years, suggested a more rigorous interdisciplinary education that included social psychology, sociology, anthropology, cultural history, and perception theory. The arts were no longer considered a critical foundation for design, and there was a heavier emphasis on developing a stronger scientific basis. Maldonado was interested in developing scientific design methodology and turned to several new disciplines emerging at that time: “cybernetics, information theory, systems theory, semiotics, ergonomics” (Maldonado, 1990, p. 223). Though these disciplines were not thoroughly integrated into the curriculum, engaging them allowed Maldonado and the Ulm school to investigate and develop design’s own scientific base.

This school, which eventually closed in 1968, has been singled out as having influenced design pedagogy all over the world. Contemporary design schools only incorporate these new disciplines at the post-graduate level for master’s and doctorate degrees; undergraduate design education at the bachelor’s level tends to be primarily skill and process focussed. It is therefore little wonder that industrial designers trained in Indian design schools show higher proclivity towards design for mass production, and the products they design visibly demonstrate European influences and the application such principles as economy of form, clean lines, geometric simplicity, and minimal ornamentation. Therefore, products created by designers working with the *tambats* (the third category of *vastu*) appear very distinct from those the *tambats* have been making (first and second categories of *vastu*) for years.

7.3.2 Design, Power, and Colonialism

My positionality is also shaped by my formal education in industrial design in India and the US. The *tambats* and I are engaged in a similar profession—that of design. However, our knowledge of the practices of making has been formed in entirely different ways—theirs through apprenticeship and experience over time, and mine through college education followed by working in the manufacturing industry and in academia. The designers who work with the *tambats* are similarly trained in design at one or more of the many design schools in India and abroad. Atelier Metalworks also invites designers from other parts of the world to collaborate with them and design products to be made in *tambat ali*. As DeNicola has pointed out in her work on wood block printing in Bagru, the relationship between designers and craftspersons is marked by differences in education, language, access to markets, caste, and class (2005, 2012). The block printers typically acquire their knowledge through "vocational or experiential training" from family members while the designers typically learn through "abstract, formal training" in colleges, and therefore "what is implicitly at stake in this narrative is the construction and maintenance of a class distinction" (DeNicola, 2012, p. 13). This distinction is maintained in other ways as well. Craft labour is often portrayed as traditional and heritage bound, while design work is imagined to be innovative. However, these labels are inaccurate as many crafts communities are constantly engaged in generating new forms, developing new tools, exploring new markets, incorporating new technologies, and so on.

Humanitarian design, design for social good, and ethical design generally (but not always) refer to projects undertaken by designers born, raised, and trained in Western, affluent nations with the intent of improving conditions for people in poorer pats of the world. However, these efforts, noble as they may seem, have also been described as imperialistic or as expressions of coloniality in design because of implicit assumptions of Western superiority, lack of recognition of indigenous knowledges, poor understanding of local context, failure to account for positionality shaped by differences in gender, class, economic condition, language, and so on (Nussbaum, 2010; Pilloton, 2010, Tlostanova, 2017; Tunstall, 2013). "Coloniality of design is a control and disciplining of our perception and interpretation of the world, of other human and nonhuman beings and things according to certain legitimized principles" (Tlostanova, 2017, p. 51).

Designers who work with crafts communities are typically from relatively more affluent families; however, "the trope of education hides within itself a normative spatial, economic, and educational distance between communities" (DeNicola, 2012, p. 796). The positionality of designers working with craft communities raises the question of whether this represents another form of design colonialism, as the privilege, education, and class of the designers shapes the nature of the relationship among the groups. Designers who are not familiar with the reality on the ground, who fail to recognize the meaning of true collaboration, and who therefore end up using alien frames of reference are likely to generate design solutions that simply do not work, are inappropriate for the context, and are often rejected by the community. In India, humanitarian projects often focus on such efforts as increasing access to clean drinking water to rural communities, promoting better hygiene through public sanitation, improving healthcare, working with crafts communities, and so on. What happens when such projects do not involve designers from the Global North but designers who are locally situated, who speak the language, and who are better acquainted with the context? In such situations, while there may be some familiarity, other forms of difference precipitated by caste, class, education might play a larger role. Native designers, not unlike native anthropologists, must negotiate familiarity and difference while recognising and acknowledging their own positionality in the field.

Anthropologist Elizabeth Tunstall, who writes about decolonising design, warns against anthropology becoming a handmaiden of colonialism (inspired by a term attributed to Lévi-Strauss), as anthropologists engage in ethnographic studies of distant cultures and designers of the Global North take on projects of social innovation in the global South (2013). She recommends a series of principles of a decolonised methodology that focus on recognizing the value systems of cultures an anthropologist might be working with, developing strategies that lead to respectful dialogue, and creating compassion among participants on the project. Mine is not a project of social innovation, but rather one of anthropological enquiry, and it was impossible for me not to recognise, respect, and appreciate the value systems of *tambat* culture. And my task was to be aware that this would shape not only what I observed and experienced in *tambat ali* but how I conducted my subsequent analysis as well.

7.3.3 Heterotemporal Design Journeys

As we saw earlier in the chapter on objects, *tambat vastu* can be categorised into three groups because their design stories, sociotechnical processes of creation, intended and actual uses, as well as markets and buyers are entirely different. While working in the present, the *tambats* are engaged in three forms of design journeys simultaneously that span different temporal ambits, some that draw upon their past experiences going back generations, and some that are more future-focused and forward-looking.

> The challenge of thinking the present of world politics is the challenge of thinking heterotemporality, ultimately neither one present nor many presents, but a mutual contamination of 'nows' that participate in a variety of temporal trajectories, and which do not derive their significance from one meta-narrative about how they all fit together. (Hutchings, 2008, p. 161)

This notion of heterotemporality may serve as a useful framework to situate the three intertwined design praxes that coexist in *tambat ali* and that result in three distinct but interrelated categories of products. As we saw in Chapter 5 on *vastu*, the first category includes designs of objects like *bamba* that have been made for generations but hardly used in urban homes anymore; the second includes designs of objects like the *supari dabbe* with traditionally recognizable forms that have evolved over time and are sold and used today for the purposes intended; and the third includes designs of new products like antimicrobial wall pegs developed by non-*tambat* designers for trendy, urban and international markets. The first category contains objects of the past that have not changed much and are built upon embodied knowledge that has been transmitted through generations of *tambats*. These objects are not used in homes today in the way they used to be, and when bought, they often serve a decorative purpose rather than being used for the purpose for which they were originally designed. For instance, the *bamba* cannot be used in apartments (outfitted with electric water heaters) where most people live, as it is a wood-fired water heater designed for traditional buildings (*wadas*) that included open courtyards within their interiors. In making objects like the *bamba*, the *tambats* draw upon their memory of an original that dates back generations, and in doing so, call upon embodied knowledge that extends its reach into the past and a distant temporal scale. The *supari dabba*, in the second category of objects, is used in homes for storing betel nut powder, fennel seeds, or *mukhwas*, edibles that are typically eaten after meals to aid in digestion or mouth freshening. Karulkar's design of the *supari dabba* has changed over time—he has updated the form, material, texture, and surface finish; he has found new outlets through which to sell it; and he says he has created and sold more than two million of these over the last three decades. The scale of production, sales outlets, and recurring design changes suggest that this practice is less akin to the way we typically understand craft, and very similar to contemporary design and marketing processes. The original version of Karulkar's *supari dabba* emerged in the 1970s but its form has evolved since then, and therefore its design trajectory has a shorter temporal scale.

The third category of objects falls within what is generally understood as the collaboration between contemporary industrial design practice and traditional craft. In this case, the original idea comes from the designer, but the design is co-created in close collaboration with the craftsperson, who will build the initial prototypes as well as the final production pieces for sale. The antimicrobial wall pegs discussed earlier and the fruit platter (seen in Figure 7.4), are examples of the third category. These products do not have a design past for the *tambats*; it is a new object with an emergent story.

