INVESTIGATING OPEN DESIGN USING JUGAAD AS A CULTURAL PROBE

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ABSTRACT

INVESTIGATING OPEN DESIGN USING JUGAAD AS A CULTURAL PROBE

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Design democratization has been a growing movement around the world, blurring the boundary between the roles of users and designers and encouraging design-after-design that makes the process of designing more inclusive. Open Design is one such approach that encourages no limits in terms of the kind, time, or space of the contribution. While a very primary attribute of this approach is inclusivity, there is a lack of exploration in terms of actual application of the process in a tangible product design process and in particular contexts. This thesis intends to explore the implications of an Open Design process in the context of a developing country where a lack of in-house production and resources empower users to be involved in their own making processes and practices. Jugaad is one such cultural practice where people innovate in the name of necessity: they personalize, adapt, re-use or upgrade whatever is available to find make-shift solutions for their very contextual problems. This thesis investigates Open Design practices where Jugaad is used as a cultural probe, putting participant designers at the center of a research through design process. Two workshops were conducted that asked participants to design alternative solutions for a home appliance (upright cleaner). The workshops required participants to take an Open Design approach, using Jugaad as a cultural probe. The insights are presented at

the end where the adaptation of this unconventional method of designing positively influenced the experience of designers, inspired them to empathize with the user group more and made them view products from a totally different perspective.

Key Words: Open Design, Jugaad, Research through Co-Design, Product Design

ÖZ

KÜLTÜREL SONDA ARACI OLARAK JUGAAD'I KULLANARAK AÇIK TASARIMIN ARAŞTIRILMASI

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Tasarımı demokratikleştirme, dünya çapında büyüyen bir hareket olup, kullanıcıların ve tasarımcıların rolleri arasındaki sınırları bulanıklaştırmakta ve tasarım sürecini daha kapsayıcı hale getiren tasarım-sonrası-tasarımı teşvik etmektedir. Açık Tasarım, katkının çeşidi, zamanı veya alanı açısından sınır tanımayan, benzer türde bir yaklaşımdır. Bu yaklaşımın en temel özelliklerinden biri kapsayıcılık olsa da, sürecin somut bir ürün tasarım sürecinde ve belirli bağlamlarda uygulanması açısından deneyim ekslikliği vardır. Bu tez, ülke içi üretim ve kaynak eksikliğinin kullanıcıları kendi yapım süreçlerine ve pratiklerine dahil olma konusunda yetkin kıldığı, gelişmekte olan bir ülke bağlamında Açık Tasarım sürecinin etkilerini araştırmayı amaçlamaktadır. Jugaad, insanların gereklilik nedeniyle yenilik yaptığı kültürel bir uygulamadır: bağlamsal sorunlara elde var olan imkanlarla çözümler bulmak için mevcutta olan şeyleri kişiselleştirebilir, uyarlayabilir, yeniden kullanabilir veya geliştirebilirler. Bu tez, kültürel sonda aracı olarak Jugaad kullanılarak, katılımcı tasarımcıları tasarım yoluyla araştırma sürecinin merkezine koyan Açık Tasarım pratiklerini incelemektedir. Katılımcılardan ev aletleri (dikey süpürge) için alternatif çözümler tasarlamalarını isteyen iki çalıştay gerçekleştirilmiştir. Çalıştaylar, katılımcıların kültürel sonda aracı olarak Jugaad kullanımıyla Açık Tasarım

yaklaşımını benimsemelerini gerektirmiştir. Bu alışılmadık tasarım yönteminin uyarlanmasının tasarımcıların deneyimini ne derece olumlu yönde etkilediğine, kullanıcı grubuyla daha fazla empati kurmaları için nasıl ilham verdiğine ve ürünleri tamamen farklı bir perspektiften görmelerini sağlayan öngörülere tezin sonunda yer verilmektedir.

Anahtar Kelimeler: Açık Tasarım, Jugaad, Birlikte Tasarım Yoluyla Araştırma, Ürün Tasarımı

Dedicated to Ama & Baba for being the wind beneath my wings, for believing in me and always going against the odds to make sure I go after what I aspire for. To my brother for offering his shoulder for me to climb on and reach for the stars.

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CHAPTER 1

INTRODUCTION

Design is a very contextual phenomenon that is in an ever-evolving state trying to keep up with the changing contexts and needs of the people and surroundings. While it may have been a commodity to be consumed back in the days of mass-production, Fordism, and the Industrial Revolution, it is now transitioning to become a shared experience. Starting from designing for the people, the design practice has morphed into an act of designing with the people. Participatory Design has been one such attempt to democratize the practice of designing and involve the user as part of the process. This approach has been particularly pivotal in terms of empowering the user and giving equitable access to a design process to every stakeholder involved.

Open Design, while having similar approaches as the ones mentioned above as tangents to its own phenomenon, roots from the Open-source movement in software businesses. Where an 'Open' involvement from anyone and in anyway is welcome be it in terms of the process, the contribution, or the outcome. The Open Design Movement, hence, was one that came about incorporating Open Design principles in the arena of tangible products; avenues of which explored adapting, reusing, modifying, or personalizing products in an Open setting and by anyone, regardless of their expertise or capabilities.

In the literature, as an attempt to contextualize Open Design in Design academia and Design practice, some practices tangential to Open Design practices emerge: one of which happens to be *Jugaad.* While it is not fully investigated how, but the common points between the two lies in terms of the ability to re-use, upgrade, modify or upgrade products/ product parts. This contextualization is essentially centered around the motivations these practices are conducted with; while Open Design practices in

European contexts vouch for agility of manufacturing, providing new ways of designing and making tools accessible to everyone, non-European contexts on the other hand have necessity and a lack of resources as a driving factor (Julier, 2020).