Figure 7.4: Spartan fruit platter by Atelier Metalworks
(Photograph courtesy of Rashmi Ranade)

Rane explains that this fruit platter (named Spartan) she has designed is not a product that the *tambats*, though they may have made it, may identify with. “So, some of our products have new interpretations, for instance, this [points to the fruit platter] to the craftspeople would be just a disc. Whereas this one [points to a traditional *modak patra*], they've seen in their communities and in their families and this they identify with closely. So, there are some products which are little alien whereas there are some with which they are closely associated, they are more familiar.” Products such as the fruit platter are designed for a market that too is alien to the coppersmiths in *tambat ali*. The traditional products that they have learnt to make from their fathers and uncles that they continue to make (albeit in smaller quantities) are primarily consumed by a local market through shops in the near vicinity.

These three forms of design praxes are based upon different plot narratives, they demand distinct ways of thinking and making, and the temporal trajectories of the originals from whence these objects emerge and make their way through processes of production, distribution, and consumption are dissimilar as well. The embodied knowledges engaged in making the three categories of objects, the artefacts created during the design process, and of the tools used vary dramatically among them.

7.3.4 Social Interactions in Making Music and Making Objects

In his analysis of Western classical music, Alfred Schütz focusses on the complexity of the social relation between the composer, performer, and listener, referring to it as a “mutual tuning-in” (1976, p.161). He defines music as “meaningful arrangement of tones in inner time” of the mind of the composer; and when listeners are listening, they participate in the stream of consciousness and the flow of experiences along with the composer’s inner time in a form of quasi simultaneity (Schütz, 1976, p. 170). When two or more musicians are performing a piece of music, they are engaged not only in the inner time and stream of consciousness of the composer, but also in the outer time of each other’s performances. Performers have to interpret their part of the music, understand others’ anticipation of their performance, and also anticipate other players’ interpretation of their parts.

The triadic relationship of the composer, musician, and listener as described by Schütz bears some resemblance to the nature of the social interactions among the designer, maker, and user. Schütz emphasises the multiple and interrelated forms of inner and outer time (he refers to this as pluridimensionality) and the social nature of the relationship between the participants involved; however, the materials and objects critical to the making of music (the skin of the drum, the wood of the piano hammers, the steel strings of the violin) are not circumscribed within these relationships. The physical properties of these materials give them specific vibrational qualities and resonant frequencies that play a key role in the creation of sound. However, they also have social lives (Drazin & Küchler, 2015) that are essential to the creation of music. In other words, one could say that while the physical properties of materials make sound, it is their social properties that make music. Similarly, while things emerge from the physical properties of materials, objects emerge from their social lives.

The *tambats* know well that it is the malleability of copper that enables it to be shaped into a variety of forms; but they are also aware of the role it plays in moulding the various interactions among them, and in defining them as a people. They are mutually tuned in not only with the people with whom they work but also with materials, tools, machines, and all that surrounds them in their places of work. The heterotemporality we have discussed of the *tambats'* design journeys—i.e., their ability to imaginatively traverse multiple temporal frames—is not unlike the pluridimensionality of time of Schütz's musicians. In making a *bamba* for example, the *tambats* are not only thinking of the *bamba* they have made themselves in the past, but also the notion of the original *bamba* designed a long time ago, and perhaps changes they might make the next time they build one. In addition, as we saw in the *chaîne opératoire* of the *bamba*, the *tambats* have to anticipate the needs of the other *tambats* and be able to deliver the components they need to at the right time in order to maintain steady production activity. And, more importantly, the components have to fit each other precisely (for instance, the lid has to snugly fit the body) for the assembly to be completed properly. Just as co-performing musicians have to maintain pitch and tempo but are able to adjust their playing in relation to one another[9], the *tambats* too make adjustments to their work in recognition of the relationality of their process as well as the products they make.

7.4 Describing Making (Art, Craft, and Design) in India

The *tambats* speak Marathi, the local language of the city of Pune and the state of Maharashtra, in which the words artist, craftsperson, and designer are difficult to distinguish the way it is possible to do in English. Regardless of these distinctions in terms, it is clear that through their collaboration, the *tambats* and the industrial designers, graphic designers, and architects working with them are sharing and reshaping each other's practices of making. Understanding how one may translate the term "design" in India presents a unique challenge because the number of languages spoken in the country is not trivial. A question posed in the 2011 Census of India, "write name of the mother tongue in full" resulted in a total of 19,569 unique responses. These "19,569 raw returns were subjected to thorough linguistic scrutiny, edit and rationalization", and further pared down to only those languages that were spoken by more than 10,000 people. This led to 270 identifiable mother tongues, which were then further reduced to 121, of which 22 are spoken today by 96.71% of the population. The roots of these 22 can be traced back to five language families—the Indo-Aryan branch of the Indo-European family, the Austro-Asiatic family, the Dravidian family and

[9] In a study of string quartets, researchers encouraged individual musicians to change tempo and introduce variations. They found that "players respond to and correct asynchronies in tone onsets that arise from fluctuations in their individual tempos." The musicians adjusted their timing in order to maintain synchrony of the quartet. (Wing, Endo, Bradbury, & Vorberg, 2014, p. 1).

finally, the Tibeto-Burmese family (Office of the Registrar General & Census Commissioner, India).

None of these languages seem to have a semantic equivalent to the term "design". However, design historians in India have suggested that the word "*kala*" in Sanskrit (an Indo-Aryan language) has an expansive meaning that seems to include not only practices of art, craft, and design but a lot more (Balaram, 2005; Chatterjee, 2005; Das, 2005; Vyas, 1984, 1991). The breadth and reach of the meaning of *kala* is seen in the work of 4th century CE Hindu philosopher and author of *Kamasutra*, Vatsyayana who classified the word into sixty-four individual types.[10] This list of sixty-four *kalas*

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[10] I have found it a little difficult to get a credible source for this list and translations of the Sanskrit words, but regardless of their source, it is clear that these include not only artistic and craft skills but everyday routines as well. According to Lalit Kumar Das, (Das, 2005), these sixty-four *kalas* included the following: 1. Histrionic talents, drama, storytelling techniques, mnemonics, etc.; 2. Making musical instruments, simple mechanical devices, etc.; 3. Playing musical instruments (e.g., instrumental music including *jalatarangam*—creating music with water, percussion, and string instruments); 4. Decorating, dressmaking, costume making, artful dressing, and personal grooming; 5. Ornaments and head adornments; 6. Singing and dancing; practicing fine arts; 7. Making beds and bedroom decorations; 8. Garland making, flower arranging, and making designs with grains on the floor such as *rangoli*; 9. Playing games such as dice; 10. Mastering eroticism as per *Vatsyayana*, erotic devices, and sexual arts; 11. Making honey, liquor, beverages, and desserts; 12. Plucking out arrows and healing; 13. Cooking, eating, and drinking skills 14. Horticulture, forestry. 15. Breaking and pulverizing hard rock; mining; 16. Making medicines from herbs; 17. Sorting, mixing, isolating ingredients 18. Making and using *astras* and *sustras*; 19. Wrestling, boxing, gymnastics, physical culture, bodybuilding, etc.; 20. Making ICBMs; 21. Parades, army bands and dharmic warfare; 22. *Ratha, Gaja, Turaga* wars (chariot, elephantry, and cavalry); 23. Asanas, postures, and mudras; 24. Training elephants, horses, birds 25. Making vessels of clay, wood, or bronze; 26. Drawing; 27. Making paints and painting; 28. Architecture, sculpture, house and temple construction, mosaic tiling; 29. Mixing air, water, etc. (air products and water products); 30. Boats, ships, chariots, etc.; 31. Making threads, ropes, etc.; 32. Weaving and spinning; 33. Diamond, precious stones, and gems—distinguishing them from ordinary ones; 34. Alchemy, chemistry, and preparing ointments and unguents for charm and virility; 35. Jewelry making including artificial jewelry; 36. Gold plating; metallurgy; 37. Skinning and preserving bodies; 38. Leather technology; 39. Dairy farming; 40. Tailoring, sartorial skills, and embroidery; 41. Swimming and water sports; 42. Cleaning houses and vessels; 43. Laundering and washing; 44. Hairdressing and shaving; 45. Managing oil resources; 46. Having control over others' minds; spells, charms, and omens; 47. Tilling and agriculture; 48. Handicrafts including carpentry, furniture making, and furnishing; 49. Making vessels of glass, ceramic and pottery; 50. Drawing water and resources; 51. Gardening and fence building; 52.

represents a broad range of professions and disciplines including literature, medicine, sports, architecture, making furniture, making utensils, engineering, and some that might be seen as routine everyday practices such as eating, cleaning house, laundering, etc. These historians include the word design under this umbrella term *kala*, and therefore make the argument that the practice of design and the work of designers have a long lineage into India's past. The word *kala* extends to the terms *kalakar*, *kalavati*, and *kalavant*, all of which refer to those who practice *kala*, i.e., singers, dancers, actors, painters, masons, architects, etc. mentioned in the list of sixty-four. These were the men and women in whose hands fell the task of the creation of religious artefacts such as idols, illustrations, paintings, and temples, as well as everyday objects such as garments, utensils, and implements. According to design educator and historian, Kumar Vyas,

> These "artists" were the masons, painters, illustrators, stone and clay workers, wood workers, and metalsmiths. Because the same artist-craftsman also created artefacts of everyday use for the householder, it is obvious that no separate terms were needed to distinguish the plastic arts from the crafts. In the minds of the creators and the people for whom these objects were created, art and craft remain one inseparable concept. This unified concept remained unchanged for

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Caparisoning, dressing, decorating elephants, etc.; 53. Child rearing and pediatrics, including doll making and toymaking for kids; 54. Punishing guilty appropriately through law and order; 55. Learning languages/dialects (both native and foreign), literary excellence, semantics; 56. Preparing "*tambool*," etc.; 57. Composing impromptu poetry; 58. Preparing perfumes and cosmetics; playing poetry games; and oratory, elocution, prosody, and rhetoric; 59. Sorcery, conjuring, sleight of hand, magic, illusions, impersonation; 60. Composing riddles, rhymes, verses, puzzles, tongue twisters, and involved recitations; 61. Making swords and staffs; archery; 62. Training fighting partridges and rams, cockfighting, bullfighting, etc.; 63. Teaching parrots and *mynas* to talk; training animals; veterinary science; 64. Writing in cipher codes and languages; secret mantras; coding and decoding.

> more than 2000 years and had a single word to express it: KALA. This is a word the meaning of which embraces all aspects of human arts, crafts, skills, and techniques. The only parallel one can think of is the old Greek word TEKHNE, which meant both art and technique. Since then, the learning of the Kalas remained, for obvious reasons, hereditary, and flourished well within the prevailing caste system till the time when the whole of the Indian sub-continent came under the direct political control of the British. This was also the time of systematic transfer of new ideas and institutions of the West to India. (Vyas, 1984, p. 92)

In this context, the terms I heard in *tambat ali* frequently were *kalakar* (loosely translated as artist) and *karagir* (loosely translated as craftsperson or tradesperson). Bajirao Karulkar, who owns one of the *tambat* workshops and typically employs four to five craftspersons, explains these terms. “A *karagir* does exquisite work. In creating traditional art, Sadashiv Apte [one of his employees] is a *karagir*. On the spinning lathe, I am myself a *karagir*. Being accomplished in one’s work is being a *karagir*. Govind Lele [another employee] is an exquisite *karagir* in doing hammertone work. A *kalakar* is someone who develops new creations; things that are not on the market. I think of myself as a *karagir* and a *kalakar*, because I can do good work, but I can also make new creations.” Conversations with other tambats reveal variations on this view. Kapil Kapre says, “*Karagir* is an appellation of *kalakar*. Only a *kalakar* can be a *karagir*.” In other words, he thinks of these words as being synonymous to each other and also goes on to say that in order to be a *tambat* one has to be both, a *kalakar* and a *karagir*.

Recent publications in Marathi penned by the faculty from the Industrial Design Centre in Mumbai refer to design as *abhikalpa* (Dalvi, Joshi, & Athavankar, 2016). This is not a word that is found in Marathi dictionaries and is a neologism that is derived from the words *abhi*, which is a preposition, and the word *kalpana*, which means imagination. And while this word is used in some of these publications, it is not used in common parlance with the *tambats* or with other designers.

The *kalas* described earlier by Vyas (1984) continue to be transmitted from generation to generation through a variety of mechanisms. "The knowledge and practice base of the designer was constructed at various levels such as learned assemblies, ashrams, schools, guilds, an apprentice system, and a hereditary system" (Das, 2005, p. 45). Das goes on to explain these forms of education through which subsequent generations learnt the practices of the *kalas*. The assemblies (of which the ongoing large one this day and age is the Maha Kumbh Mela, translated as the Great Pot Festival) were gatherings of sages and hermits, where knowledge was advanced and passed along. The ashrams, which ascended to significance during the time frame of 500 BCE to 200 CE, were set up by the sages in order to impart education to disciples. The schools or universities, of which Takshashila (often considered one of the world's oldest learning centres dating back to 1000 BCE) and Nalanda University (400 CE to 1200 CE) are the best known, had specialised educational programs for the teaching of archery, sculpture, medicine, etc. The guilds, not unlike others elsewhere in the world, were places where artisans worked together to promote and safeguard traditional ways of practicing their craft. The apprentice system and the hereditary systems both were set up so that master craftspersons and parents, respectively, would teach the craft to their pupils and children. In *tambat ali*, the guild, apprentice, and hereditary systems of production and knowledge transfer are visible today.

Most *tambats* who are working today have learnt the craft from their fathers, uncles, and other older family members. The hereditary system is rapidly changing though, as sons and daughters of many of the *tambats* are choosing other professions, often at the bidding and encouragement of their parents. However, some of the *tambats* continue to draw their children into the work as and when possible. Hira Palekar, one of the few women in *tambat ali* who works closely with her husband Murli Palekar, handles all the accounting, production schedules, and supply chain issues for their microenterprise. Hira and Murli have two daughters who also help as and when they can after school and during vacations. These forms of education and knowledge transfer evolved over time, and dramatically with the advent of Macaulayism after India came under colonial rule. Thomas Babington Macaulay is considered responsible for promoting European science and literature over native ones and English as the medium of instruction instead of Sanskrit, Arabic, or Persian (Sharma & Sharma, 2004). This system set up in the 1800s for primary schooling and higher education continues to date, albeit with some changes.

The education of arts and crafts, previously based in apprentice and hereditary models, too started changing. “In the early nineteenth century during the colonial rule, Britain introduced art schools to India in Calcutta, Madras, and Bombay (in that order), that tried to include craft in the curricula. But these art schools run by British principals were intended only to produce "copyists" to serve various colonial government agencies.” (Balaram, 2005, pp. 254–255). Over time, instruction in the art schools changed from the promotion of European ideals to preservation of Indian arts and crafts (Guha-Thakurta, 2017; McGowan, 2009). The cause for Indian craft was taken up by freedom fighters as part of the *swadeshi* (made in India from Indian raw materials) movement in the mid twentieth century. Swadeshi goods and their traditional forms of manufacture were seen as expressions of identity, statehood and therefore liberation from colonial rule. Independent India (after 1947) prioritised industrialisation for economic growth but did not forsake handicrafts. M.K. Gandhi believed that craft and manual labour (such as that of spinning yarn on a wheel) could not only make Indian villages self-sufficient but could also assist in reducing the caste politics of untouchability and improve morality in the population.