Jugaad is a term very common in south-Asian contexts and is a rather common practice in Indian and Pakistani cultures being the developing countries that struggle with economy and resources in general. Due to a lack of in-house production and access to resources, people on the street hack everyday objects to morph them for different reasons. Products are repurposed, reused, personalized, or upgraded by often unconventional means, making ingenious solutions that contributes to an extension of the product life in many cases. While being called '*Jugaad*' in Pakistani and Indian cultures, a similar practice is called *Halletmek* in Turkish culture, *Shanzai* and *Gongkai* in Chinese culture, and is quite common in many other developing economies where lack of resources for product maintenance, non-availability of spare parts for up-keep and financial conditions of the masses gives people motivation to innovate in the name of necessity.

As mentioned earlier, the practice of constant repair, reuse and upgrade is tangential to Open Design practices and understanding designers' approach towards jugaad and investigating the Open Design principles on which jugaad is practiced is the subject matter for the thesis. Much discourse on the adaptation of Open Design as a design process has been done; how it challenges or changes the role of a designer as part of the conventional design process is always a point of rebuttal in literature and practice. While there are many frameworks that have now surfaced in order to regulate the process, in many cases the autonomy over a design from a designer does experience a shift. The aim of this research is, first, to investigate Open Design principles keeping Jugaad as a cultural probe, keeping designers as the participants of the process. Secondly, based on this investigation, the study intends to investigate whether Jugaad can be adopted as part of a design process and whether the frugality of it adds value to a design process keeping the shift in autonomy over the design process (that results from this), in mind.

1.1 Scope of The Study

The scope of this study was to investigate the process of design using Open Design principles keeping Jugaad as a cultural probe. For that matter, a thorough analysis of Open Design practices was done, and it was seen in comparison to the cultural practice of Jugaad. The study includes studying the literature to understand Open Design and its manifestations in a design process and a simultaneous analysis of case studies to gauge the concept of *Jugaad* and practices similar to it. This is achieved with the help of research through design where generative tools are utilized in a collaborative setting to ensure a re-creation of an iterative process to test the phenomenon out and to generate a discourse regarding the experience of designers as part of the process.

Jugaad, being a phenomenon that is massively under-tested in terms of its application and having possible dangerous repercussions in case of use as a short cut, requires a lot of regulation. On the other hand, it has many advantages to a developing economy like Pakistan where a lack of availability of resources, products or product parts makes *Jugaad* a convenient and affordable approach. What this study attempts at is to investigate *Jugaad* as part of a design process that is similar to it in terms of certain attributes and can afford being regulated.

To understand *Jugaad as* a practice, certain observational techniques apart from literature on sister-topics like the practice of *Halletmek* (Horsanali, 2018) are utilized to generate substantial information to frame *Jugaad. While* Birtchnell (2011)*,* define *Jugaad* as a systemic risk, a brainchild of extreme limitations of resources, Beniwal (2016) argues it to be a possibe useful resource based on the similarities among design and *Jugaad*. The one aspect lacking in this discourse is actual testing of the phenomenon through practice which this thesis intends to do explore.

1.2 Aim, Objectives, and Research Questions

The aim of this research is to investigate Open Design practices keeping Jugaad a cultural probe and gauging the feasibility of *Jugaad* as part of a design process. It was

also to understand the shift in the role of a designer being a part of such an unconventional process of designing. Some objectives of the study were set in order to achieve said aim.

- To understand Open Design, Open Design practices and their manifestations
- To understand *Jugaad* as a cultural practice
- To analyze the similarities and dissimilarities between *Jugaad* and Open Design
- To analyze the kind of products/ processes that can be utilized to test this method on
- To analyze the value addition/ enhancement in user experience that Open Design practices like *Jugaad* can offer to designers
- To investigate the shift in the role of Designers in terms of their autonomy over a design process

Two parent research questions were posed to guide the research, each with three sub-questions to provide elaboration, as follows:

RQ1. What categories of problems is *Jugaad* applied to (e.g., problem solving**, adding value**, enhancing user experience), and what are typical outcomes? (e.g., types of products…)

- RQ1a. How is *Jugaad* used for solving problems locally?
- RQ1b. Who practices *Jugaad*?

RQ2. How can *Jugaad* be adopted as a particular approach towards Open Design?

- RQ2a. How does the role of the (trained) 'designer' change when using *Jugaad* as a method for designing?
- RQ2b. What convenience/ inconvenience does *Jugaad* create in creating an open process of designing?
- RQ2c. In what ways is *Jugaad* similar / dissimilar to Open Design practices?

1.3 Structure of The Thesis

The thesis is structured into seven chapters:

Chapter 1*: Introduction*: The chapter gives an introductory background to the research subject and outlines what is being investigated, the scope of the work, the aim and objectives alongside the research questions, and a summary of the thesis structure.

Chapter 2*: Literature Review*: The chapter covers the most important areas of literature related to the investigation at hand. The first part of the chapter defines Open Design and Open practices in general. It also covers the root of Open Design practices. It progresses to explain the concept of democratization of design activity and its links to Open practices. This is followed by framing Open Design in terms of contexts and its implementation within these contexts. This leads to the second part of the chapter, where cultural practices spanning *Jugaad, Halletmek, Shanzai* and *Gongkai* are introduced as cousins to Open Design within developing economies. The roles of designers and stakeholders in Open Design and *Jugaad* practices are briefly uncovered and compared, leading to an analysis of some cases to examine how closely Jugaad/ Halletmek practices reflect the principles and practices of Open Design.

Chapter 3: *Methodology:* This chapter explains the methodology utilized in this thesis for data gathering and analysis. The rationale behind every step is also explained. The methodology presented consists of two workshops and debriefing sessions as means for data collection, followed by data analysis.

Chapter 4: Workshop: This chapter presents the main field study for the thesis which were two workshops. The generative tools utilized, and the entire procedure is presented in detail. Chapter 4 encompasses the first workshop.

Chapter 5: *Workshop 2:* This chapter documents all the activities conducted in the second round of the Design workshop along with reflecting on the process with a new set of participants.

Chapter 6: *Debriefing Session Results and Analysis*: This chapter presents the primary source of data analysis i.e., the debriefing session and presents the results of the data that were analyzed with the help of coding. The findings are presented in terms of statistics and categorized under various research outcomes.

Chapter 7: Discussion and *Conclusions:* This chapter revisits the research questions and reviews the limitations and gives suggestions for further developments on the study. This chapter also includes a research reflections section.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The scope of this research is to first explore Open Design in the arena of product design and progress to investigate it with Jugaad as a cultural practice. The literature is hence divided into two phases, based on how the research progressed. The first phase attempts at framing Open Design based on where it roots from, open design as a design process and an outcome. While having the effect of blurring the roles of the user, consumer, and the designer, open design is still a relatively newly developing approach with very limited amount of practically measurable outcomes available beyond observable possibilities. (Bakırlıoğlu & Doğan, 2020). Through this literature, the aim is to first try to understand the root of Open Design, its properties, and implications to a design process. The second phase progresses to understand Jugaad as a cultural practice and relates it to Open Design practices. This ultimately leads to the field research for the thesis, which is an attempt to understand the practical implications of Open Design practices by utilizing Jugaad as a cultural probe. And within this, making an investigation of how the role of users and designers is impacted by it.

2.2 The Open Approach

"The Open Approach" is a concept that (Boisseau, Omhover, & Bouchard, 2017) states Open Design to have rooted from. The Open-source movement originated from the "free software" approach that started in computer engineering. This concept encompasses the easy and free accessibility of resources to anyone. Accessibility in terms of either the contribution, usage, or the outcome and as a result having the ability

to use it as it is, modify it or upgrade it. This concept then found its way into the design of tangible products among many other avenues such as open data, open science etc.

As a starting point, the Open Approach mainly encompassed digital platforms or cloud sources where the contents of said platforms were openly accessible in terms of usage, modification, or consumption.

2.3 Open-Source Movement

The Open-source movement became popular among programmers who started to share the source code for various software for anyone to access. The idea was to provide equitable access to the software among the programming community so that they could be utilized without any hindrance, be understood as common language, and hence be modified and redistributed. The open-source movement became a way of legalizing the copyrights and ownership of a certain source code where it could be owned and utilized by anyone while also being adaptable. The open approach ultimately seeped into various other avenues and became a method of sharing information. The term "Open-x" defines the fact that in the field of software development, what was "open" was the development process and the source code, not the software itself. Which, thus, enabled its application outside the bounds of IT. The "x" being a variable for any possible avenue this approach could be applied to, Open x, basically is an attempt at opening systems beyond software for instance open art & culture, open-science, open licensing etc. (Boisseau, Omhover, & Bouchard, 2017). In a similar fashion the variable "x" also got replaced by design. Not necessarily a consequential event, but the Open design movement arose which also took root from sharing design information on Open platforms and mostly online.

Hence, fixing, improving or redesigning, also became a part of the process when the process of designing a product became open. Platforms like Instructables, Maker-Bot:

Thingiverse became platforms for editable blueprints and encouraged the concept of contributing to the design process by editing, upgrading, or redesigning.

2.4 Manifestation of Open-source principles in tangible product design

Shifting the focus of design activity from outcomes to the process itself, a continuous designing and redesigning process can respond to changing contexts and needs, and divergence can be achieved through collaborative designing. This current research is intended to investigate the possible democratization of design activity by making the process of designing and redesigning: open. The open-design movement involves the development of physical products, machines, and systems through use of publicly shared design information. Open design is a form of co-creation, where the final product is designed by the users, rather than an external stakeholder such as a private company. Open design has many different manifestations (as a process and as an outcome) depending on the varying contexts.

Having many different manifestations in the literature, the concept of Open Design is still evolving. It essentially roots from the open-source movement that started in software development industry where the source-code for each file/ product became available to developers, software engineers and researchers for open modification. (Williams & Stallman, 2010)

Rooting from here on out, *Open x* became a heterogenous possibility for the different avenues Open principles could be applied to. As mentioned above, over the years the same open-source principles then took various routes ranging from Open data, Open art & Culture, Open science, and Open licenses. (Boisseau, Omhover, & Bouchard, 2017). These principles also found their way to the Open Design of tangible products. There are different ways in which the Open approach is described to have manifested itself in the arena of products. (Williams & Stallman, 2010), mention the increase in digitization of the process of manufacturing products that has led to a very high

accessibility of information for anyone and everyone. The digitization of the design process itself also made the possibilities of intervention, open. While it may have started with 3-D blueprints of products, the inclination of Open Design towards tangible products is increasing in the design discourse globally. The term used to summarize this concept is the democratization of design activity (Williams & Stallman, 2010). Design democratization is also said to have emerged due to the digitization of the product design process thanks to Computer Aided Design (CAD) and Computer Aided Modelling (CAM). Increasingly, there are new platforms developing where collaborative designing can be done on these very accessible designing tools also in real-time.

"Hacking" is defined as the figurative and literal way of opening and modifying the source code in the case of digital software and hardware products, respectively (Richardson, 2016). The maker movement is also compared with the fordist times and a highlight on the intention for both to democratize the process of designing is also highlighted all the while when their process were wildly contrasting (Jones, 1983). While Ford focused on labour division to maintain the integrity of an affordable end outcome, maker culture focuses more on the inclusion and diversity that is offered keeping every user and consumer into consideration. (Jones, 1983), theory of openness is in great alignment with the latter concept i.e. Open Design – allowing cycles of innovation to be selfcoordinated by community-based networks.