7.5 Design and Craft Collaboration in *Tambat Ali*

Much of the writing about design in India has focused on architecture (Asher, 1992; Brown, 1900; Grover, 2004), interior design (Chauhan & Bose, 2007, Sethi, 1999), and textile design (Fotheringham, 2019; Gillow & Barnard, 2014, Karolia, 2020), but less has been written about industrial design. Over the last two decades however, designers, design historians and design educators, many from NID and IDC, have directed their writing towards design in and for India (Athavankar, 2002; Balaram, 2011; Chatterjee, 2005; Das, 2005; Kasturi, 2005; Mathur, 2011; Ranjan, 2005; Vyas, 1984, 1991, 2000). Many of these scholarly efforts outline the beginnings of the professional practice of design in India in the 1950s, offer recommendations of what design can and should do in India, document craft traditions, and describe efforts in design education. And while case studies and design projects are described, these studies typically do not involve ethnographic descriptions of the practice of design in industry. However, there has been an increasing interest in the examination of the work of Indian designers who are collaborating with craft communities in the development of new products with such materials as textiles, bamboo, stone, etc. (DeNicola & DeNicola, 2012; Ranjan, et al., 2004; Reubens, 2010; Venkatesan, 2009; Wilkinson-Weber & DeNicola, 2020). Engaging with craft creates a form of industrial design practice in which designers work closely with communities of weavers, metalsmiths, block printers, and many others that have been practicing a specific profession for generations. This type of collaborative craft and design practice bears some similarities to but is also distinct in many ways from the more routinely known industrial design practice involving medium to large corporations and mass production. “Some people distinguish craft from design, while others argue they are both examples of unfolding creative traditions, and that many examples of what people call crafts are really forms of design appropriate to particular cultural contexts” (Drazin, 2021, p. 171).

Craft-based processes of making with long histories, regardless of the type of product, are different from practices of contemporary industrial design in three distinct ways. First, in contemporary industrial design practice, the act of conceptualisation (also referred to as ideation or planning in the design process) has been separated from the actual production (or manufacture) of things. With the onset of globalised manufacturing and technologies of production at scale, it is no longer possible for the industrial designers who imagine new ideas to also be directly engaged in the making of the goods they have conceptualised. Second, the making of all manner of everyday, utilitarian things like phones, toasters, and cars now occurs at large scales involving highly automated, computerised tools, machines, and processes, and this is where most industrial designers tend to focus their efforts. On the other hand, the making of craft items typically involves a combination of slower, labour-intensive manual work with hand tools as well as smaller machine tools and happens at relatively smaller scales. Quantities are often determined by principles of batch production or on-demand production. Third, implicit to the contemporary notion of design is the push for the annual model change—the pressure to introduce a new version of the product each year—and this involves significant experimentation with colours, materials, textures, finishes, forms, and technologies.

The separation that has occurred in typical, contemporary industrial design practice between the activity of ideation and that of production has pushed most industrial designers into focusing their efforts on the earlier phases of the design process that involve conceptualising new products, getting prototypes made, testing them, and so on. And while they may visit production facilities for quality checks once manufacturing has started, the actual making of the components and assembling them into the final product is left to an entirely different set of people. This focus on conceptualising has led to designing being more closely associated with innovating. On the other hand, the innovation done by craftspeople is often not recognised or celebrated. They are often seen as traditionalists who keep recreating the same artefacts for generations that are identical to their historical precedents. The *tambats* often make changes to the products, by experimenting with new die materials, different gauges and types of copper, newer finishing techniques, and so on. What makes them truly end-to-end designers is that they maintain control of the entire process of creation including the act of coming up with a new idea for a product, making it in quantities, marketing it, and selling it. As the *tambats* have mentioned, they consider themselves to be *kalakars* and *karagirs*, constantly experimenting with tools and techniques. But they are primarily recognised by and identified with a few traditional objects like the *bamba*, *pimpa*, and *ghangal* which they continue to produce. For instance, while the *bamba* that is currently being made in *tambat ali* may look similar to one that has was made by *tambats* four or five generations ago, there are several innovations that the *tambats* have introduced that are invisible outside. For instance, the top and bottom lids of the *bamba* are spun on a lathe instead of being made by *kholkam*; they use different cleaning chemicals; polishing is done faster on motorised buffing wheels; and more updated coal-fired furnaces now soften the copper. However, the externally visible overall form, texture, and materials used (copper and brass) look very similar to the older *bamba*.

While talking about the products Karulkar has on display in his workshop, he often points out proudly to a *supari dabba* that he designed in 1985. He has a few other *tambats* working in his workshop, and therefore he has not made them all himself, but he has updated the designs over time. At times, they have been made entirely from copper (container, lid, and spoon), but at times the lid is made of brass. The forms of the containers and the lids have evolved; at times they are embossed and at times the texture is created by *matharkam*. Govind Lele, who currently makes these in Karulkar's workshop is particularly adept at *matharkam* with a specialised hammer, and therefore the textures of the *supari dabbe* have evolved over time.

1.  2.  3.  4. 

Figure 7.5: Form, material, and textural variations on the *supari dabba*, designed by Bajirao Karulkar (Photographs by Satchidanand P. Sahasrabudhe & the author)

The engagement between design and craft has taken various forms in India and the difference is driven largely by needs and motivations of the two groups involved. Some designers work with craft communities and commission them to do bespoke work that is specifically designed for high-end, boutique hotels, and expensive homes. The objects made by the craftspeople in this case serve the purpose of supporting a vernacular interior design aesthetic that the designer may have imagined. Intricately carved wooden door handles, brass and copper lighting fixtures, and decorative clay pottery are examples of this work. Some designers run product design workshops with craft communities often funded by Designer Empanelment government grants[11], in which craftspeople are exposed to design processes and techniques. Atelier Metalworks creates products for a market that is often defined by consumers looking for uniquely crafted objects with a story. And finally, there

[11] The goal of these government grants is to make handicrafts a viable economic activity by making the products more acceptable in the market. five Regional Design and Technical Development Centers have been set up to provide design and technical guidance as well as training facilities in different crafts to artisans in their respective regions.The main activities of the Regional Design and Technical Development Centers in Handicrafts are: 1. To make crafts a success in the contemporary market and thus enhance income and employment opportunities, and 2. To preserve the craft's traditional beauty which is the main source of strength to a designer. These centers are concerned with the development of new designs and products in certain crafts in collaboration with outside designers. Design workshops in various crafts are being organized from the empanelled designers/an alumni of NID/NIFT in the crafts pockets by these centers. http://www.handicrafts.nic.in/panel.aspx

are craft aggregators and curators, who create online platforms for craft communities for selling their products but provide no other assistance. A large percentage of the collaborative work between designers and craft communities occurs in short bursts, leading to one-off things that may or may not have long lives. A few designers develop long-term relationships with the craftspeople, and it is in such situations that new models of partnership emerge. For this to be successful, the nature of the co-working has to be socially and economically viable for both the groups involved.

Drazin identifies several “ways by which anthropologists have interpolated into this relationship between crafts and design depending upon which problems they wish to address” (2021, p. 171). For instance, De Nicola and Wilkinson-Weber foreground the notion of explicitness and examine crafts as a “discourse and praxis [that] help people tell themselves, their communities, their connections, and their classes” (2016, p. 1). When collaborations between designers and craftspersons are meaningful and beneficial to both groups, a shared ‘telling’ can emerge. This telling is evident not only in the *vastu* that the *tambats* and the designers create together, but also in the way they talk about their work and what is published of their collaboration. When there are frictions and disagreements between the groups, divergent and irreconcilable narratives can emerge from their engagement. The *tambats* will at times turn down requests or refuse to work with designers if the terms of engagement are not acceptable to them. Such situations too are ‘telling’ of the people and their communities.

The relationship between designers and craftspersons can be one of genuine collaboration with mutual respect, or it can be one of discord and disrespect. This often depends upon what the expressed and covert intentions of designers may be, and how they approach craft communities. If they see design with craft as a social project of saving a heritage, uplifting a community, bringing innovation to traditional and outdated work, it becomes one-sided and likely to benefit the designers, and it tilts the power in design's favour. If designers view the craftspersons primarily as service providers, manufacturers, or a labour force, they fail to recognize the creative potential of the craftspersons and in process create a relation of inequity. If designers seek crafts as an outlet for creativity and an effort to find more meaningful work only for themselves, this too serves to primarily benefit the designers. Whether or not a certain crafts community (and any profession for that matter) needs to be saved, should be a decision of the members of that community; it is neither the prerogative nor the privilege of the designers or the government. It is only when the craftspersons are seen as co-designers and creative collaborators with equal responsibility and decision-making power in the work, process, shared learning, tangible and intangible gains, etc. can the relation be one of equity.

The *tambats* have worked with a large number of designers and architects, and have encountered relationships of all kinds over the years. While not always possible, they do refuse projects, they turn down requests, and they exercise a level of autonomy. It is also interesting and relevant to note that in the situations of joint work, it is always the designers who visit *tambat ali*, seeking to work with the coppersmiths. In my discussion with many of the *tambats*, I have not encountered an occasion in which they have reached out to an external designer or architect seeking work or projects.

DeNicola and DeNicola (2012) describe some of these collaborations as forms of “rescue and redemption”—that is, the crafts are rescued by designers, in process redeeming the nation from problems of industrialisation and imitation of the West. While some of the designers who work with the *tambats* assume that their collaboration will extend the longevity of this craft tradition, for many, the primary allure is the material itself. Rane, who worked as an industrial design consultant with large corporations was drawn to work with the *tambats* for several reasons. She found copper a remarkable material to design with and was attracted to its unique properties. She also felt that while working in industry her designs were often changed due to manufacturing constraints, engineering difficulties, resource problems, and so on. Working directly with craftspersons, she felt, would put her in closer contact with the actual making of things, making it more likely to realise her design intentions. In addition, having designed short-lived plastic consumer goods like toothbrushes, she saw copper as an enduring, sustainable material that was significantly better for the environment.

Ruebens, in her study of bamboo craft proposes the notion that a holistic sustainability is possible through the design and craft collaboration, suggesting that “designers can be instrumental in enabling craftspeople to leverage sustainability-aligned markets, and thereby sustain their own livelihoods” (2019, p. 3). However, it is not certain if copper is indeed a superior material in terms of environmental impact, as studies suggest that in some cases, plastic may be better[12].

[12] While each product has to be evaluated carefully and thoroughly, the technique of Life Cycle Assessment has shown that polyethylene pipes used in plumbing are more sustainable than copper pipes (Asadi, et. al., 2015).

The nature of the engagement between craft and design in *tambat ali* may also be explained through the notion of configuration, as we earlier did to describe the relationality between the coppersmiths and copper. Design and craft, *kalakari* and *karagiri*, designers and craftspeople configure each other through this collaborative work. "In material culture we are concerned at least as much with how things make people as the other way around" (Miller, 2013, p. 43). In the process of making things with copper, designers and *tambats* configure each other. In this case, the craftspersons not only tell themselves (Wilkinson-Weber & DeNicola, 2020), but craftspersons and designers *tell each other* in a form of mutual relationality.

7.6 Conclusion

Building on the previous chapters, this chapter examined the meaning and place of design and craft in *tambat ali*, and in India. The *tambats* are engaged in heterotemporal design trajectories that simultaneously span different temporal ambits. Some of their work draws upon their past experiences going back generations, while some of it is future-focused and forward-looking. This has given the *tambats* the ability to traverse through their generational pasts invoking knowledge of form in the creation of traditional objects, and simultaneously giving them the means of drawing on processual, material knowledge of copper to create a series of new products on their own as well as in collaboration with other designers. Though they are generally referred to as craftspeople, the *tambats* are designers, who have adopted a unique approach to design that starts with materiality. This includes understanding the properties of copper, recognising its transformative potential, and visualising what forms could emerge from it.

Theirs is a type of design that I would like to call ‘enduring design’ that sustains over multiple temporalities and draws on historical precedent while simultaneously being forward-looking; this is design inspired by a material that itself has endured over time. In *tambat ali*, design immerses itself into and emerges from the social life of the material.

Chapter 8

Conclusion

8.1 Introduction

This concluding chapter of the thesis starts with a look at the impacts of the lockdowns triggered by the Covid-19 pandemic in Pune. In addition, building upon the scholarship on the topic of the anthropology of the future, the chapter ventures speculations regarding possible scenarios that might unfold in *tambat ali* over the next few years. I also offer some ideas regarding the future of design anthropology, a (sub)discipline within which this thesis may be situated. Copper, the material that has inspired this research, has also inspired some concerns. Environmental scientists, geologists and mining experts have sounded alarms about peak copper—the time when the finite resource of this metal will have reached maximum global production levels—when industries will have to rely on recycled copper to meet their demands. This is likely to affect the already skyrocketing prices of copper and might therefore impact *tambat ali* as well. The chapter also imagines the potential future of design in India. Finally, I have summarised some of the key arguments and learnings of my research with an attempt to tie them all together in a cohesive argument.

8.2 Impact of the Pandemic

In April 2020, the SARS-CoV-2 virus spread swiftly through Kasba Peth, effectively shutting down all activity in *tambat ali*, causing significant financial hardships to the *tambats* as well as architecture and design houses. City authorities set up barricades where cases were high to prevent movement of people, and Kasba Peth was one such region. Only essential supplies were allowed in and out, and grocery stores as well as pharmacies were open with reduced hours. The lockdown halted the movement of raw materials such as copper sheets, partially finished objects like *pimpa* that are typically sent from the traders for hammering, and other supplies into *tambat ali*. And therefore, the *tambats* were unable to make anything to be sent back out from the workshops. Without work, the financial situation of many of the coppersmiths suffered. Unable to continue paying the rent for the office (which included spaces for a showroom, quality control, and packaging), Atelier Metalworks had to shut down the facility and rent a portion of a warehouse where goods could be packaged and shipped, with the staff working primarily from home. Face-to-face interactions between the designers and the *tambats* had to be completely halted. Recognizing the hardships faced by the *tambats*, Atelier Metalworks started a fund and invited donations that would then be collected and passed on to the craftspeople. This initiative was able to support several *tambats* for six months through direct payment, after which restrictions were lifted and work started again.

Unfortunately, a second wave of the virus rolled through the city starting around May 2021, and at this time, Atelier Metalworks worked with other non-profit institutions as well as industries such as Nest, Rah Foundation, Forbes Marshall, and Sudarshan Chemicals to raise funds and create provision kits (also referred to as ration kits which included household essentials such as grains, flour, salt, sugar, sanitizers, soap, etc.) for distribution. Local grocers were paid to create these kits, who then delivered to temples where the *tambats* could pick them up. Some of the *tambats* themselves who had the means to do so also put together similar kits in partnership with grocers for distribution in the community. Fortunately, many of the *tambats* were able to get vaccinated before the second wave came through, and that substantially reduced the impact of the virus in the community. In some cases, before vaccines were administered, some *tambats* did get infected, and sadly some lost family members. The past two years (2020 and 2021) have been incredibly difficult for the community. Fortunately, the second wave too passed and soon the polyrhythmic ringing of the sonorous hammers filled up the air, reinvigorating *tambat ali* once again.

8.3 The Transformational Materiality of Copper

As we have seen in the previous chapters, the transformational materiality of copper and the qualisigns of its inherent properties have the agency to truly shape all that is around it, materially and socially. This materiality of copper generates a unique set of techniques, *vastu* that inhere plots of their own lifecycles, malleable bodies and personhood, places of assembling, a community structured not only around matters of concern but also matters of care, heterotemporal design journeys, and a materially inspired sociability. Copper, I have argued, can be imagined as being at the centre of a social context and a nexus, and that is why its materiality matters. And that is why it has merited this investigation. It is evident that copper's transformational materiality creates more than objects; the objects it shapes have their own lifecycles, which then entangle with the lives of persons and communities; and it is in this process that the material creates sociability.