Fab-Labs, maker spaces and hacker spaces are new platforms that have proposed new structures for designing which focus on personal fabrication of products. Tools and materials are available for anyone to turn their design ideas into prototyped realities. This increase in accessibility is a part of the maker culture that calls on users, and masses in general to step into the arena of design.

While Boisseau, Omhover, & Bouchard, (2017) deem the democratization of design and the factors that fall under it for the popularization of Open Design, Bakırlıoğlu & Kohtala (2019) mention the DIY Culture, Maker/ Hacker Culture and a shift in designer and user's relationship as the main factors. Upon reflection, there are various intersectional points between the two and the difference in categorization exists only because of the different approach of framing the concept.

2.5 Democratization of design

As a concept at large, Open Design occurs due to a democratization of design. The ease in access to the act of designing that is now available to a layman is easier on all accounts of technicality, legality, knowledge, or practicality. Three main factors that are accredited as the causes of this by Boisseau, Omhover, & Bouchard (2017): are the spread of digital manufacturing, the digitization of the design process, and the rise of new structures of design. Digital Manufacturing is mostly applicable towards the later stage of the design process where additive methods of manufacturing like 3-D printing are used and laser cutting too. This is usually carried out with the help of a digitization of the design process through Computer Aided Modelling (CAM) and Computer Aided Design (CAD). Since the access to these modelling techniques is now available on personal computers, the possibility of innovation will continue to grow even if the demand to invest in a particular kind of product remains constant (Hippel, 2005). The computation of these steps of the design process often eliminates the need for perfecting craftsmanship which in turn increases the chance of anyone and everyone contributing to the act of designing (Shirky, 2005). The third avenue of democratization are the new structures of design. Emerging concepts of Maker/ Hacker spaces and Fab Labs (Fabrication Laboratories) is also rising owing to the Maker movement (Anderson, 2012; Dougherty, 2012). These spaces essentially encourage everyone, no matter what background to step in and utilize the resources to

create. This practice also thins the line between the roles of users as users and users as creators.

While Boisseau, Omhover, & Bouchard (2017), frame open design of tangible products in a very consequential, chronological, and pragmatic way, Bakırlıoğlu & Kohtala (2019) identify the concept and its occurrence also as an outcome of the context it exists in. That is to say that while the concept of conscious democratization of design activity and making it more accessible exists as a conscious effort for growth and development in some contexts, others have such similar practices existing as part of their cultural identity. These practices are often overlooked since they are applied on everyday life objects: they are utilized so often that they are not seen anymore (Horsanalı, 2018).

2.6 Strands of Open Design

Two main strands of Open Design in literature and practice are identified as (i) openly shared, publicly available designs and (ii) open-ended design activity (Marttila & Botero, 2013).

The former can be identified with practices such as 3-D blueprinting, online collaboration, maker/ hacker spaces. Online platforms for sharing or modifying designs like online maker and hacker spaces where people from any background can come together to create, modify, and share ideas and practices fall under this category. The following examples relate to the first category (openly shared, publicly available designs).

2.6.1 Open Sources for Hacking and Making

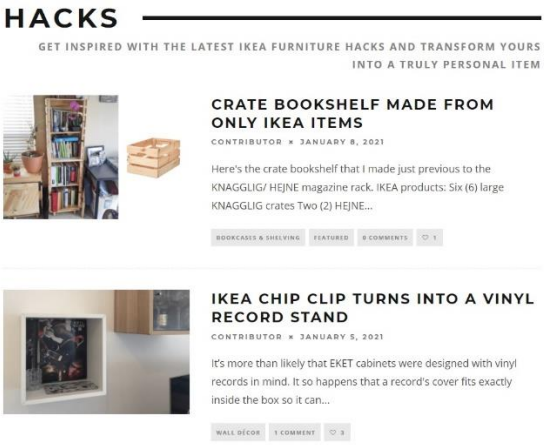


Figure 2.1: Screenshot of the webpage of an online platform called IKEA Hackers (https://ikeahackers.net/)

Do It Yourself is an approach of self driven and self directed design activity where the process is carried out closer to the user's end than the production end is also a phenomena accredited to have contributed to the democratization of design. (Atkinson, 2006; Stallman, 2014)

Platforms like IKEA Hackers fall under the first strand of Open Design Practices. It is an online community for modifying found objects and contributing openly.

2.6.2 Making

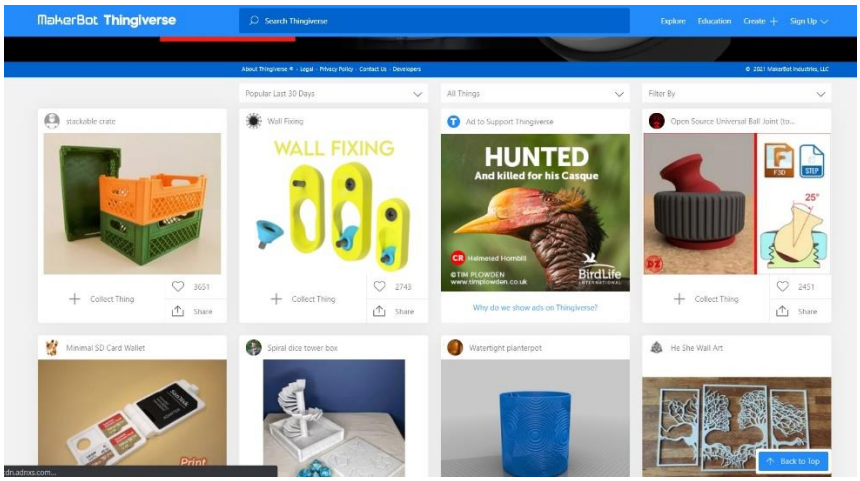


Figure 2.2: A screenshot of an online maker space called MakerBot – Thingiverse (https://www.thingiverse.com/)

Another online community called MakerBot – Thingiverse is an example of openly shared, publicly available/ editable designs. It is an open community for source files of editable blueprints that can be accessed, modified, and downloaded for personal use.

The second strand (open ended design activity) essentially talks about the concept of participation and involvement of designers, users, or any other stakeholder to come together and design. Their act of making, changing, modifying, and upgrading on products or product parts is what this aspect encompasses (Marttila & Botero, 2013).

2.6.3 Hacking

Figure 2.3: Amsterdam Fab Lab at The Waag Society in the Netherlands (wwwhttps://www.fablabs.io/.)

Fab labs are low-cost fabrication laboratories comprising digitally enabled manufacturing tools. They were designed to democratize the practice of making and provide equitable access to products and services for everyone around the globe.

2.7 Contextualizing Open Design

The ways Open design is used in practice or academic conversation has been classified by context by Bakırlıoğlu & Kohtala (2019). It is framed in terms of its existence in European and Non-European contexts. While the main concept of Open Design remains similar i.e., to blur the lines between the roles of the designer and user; the way it is implemented in both these contexts changes (Koren & Shpitalni, 2011). The level of design maturity in the community in both these contexts is a very significant factor in how open design is carried out.

2.7.1 European Contexts

The main factors discussed in literature are the need for increased democratizing of design activity, to improve agility of manufacturing and to make new tools and methods of designing accessible for all. (Koren & Shpitalni, 2011). The focus is towards research and development and on the adaption of new, progressive methods of manufacturing. The concept of fab-labs, maker and hacker spaces is also more relevant in European contexts. In fact, the concept of Fab labs first originated from the Netherlands. The idea of these were to allow access to basic tooling and manufacturing equipment to anyone irrespective of them being designers, manufacturers or even users themselves.

The relevance of the pragmatic and conscious approach to the Open Design Movement discussed by Boisseau, Omhover, & Bouchard, (2017) is more applicable in European contexts as well considering the intent towards opening newer avenues for designing products and giving equitable access to the product design process. The imperative purpose behind bringing open-source software principles into the arena of tangible designed products is to induce creativity, innovation and learning, adaptation, and growth.

Thus, empowered users can now 'hack' their objects by changing their original purpose, or by improving them via the development of 'tangible add-ons'. If this phenomenon is not new, or directly related to opening object sources stimulates this behavior, as well as recently created digital platforms for sharing DIY projects.

2.7.2 Non-European Contexts

Non-European contexts, however, are the other category identified by (2019). While there might not be an active coining of the terminology "Open Design" or avenues to identify it happening here as is, per se, the openness of design can be measured and seen in many ways. Practices that are adjacent to or tangential to the concept of open innovation existing in these contexts are practices like *Jugaad* (Rangaswamy &

Sambasivan, 2011), *Gambiarra* (Springer, 2016) and *Halletmek* (Horsanalı, 2018). Jugaad is a practice mostly prevalent in the subcontinent including India and Pakistan (Rangaswamy & Sambasivan, 2011). Gambiarra, (Springer, 2016) is mostly practiced in Brazil whilst *Halletmek* features in Turkish culture. There are similar practices such as *shahzhai* (Han, 2017) and *Gonghkai* (Moody, 2015; Huang, 2014) that are common knowledge in China. Almost all these practices are intertwined with the culture of the country they originate from. These practices mostly encompass post-production hacking and are more relevant to tangible products as opposed to 3-D blueprints and online modes of data sharing and consumption as characterized for the European contexts. Another concept similar to the ones mentioned above that is existent is *Jua Kali* (Campbell, 2017), mentions that practices like these including *Jugaad* and *Gambbiara* are problem solving approaches that are mostly existent in developing countries. (Julier, 2020)

Arguably, these practices are the flagbearers of design democratization more than any other open practice. Each of them being a constant design-after-design approach with both the process and outcome of design conceived as 'open'.

While the discussion about specifically the practices carried out in developing societies will be covered in more detail in the sections to follow, below is a flow diagram that was created by the researcher to understand the relation between developed societies, developing societies and how practices like *Jugaad* or *Halletmek* could be placed among them. The hierarchy in this diagram is particularly applicable to the Pakistani context where there is a lack of in-house manufacture/production. Most products are obtained either by importation or as purchases of discarded products from flea markets like *Itwar Bazar*.