Copper's properties play an essential role in what the *tambats* make, how the designers think of design, and how objects made of the material are used. Copper's material agency is not a fixed entity; it changes with geographic location, weather conditions, ambient temperature, atmospheric pressure, human touch, and so on. It is therefore inherently relational; its properties and agency are both influenced dramatically by its relation to other materials and agents in its vicinity. Its malleability, purity, and reactivity are extended to the *tambats* who work in extremely close proximity and contact with the material. And in this process, they embody and impersonate the capabilities of copper. The knowledge of the *tambats* (of the material's properties, potentialities, future states, and design journeys) is embodied over years and generations. Their skills are interactional; while they express them in individual techniques of the body, they are founded on a broader enclosing of relations that also includes other *tambats*. As we have seen with the making of the *bamba*, the *tambats* engage with material and also with each other; their knowledge is embodied and shared.

Copper's malleability has created a malleable form of personhood and a community that is not bound to the rigid hierarchies and structures of caste. Many of the best craftspersons in *tambat ali* are not *tambats* by caste; however, they consider themselves made *tambat* by work. Malleability, described as the capability of an entity to be influenced, shaped, and extended through external forces, is a characteristic property of copper. *Tambat* personhood is similarly malleable; it cannot be described merely in terms of hierarchy, dividuality, or a continuum between individuality and dividuality. This form of personhood is multidimensional and fluid; it enables persons to shape and reshape themselves without the constraints of caste and profession. People (*tambats* and non-*tambats*) move in and out of engaging in some form of copper work in the community, whether it is designing, making, exhibiting, or selling, out of a sense of joy, passion, and pride. Rigid strata of hierarchy, inflexibility of movement, or limitations placed by caste are not visible.

This transformational materiality of copper is also the subject of design. As we have seen, the words art, craft, and design do not translate with ease in *tambat ali*. The forms of design observed defy being described purely in terms of the professional practice of industrial design, vernacular design, social innovation, speculative design, or many of the other new approaches discussed in contemporary design theory. Design creates for itself and exists in its own social space and context. And in *tambat ali*, it intersects with the social context created by the presence of copper. As transformational forces, design and copper shape each other. Design's *modus operandi* generally assumes that the society it studies and designs for is pre-existing rather than being created; it responds to a social that is outside of itself. But in its intervention, design has the ability to create situations and potentialities in which social relations can thrive. These relations in *tambat ali* emerge around copper and copper *vastu*, leading to an assembling in place of *tambats*, designers, visitors, traders, suppliers, tourists, and anyone else who happens to be drawn in by the transformative properties of the material.

The journey of copper progresses, from its raw material state as an idea for a thing to a fully finished product through several places, from the supply warehouse to the design studio, to *tambat ali*, to the city markets in Pune, and to an online presence for distant consumers. These places, I have argued, serve not as containers where a variety of entities and activities are simply housed, but as active places of assembling, where people and things are constantly becoming who they are. *Tambat ali's* unique sense of place emerges from the presence of this striking red-orange metal as well as the sound it makes when struck with a steel hammer. It is in these unique places that the *tambat* techniques are practised.

The techniques of working copper, revealed through *the chaîne opératoire*, show how the *tambats* collaborate and transact amongst themselves and with external designers, how they forge and manage relationships, how they interact with a variety of materials, how their gestures shape their bodies, and how they pass on knowledge and skill through generations. People, materials, tools, instruments, mental actions, bodily gestures, places, energies, etc. work together cohesively and compatibly to enable the copper objects to emerge. In this process, the materials which the *tambats* use interact with each other in arresting as well as accelerating the flow of the technical actions in a form of temporal efficacy. While it is clear that these operations are material and technological, they are inherently social as well.

As we have seen, the *tambats* have been making a variety of *vastu* daily, over their lifespans, and through generations. The additional meaning of *vastu* as plot helps us imagine objects as stories and highlights the engagements between the persons, places, processes, and products of *tambat ali*. These plots can be seen as biographical in nature, holding entire arcs of the journeys of the objects through ideation, production, distribution, consumption, and re-emergence as well. In other words, these plots are not only themes, morals, or interpretations one can draw about the objects; they tell entire life stories. As *vastu*, these *tambat* objects and plots hold relations immanent within them; they are not generic stuff, self-sufficient things, or items that stand alone without any transactional or substantial engagement with people, other objects, or place.

8.4 Anthropology of the Future and the Future of *Tambat Ali*

Having examined the past and the present of *tambat ali*, it seems essential to also consider its future. However, "the future tends to be a displaced temporal topic, absent from its homeland in the past-present-future relation" (Munn, 1992, p. 116). Anthropological attention tends to veer more in the direction of the past and the present, leaving the future somewhat bereft of consideration and scholarship. However, there has been a steady increase in future-oriented anthropological examinations of temporality, as catalogued by Bryant and Knight through an exhaustive survey in their recent publication *The Anthropology of the Future* (2019). These examinations have included considerations of the future in terms of anticipation in the "uncontrollable dynamism of time" (Gell, 1992), as projected "construals" of the present (Munn, 1992), and future time as related to "social experience" (Greenhouse, 1996). Bryant and Knight offer "orientations" as an entry point into a study of the future, with "anticipation, expectation, speculation, potentiality, hope, and destiny" as ideas through which we can understand how considerations of the future could orient our present (2019, p. 2).

Designers generally operate on the premise that what they design today can only enter society sometime in the future. All the artefacts of the design process are created with this fundamental idea that they assume a future social condition in which products of their design will inhabit. And though design has been described as future-making (Fry, 2009; Yelavich, 2014; Gunn, Otto and Smith, 2013), ethical, environmental, and social concerns have led to a call for redesigning design itself to redress these problems. “We live in world that is taking away futures for ourselves and non-human others”, and this is an act of de-futuring in which design has engaged for as long as it has been around (Fry, 2020, p. xxii). Calls for new agendas, new intentions, and new processes of thinking and doing design aimed at making our world a more sustainable, just, and equitable place for all species on the planet are plentiful (and listed in the introductory Chapter 1). How does one imagine futures more productively so that the outcomes are socially, materially, and environmentally beneficial to all? This is the task of design anthropology. “Futures are not so much made from within the imaginations of designers, as discovered, confronted and negotiated around material objects and materials” (Drazin, 2021, p. 207). These acts of discovery and negotiation should be social and material; they should involve designers, anthropologists, people who may gain or lose from these interventions, as well as sketches, prototypes, materials, tools, and other artefacts of thinking, making, and living.

The heterotemporality that inheres in the *tambats'* ways of making (as discussed in Chapter 7 on design and craft), gives them the ability to traverse through their generational pasts invoking traditional knowledge, and simultaneously affords them the means of drawing on processual, material knowledge of copper and that of new tools while working in the present. These ways of thinking and making can be said to extend *tambat* thinking into future orientations. They speak about being flexible enough to keep on designing new objects, adopting new tools, working with new designers, tinkering with new ideas, and innovating into the future.

They also talk about the uncertainty of the next few years as the new generation considers its options of work and some *tambats* move away from the tradition of coppersmithing. Some have pondered a scenario in which *tambat ali* no longer exists in twenty or thirty years; some have considered starting a school where *tambat* work can be taught to anyone interested (*tambat* or non-*tambat*); and some have imagined a new version of *tambat ali* in which all the work is done on machines, and painstaking, time-taking techniques like *matharkam* and *kholkam* are no longer practiced. These are some potential futures imagined by the *tambats*.

For Munn, "futures are projected out of construals made of or in relation to the present; and these construals in turn… cannot be detached from the ways pasts are felt to be in or excluded from the present" (1992, p. 115). *Tambat* imagination has shaped these "construals", taking into account a long past, an uncertain and fleeting present, and many possible futures. "Ways of attending to the past also create modes of apprehending certain futures or of reconstructing a particular sense of the past in the present that informs the treatment of "the future in the present"" (Munn, 1992, p. 115). In their heterotemporal design journeys, the *tambats* are aware of the generational, embodied knowledge they bring into the present from their pasts, and this awareness not only shapes what they make in the present, but also slips into their minds, in the now, possible futures for their work and for *tambat ali*.