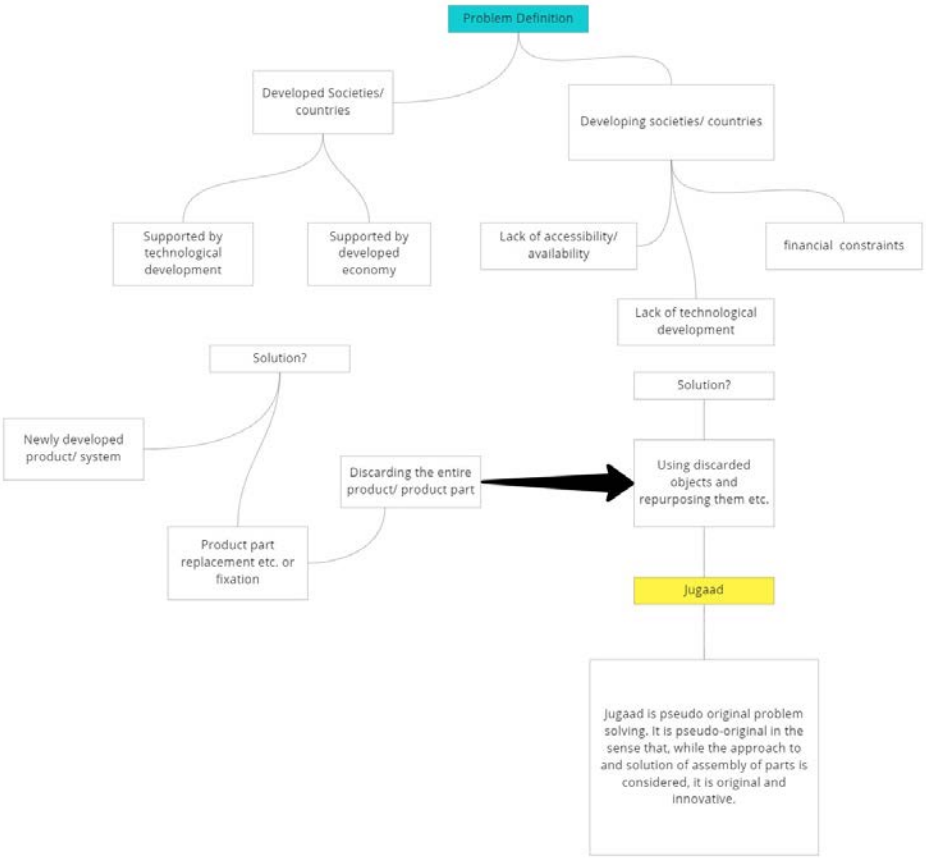


Figure 2.4: Flow diagram to understand the product consumption hierarchy in Pakistan

2.7.3 Potential of Open Design

Referring to section 1.5 of this chapter: the second strand of Open Design is a characteristic of Open Design that aligns with practices (that are tangential to Open Design) (Bakırlıoğlu & Kohtala, 2019) carried out in non-European contexts (section 1.6.2.). In other words, the characteristics of Open Design that are common to some of the practices like *Jugaad*, *Halletmek* and *Gongkai* etc. are that open part and product designs can be:

- **altered and personalized** for different people
- **repaired** when they are broken

- **upgraded/ developed further**, due to the possibility of intervention and openly available knowledge

2.7.4 Cultural practices tangential to Open Design

From here on the literature progresses to briefly shed light on the practice of *Halletmek* and *Jugaad* and view them as cultural practices that are intertwined with the everyday lifestyles of the natives. The autonomy and leeway these practices offer to a common man and the ingenuity and innovation they offer is something very fascinating that will be expanded upon in the following sections.

French terms *bricolage* and *bricoleur* that are emphaised upon by Levis Strauss in his book "The Savage Mind" (Strauss, 1966)*:* these are some common concepts that help in understanding the very imperative and productive role of users as part of everyday life and how that transitions into them acting as makers or designers in some cases. In fact, The Savage Mind and Michel De Certeau's "The Practice of Everyday Life" (Certeau, 1984) are attributed as the most promiment ones in associating users as designers or makers (Horsanalı, Altay, & Öz, 2019). Lévi-Strauss explained the concept of *bricoleur* in the The Savage Mind (Strauss, 1966) as follows:

"The 'bricoleur' is adept at performing a large number of diverse tasks… His universe of instruments is closed and the rules of his game are always to make do with 'whatever is at hand', that is to say with a set of tools and materials which is always finite and is also heterogeneous…" (p.11)

Similar to *Halletmek*, *Jugaad*, *Shanzhai*, *Gongkai* etc, *bricoleur* (Rossi, 2013; Louridas, 1999) focuses on focusing on the means available at hand and takes into consideration the properties of the objects that are available. Similar to this, is the concept of "ad-hoc" which means "for this". Ad-hocism is also defined as a democratic way of producing based on the art of improvisation. (Jencks & Silver, 2013).

Ingold and Hallam (2007) define these acts of spontaniety as part of everyday life and associate creativity with improvisation. They also associate the creativity of

improvisation to be in the process itself while that of innovation is in the end product. Associating the process of improvisation to innovation can help derive an effective process of making and producing. Ingold and Hallam (2007) also suggest that there is a discint creative manifesttaion in design through improvisation and this is something designers should explore for added value. (Ingold & Hallam, 2007).

2.7.5 Halletmek – The Turkish Jugaad

In literal terms the Turkish word '*Halletmek*' means to settle. The way Nur (2018) has described it is to emphasize on the idea of finding makeshift, quick solutions to things and settling for low-fidelity hacks that work in very contextual terms. It is so inherent and intertwined with the Turkish culture that it had become almost invisible as a practice.

This book, that traces the practice of *Halletmek*, while mostly being a visual journey through the streets of Turkey, gave great insight on the intentions behind these actions and the kinds of interventions that were mostly done.

Horsanalı (2018) categorizes these practices as "States of Halletmek". The states being

1) Sitting
2) Sheltering
3) Displaying
4) Other utilities

Each of these states represent something recurring and common about the Turkish streets and it becomes evident just how cultural, localized, and contextual this practice is. Turkey is known for the excessive number of cats in the country, resultantly the number of shelters for street cats is large and one of the most prone to have had this concept applied to.

Horsanalı (2018) identifies the materials that are most frequent throughout her research for instance duct tapes.

Some *Halletmek* practices are so contextual, they do not make sense if they are taken out of that context. Objects are alienated to the point of them only making sense in that situation. Materials are the limiting factors of *Halletmek* and the defining factors of the outcome (Horsanalı, Altay, & Öz, 2019)

Figure 2.5: An old toilet bowl is reused/ repurposed to be used as a planter (Horsanalı, 2018)

Figure 2.6: A discarded plastic boot is used to redirect the flow of water. (Horsanalı, 2018)

Some practices are common among certain areas or streets only because they usually spread around by word of mouth or a person noticing and replicating what someone else has done.

Horsanalı (2018) also indicates the kind of ownership the people deploying *Halletmek* have towards their little interventions. For instance, one stall vendor was mentioned to have claimed a make-shift intervention on a product on the street as their own design, 'this stand is my design'. While these insights were extremely helpful in understanding and co-relating the properties of such practices, one aspect of this study was used directly as an inspiration for this thesis research.

Horsanalı (2018) mention the patterns noticed in the actions and reasons behind them at the end of the process. *Halletmek* identified those actions to be "repurposing, building, upcycling, personalizing, upgrading etc.". While Horsanalı (2018) does not actively link *Halletmek* to Open Design practices, the actions behind each intervention build a very strong common base between *Halletmek* and Open Design. The researcher

of *Halletmek* wishes for this concept to be explored further and seen in the light of conventional design practices, which is what this thesis attempts to do.

2.8 Jugaad

Jugaad is an informal, conversational Hindi word that translates as "quick fix", "workaround" or "hack". This term essentially represents a concept very contextual to the subcontinent (India & Pakistan). Over time it has grown to be recognized as not just another technique, but a mentality, even a lifestyle (Arya, 2020).

The concept of Jugaad is a cultural practice associated with the socio-economic conditions of the regions it is deployed in (Arya, 2020). It is a practice common to people of developing nations where the lack of access to latest technology, an ever-increasing population with an ever-present lack of resources causes them to fulfill their needs in a way that has as little financial outlay as possible (Rangaswamy & Densmore, 2013). It represents the idea of seeking solutions in adversity and innovating in the name of necessity. '*Zarurat ijaad ki maa hai'*, i.e., necessity is the mother of invention, is a very common proverb used in Pakistan upon sighting a Jugaad or initiating one.

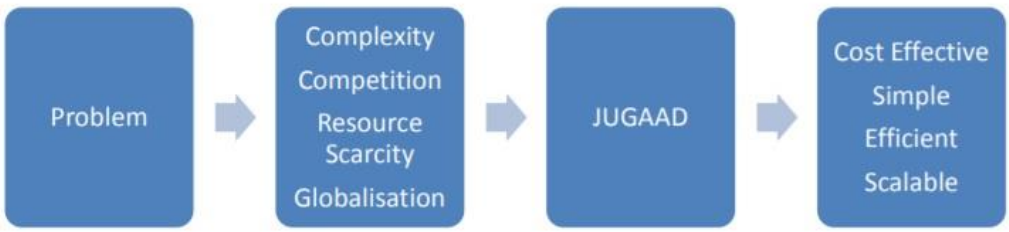


Figure 2.7: Dimensions of Jugaad (Rangaswamy & Densmore, 2013)

In each case, the end goal is to have a functional outcome no matter how that is achieved. It often involves repurposing products into something different than their

original purpose. Motivations behind deploying a *Jugaad* could be to either re-use, upgrade or personalize an item to fit the need for that instance or context.

It is an act of personalization, making ingenious solutions and continuous design-after-design that contributes to product life longevity or upcycling in many cases.

Considering the very short-term intent behind finding a solution to a problem while deploying a *Jugaad*, there is often a high chance for the outcome to be shoddy or even dangerous in some cases. The can-do approach when turns into a "make-do" approach can cause a lot of problematic situations. Hence, the light in which Jugaad has been seen or encouraged has evolved to be termed as "frugal innovation" (Radjou & Prabhu, 2015). Without compromising the safety, efficiency or utility of products, frugal innovation intends to address the essence of Jugaad but in a regulated way.

Campbell (2017) also emphasized the importance of working together of "lay designers" i.e., somebody without any knowledge of the professional design practices with professionals to find informed compromised between the two approaches. Campbell (2017) also emphasizes the need to acknowledge the efforts of lay designers more in order to achieve more sustainable and appropriate outcomes.

2.8.1 Types of Jugaad

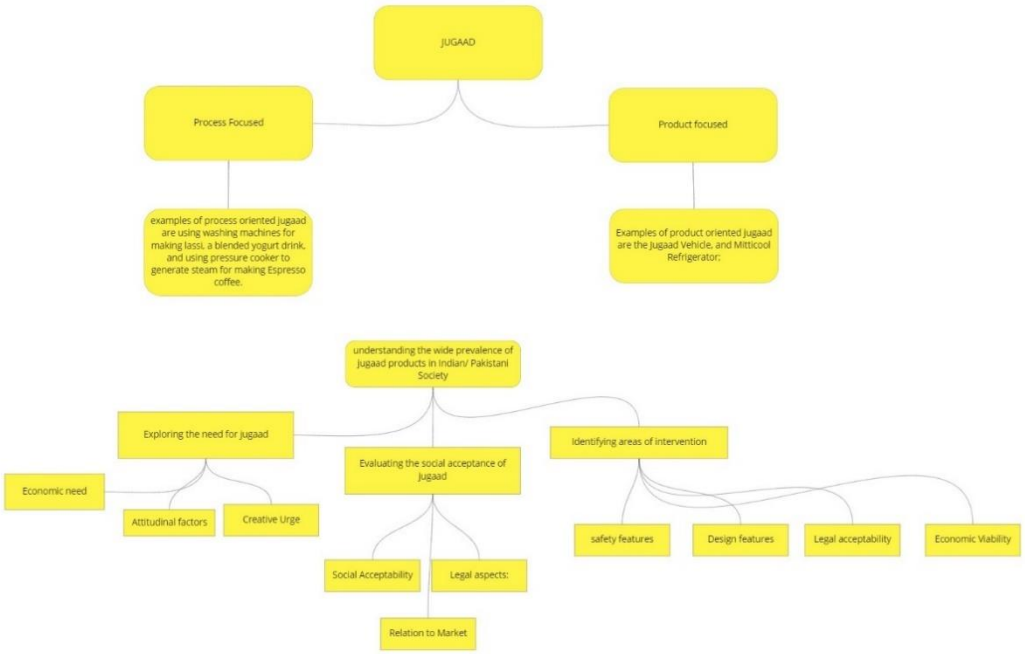


Figure 2.8: Flowchart created by the researcher of this thesis based on a Jugaad Report by Indian Institute of Technology (Rangaswamy & Densmore, 2013)

Jugaad is defined in two types: product focused and process focused. (Rangaswamy & Densmore, 2013)

The process focused approach essentially encompasses using Jugaad to create a service out of a product. For instance, using a washing machine for making lassi (a blended yogurt drink), using the rotational element of the machine and utilizing the process of rotation for unconventionally doing something else (making a drink), that also requires thorough whisking/ mixing.