The designers working with the *tambats* have also expressed a sense of uncertainty about what their collaboration will look like in a few years. They have taken notice of the fact that architecture, design, and interior decoration advice columns and magazines are promoting copper as a ‘trending material’. Headlines read “warm, glowing and reflective, copper and brass are traditional materials that are storming back into fashion” (Simmons, 2014), or that from 2021 “copper and brass parts take first place among decoration tips” (Newdecortrends, n.d.). Such sources suggest, “this fall, try incorporating some gold, brass, or copper accents into your home design for a rich yet not too opulent look” (Dwell, n.d.). Designers are saying “I’m seeing a big return of old materials used in new ways… Brass hoods, copper panels, wood cabinets, onyx instead of marble, unique lighting, sinks in different finishes—so much good stuff!” (Gibbs, 2021, para. 8). In some cases, copper is recommended for its antimicrobial properties. “In the face of an unavoidable future full of global pandemics, we should be using copper in healthcare, public transit, and even our homes” (Wilson, 2020, para. 5).

Copper is described either as a traditional, old material making a comeback and heading into a trendy future, or as a material panacea to a future world that will continue being attacked by microbes. If, as these trends suggest, there is a market and a demand for copper that is likely to sustain over the coming years, a new crop of *tambats* and external designers could potentially imagine collaborative futures together. According to a report published jointly by the British Council and the India Design Council on design education, “from a handful in 2010, the number of design institutions has grown to over 70 by 2016”, and therefore the number of designers in the workforce will increase substantially over the next few years (British Council, 2016). Of this upcoming group, it is of course not possible to know how many will work with crafts once they enter the profession as practising designers. Similarly, it is not known what the makeup of *tambat ali* will be like in the coming years, how many workshops and coppersmiths will continue the work, or what kinds of *vastu* they will make.

Bajirao Karulkar offered his point of view in a conversation about the future of *tambat ali*. “I think this work will continue if we introduce changes and bring new production that is useful today. Now for example, Covid has proven that germs do not survive on copper. The value and benefits of copper have been re-discovered by people. I have created some new products for a couple of Ayurvedic clinics here in Pune. As you enter the clinic, you take off your footwear outside, and you step on square copper tiles until you reach the doctor. I have created copper covers for the arms of the chairs where the patients sit. Door handles are also made of copper. If we use this new importance of copper, then business here will flourish. And there are people willing to do the work in the next generation. Even though they may have formal education, people are entering this profession because these are good days for this work. And nowadays, things are more advanced. We have spinning lathes, buffing machines, and so manual work of shaping is not required. So, if we respond to people’s needs, then this business will not die. Those are the *guna* (properties or virtues) of copper.” Karulkar has been conducting informal trainings for students and visitors in his workshop for decades. He also has a vision of reimagining his workshop as one in which part of his time is spent in education and the rest in production. He has established a charitable foundation called Ravi Copper Works, through which he intends to formalise an educational model for anyone interested in learning *tambat* techniques. He is also making plans along with his daughter, an interior designer, to start a *tambat* workshop in the US where she lives. He has, in the past, done short courses on spinning and hammering in the US and has also established contacts with metal spinners. He imagines a future in which he spends six months in India and six months in the US, continuing the education and production model in both countries.

Kapil Kapre also expressed his opinions about the future. He said “in the future, work will increase, making decorative pieces, architectural work, and continuing repoussé work. The number of workshops doing repoussé work are increasing, young people are entering this work, and they can make good money doing it. I think it is on this work that *tambat ali* will survive, it will grow, and it will make a name for itself. Young people are getting trained in this repoussé work, we will have to figure out how to train them in the *matharkam* as well. I think the work is going well… I don’t think it will die for another one or two generations at least. I have two daughters, one of them works in a bank and the other one is a lecturer in education. I think it will be good for more young people to enter this profession. Young women are participating in exhibitions of our work, and are taking on the responsibility of marketing and sales.” Arun Parulkar said he was not so sure about the future of *tambat ali*. “Who knows what might happen in the next few years? All this might not be around after our generation of coppersmiths stops working.” A common refrain is that *tambat ali* will have to change in order to continue, but this is nothing new to them. Over the years, they have been used to changing tools, adopting new machines, designing new products, working with new designers, changing factory layouts, and so on. They have done this before, and they speculate they will have to do it again. And if speculation is “the making present and materializing of uncertain futures” (Bear et al., 2015, p. 387), it is through these imaginations and conversations that the coppersmiths conjure up several possibilities and potentialities for *tambat ali*. This cerebral activity of imagination, which has been described as “the creative contemplation of possibility[,] is part of the temporal disposition inherent in speculation” (Bryant and Knight, 2019, p. 98). We could turn this around and say that it is the heterotemporality inherent to *tambat* thinking that aids them in speculation of futurality. Time will tell which one of these speculations will materialise years from now, turning potentiality into certainty and actuality.

8.5 Expanding Design Anthropology’s Horizons

Having explored what some potential futures of *tambat ali* might look like, perhaps it might be productive to scrutinise new potential horizons for design anthropology itself. Anthropologists of design are now calling for a much broader, more bilateral, and analytical as well as generative agenda for the discipline. Design anthropology is framed as a practice rooted in collaboration and communication with a focus on contexts, values and futures (Drazin 2021), and described as a means of theorising object culture in the twenty-first century (Clarke 2011). It is a discipline focused on studying the materiality, temporality, and relationality of design (Gunn, Otto and Smith 2013), and a means of reimagining relations between designing and using and between people and things (Gunn and Donovan 2011). Its scope now includes critical examination of methodologies and epistemologies, materiality and objectification, relations and engagement, techniques and gestures, ethics and politics, and knowledge systems that bridge these disciplines (Clarke, 2011; Drazin, 2013 and 2021; Gunn & Donovan, 2012; Halse, 2008; Küchler, 2011; Louridas, 1999; Miller, 2011; Otto &

Smith, 2013; Squires & Byrne, 2000; Suchman, 2011; Tunstall, 2013).

In extending design anthropology's boundaries of concern, care, and locus of action, perhaps there is room to insert a third element to add to the social and the material—the natural—and turn our attention to ecological and environmental anthropology. And while one might suggest that concerns about the natural world, ecological issues, and environmental problems are inclusive to our conceptions of design and anthropology, foregrounding them here lends additional purpose to this discipline.

> Ecological anthropology focuses upon the complex relations between people and their environments. Human populations, socially organized and oriented by means of particular cultures, have ongoing contact with and impact upon the land, climate, plant and animal species, and other humans in their environments, and these in turn have reciprocal impacts. Ecological anthropology directs our attention to the ways in which a particular population purposely or unintentionally shapes its environment, and the ways in which its relations with the environment shape its culture and its social, economic and political life. (Salzman & Attwood, 1996, p. 207)

Copper is often talked about as a sustainable material, largely because it is recyclable. Unlike polymers that tend to degrade in terms of their mechanical properties as they traverse through journeys of being moulded into new components, collected for recycling after their end of life, shredded for reuse, and used again in moulding, metals do not. Scrap copper can be molten and converted into sheets for reuse through endless cycles of liquefaction and solidification without significant loss in its properties. However, the processes of mining of copper ore and smelting it to produce pure copper have been known to cause enormous environmental impacts. Copper is generally mined in large, open pits where deposits are found. This form of mining is known to cause a variety of environmental problems including but not limited to land erosion, total loss of biodiversity on the site, and groundwater contamination caused by such chemicals as sulphuric acid used in the mining process. In addition, significant waste volumes are associated with copper production, and some wastes may contain radionuclides due to their natural presence in ores. Often, only small amounts of excavated earth yield usable ore. In addition, processes of smelting and refining the ore to produce pure copper lead to gaseous emissions, particulate matter, sewage water, and solid waste material. In other words, referring to copper as sustainable may not be entirely accurate and it only tells a part of the story.

Figure 8.1: The Chuquicamata mine, a large open pit mine in Chile (Creative Commons)

As we face a growing number of environmental problems associated with global climate change, it is apropos to question the anthropocentrism of anthropology. Though designers create products and services primarily for people, the consequences of design activity (human-centred or otherwise) reach far beyond humans. We are, after all, one of several million species who live on this planet. While anthropology is structured around our desire and need to better understand human society, ecological/environmental anthropology examines the relationship between people and the environment and might offer new directions for sustainable design.

> This work [of environmental anthropology] is grounded in the premise that anthropologists must engage across disciplines and with practitioners around the world to pose, analyse, and refine viable possibilities, and in doing so, move beyond disengaged cultural critique. In fact—in going beyond our usual roles of recognising, describing, analysing, and deconstructing culture—such work suggests that anthropologists can be co-creators, with engaged practitioners of our research projects, in the cultural process. (Lockyer & Veteto, 2013, p. 3)

The notion of anthropologists as co-creators resonates closely with design anthropology's call to go beyond participant observation to participant action. Many of our environmental problems are caused by injudicious use of natural materials transformed into objects for social use. The divisions among the social (related to people), the natural (related to the environment) and objects (related to human activity) are not as clear as one might initially assume. We, as a species are components of the ecosystems in which we reside and are therefore a part of nature. Similarly, all the resources needed to produce the things we use are extracted from the natural environment. Finally, human-made objects are sociotechnical systems rather than stand-alone physical things. Therefore, boundaries between them are difficult to inscribe with hard clarity. Design anthropology, in its critical stance, should engage them equally, and in addition, also examine the relations among them.

8.6 Potentialities of Copper

As a natural resource, the amount of copper available in the earth's crust is limited. Though there is no consensus regarding when we might reach peak copper, using existing resources more carefully is prudent. Recent world data state that about 24 million tonnes of copper is being used annually, of which 35% comes from recycled material (Glöser, et al, 2013). The environmental issues related to copper mining are not broadly known in the *tambat* community or to designers who work with copper. "Speculation about natural resources by definition concerns what is hidden, buried, immanent, or potential" (Bryant & Knight, 2019, p. 99). The authors go on to explain that these natural resources have the power of reshaping futures. Certainly, the availability of and access to copper will shape the future of *tambat ali*.

Bryant and Knight further bring forth the distinction that Aristotle makes between matter and form, where he describes the former as potentiality and the latter as actuality. For Aristotle, potentiality precedes actuality, but Paolo Virno sees them temporally rather than chronologically, because "potential always exists alongside the actual as its possible future in the present" (Bryant & Knight, 2019, p. 130). To the *tambats*, their materials, their embodied knowledge, their virtuosity, their tools, their places, all can be imagined as conglomerates that they bring to bear in imagining future potentialities. The heterotemporal design thinking of the *tambats* facilitates these imagined futures.

8.7 Future Orientations for Design and Craft in India

Much of the push for economic development in India is happening without careful examination of its potential impacts on society, culture, or the environment—in other words, there is scant mention of sustainability in the discourse on growth in India. I refer to sustainability in social, cultural, and environmental terms. In 1997, John Elkington explained sustainability as development that takes into account issues of social equity, environmental responsibility, and economic prosperity, a definition famously referred to as the triple bottom line (1997). Within the scholarship on sustainability, a significant amount of emphasis has been placed on the environmental and social issues Elkington outlined. However, the cultural dimensions and impacts of development are often ignored in sustainability literature. Social equity primarily includes attention to appropriate labour practices, fair wages, good factory conditions, and employee benefits, but does not include discussion of cultural practices. The aspect of sustainability that is least discussed in the literature is the impact of new products on cultural traditions, vernacular lifestyles, prevalent belief systems, timeworn rituals, etc. In today's world of global supply chains where commodities are designed, manufactured, and exchanged across national and continental borders, these questions are critical.

Design often engages with craft in an attempt to rescue cultural traditions, heritage practices, and age-old production mechanisms

(DeNicola and DeNicola, 2012). India's design educators and leading scholars (Balaram, 2009; Chatterjee, 2005; Vyas, 2000) advocate for design as a force in regenerating crafts in India. Built into the Ahmedabad declaration are recommendations to assist craft and small-scale industries "which are often unable to afford their own full-time designers" (Balaram, 2009, p. 67). This assumes that craftspeople are not designers and need industrial design services. As explained in Chapter 7 on craft and design, it seems evident that the *tambats* are in fact designers who innovate and use specialised techniques that include the creation of prototypes and other artefacts of the design process. Design education, governmental policies, and the popular press, all identify designers and craftspeople differently, and classify processes of making of the two groups as distinct from each other. Recognising craftspeople as designers might be the first step that needs to be taken in order to truly understand practices of craft and design in India.

8.8 Learning from *Tambat Ali*

After having spent time in *tambat ali* and having written this document, it seems rather daunting to try and extract an intelligent, overarching argument that makes a worthwhile contribution to the discipline of anthropology. However fraught with difficulty the task may seem and however inelegant my response is likely to be, it is a worthwhile endeavour. Each topic pursued as part of this research (and organised into the individual chapters of material, production, place, objects, personhood, as well as design and craft) has helped me discover something unique. At the risk of extreme cursoriness, I can say that the nuggets of insights gathered from my work suggest that copper is a transformative material; places enable assembling; production produces people in addition to objects; objects (*vastu*) encode arcs of substantive, sequential plots; personhood is malleable; and the *tambats* have always been designers rather than craftspersons. How does one knot these individual learnings into a single cord that strikes a chord with anthropologists?

Perhaps Aristotle's concepts (re-presented by Bryant and Knight) of potentialities and actualities in pondering futures can serve as inklings of ideas to take on this task. "Whereas the physical (form, actuality) appears to fix the object as a product and representative of a particular time, the material and its potentiality suggest that the object is always within time, always yet to be made." (Bryant & Knight, 2019, p. 130). When an object emerges from a material, it brings potential futures into our present; this is when it becomes an actuality. However, the material from which it emerged maintains its potentiality on a temporal scale that extends before and after that of the object. These material futures are less known and full of multiple potentialities. We therefore have two temporal scales: of material and of objects. A third time scale of the persons who engage and transact with the material and its objects runs contemporaneously. Copper's potentialities actualize into a variety of *vastu* with the skilled bodies and tools of the *tambats*, all three—material, object, and human—dynamically linked through their temporal journeys.

In material culture studies, while materiality has been described in more abstract terms, materials have been considered to be more concrete or brute (Miller, 2005; Tilley, 2007). If *objects* represent actualities, and *materials* of which they are made are potentialities, perhaps we can imagine *materiality* as an all-encompassing speculative construal, by compounding the concepts of Bear, et al. (2015) and Munn (1992) discussed earlier. If speculation makes the present and materialises futures (Bear et al., 2015), and if it is from construals that futures are extended out while still being in relation to the past and present (Munn, 1992), materiality can be conceived in terms of a speculative construal, extending pasts and futures while being present in the present.

For the *tambats*, copper is a speculative construal that extends out temporally, stretching what Munn refers to as “the past-present-future relation” (1992, p. 115). In this temporal frame, they actualize three distinct but interrelated categories of *vastu* from the potentiality of the material, by activating their heterotemporal design journeys. And, as Munn goes on to say that “in a lived world, spatial and temporal dimensions cannot be disentangled” (1992, p. 94), the techniques the *tambats* deploy from their repertoire of sensate, embodied knowledge, unfold in places of assembling. These are places where, through shaping this malleable material, the *tambats* shape themselves into malleable persons, and this is where they build community.

The *tambats* have been around in this little neighbourhood in Pune for generations, and as imagined in their speculations, they are likely to be around, right here, for several more.

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