The product focused approach simply focuses on the product for what it is. Using its morphological properties or structural properties for fulfilling a function while also having a product as an end-result.

Some examples of Jugaad carried out in Pakistan and India are represented in the section below. Although, there is not much quantitative or qualitative research on the relative prevalence of either process focused or product focused Jugaad deployed in Pakistan, for the scope of this thesis, the examples available online and some examples seen around in the streets are briefly discussed.

2.8.2 Examples of Jugaad

The most common avenue of Jugaad deployed in Pakistan is usually transportation vehicles. It is either applied in a product-centric way or a process-centric way.

Figure 2.9: A slide shown to the participants of the Open Design Workshop (Chapter 4) (Examples of Jugaad)

As shown in Figure 2.10, in one case the mechanical properties of a motorbike wheel are being used to power a water pump which also requires rotational motion for it to

pump water. The input of the person deploying Jugaad is to know the bike wheel offers rotation and the water pump needs rotation, connecting them both through a belt would ensure rotation in opposite direction for both and get the job done, no matter how temporarily. This method is deployed in a village where is there is usually no electricity to pump water, so a bike is utilized to get the job done.

Figure 2.10: A motorbike being used as an extension for a water pump

Wicker is a very common and widely used material in Pakistan due to its multi functionality. It is an insulator and is very light weight, so it's often used to make baskets to contain and keep the food warm or sometimes it is used to make handheld fans. In Figure 2.11, a *Jugaad* is deployed where three wicker baskets are used in the place of a fan's fins. This little intervention is ingenious since it makes sure the fan can work even when there is no electricity (just like a hand-held flat fan). Because of

the wicker the entire unit is light weight and can easily be pushed around to rotate and do the job.

Figure 2.11: A fan with three wicker baskets as fins

Figure 2.12 is self-explanatory in terms of understanding how subtle a process *Jugaad* can be. The eye of a "Jugaad Innovator", in this case, would simply require an identification of one object that needs containment (a TV), and another object that offers containment (a chair). Putting them both together and suspending them from the ceiling makes for one of the most common practices of watching TV from a suspended TV in male salons and *dhabas* (low budget eateries) of Pakistan.

Figure 2.12: A make-shift TV stand made from a chair

2.8.3 Limitations of Jugaad

While there are many such examples of this process being deployed successfully, and also noticing the ingenuity behind it, there is no real structured or organizational investigation of Jugaad being able to be deployed as part of a research or design process.

While the frugality of this kind of innovation is ingenious, it can also be dangerous. Investigating how this cultural concept can align with design processes that have similar attributes to this process is essential.

In the Jugaad Report by IIT (Rangaswamy & Densmore, 2013), India, similar constraints regarding Jugaad being an inventive method but having certain limitations is explained. Some of the limitations being the fact that Jugaad is as follows.

Largely Untested in the Organizational Setting: To utilize Jugaad as a process, it needs to be investigated as a concept in a structured setting where the drawbacks of it can be overcome through frameworks.

Jugaad is an Idiosyncratic Response to a Problem: Because Jugaad is often applied to solve very contextual or very personal problems and is usually a very individualistic problem-solving approach, there is a need to practice it in group settings without any

restrictions or need for approvals. In this manner, possibilities of finding solutions that can be ingenious while also being universal can be found.

No Design Element or Risk Undertaken: Jugaad is not born out of research or a pragmatic approach to ensure its scalability to address a larger audience. Hence, there is an opportunity to explore it in that arena.

Quick Response Solutions to Problems: Jugaad is driven by a fix-it attitude that generates a just-in-time solution, to resolve a firmly constrained problem. It is not a strategically tailored innovation conceived to develop an open-ended opportunity. However, again, there is an opportunity in this arena owing to similarities in attributes of Jugaad and certain design practices that are pragmatic and research-driven i.e., Open Design Practices.

2.9 Conclusion

This literature review was divided in two phases: the first phase framed Open Design and Open Design practices and the second phase transitioned to contextualizing open design practices. It progressed into a review of the practices that are tangential to open design, followed by a review of practices like *Halletmek* and *Jugaad.* Based on this literature, essentially the opportunities and common points between Open Design and *Jugaad* were explored. For instance, the democratization of designing/ making that both practices offer and the ability to reuse, upgrade or personalize products that both the processes offer. Another important factor considered is the open involvement of users or designers or anyone for that matter, in the process. The way Open Design and Jugaad practices morph the role of a designer in the process of open involvement of anyone in the process is also an aspect of this thesis that this literature builds the basis for. Certain limitations like the ones mentioned in the section 1.10.3. will be investigated as opportunities in the field research of this thesis to understand the implications of Jugaad as a cultural probe while conducting Open Design practices.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The aim of this research was to investigate Open Design practices with Jugaad as a cultural probe, to evaluate the possible conception of Jugaad as a variation of Open Design and the feasibility of it as a possible design method.

The research supporting this thesis started off by developing an understanding of co-creation practices in general, covering concepts such as participatory design and collaborative design acting as umbrella terms. While they were deeply studied and understood, they were not utilized or documented as part of the literature review in Chapter 2. The co-creation practices, however, greatly helped in setting a pre-text for understanding the intention behind conducting practical studies using such co-creation practices. The kinds of scenarios they can be applicable to and situations where they can be particularly useful were also understood. The literature review, on the other hand, focused on framing Open Design in terms of how it took root, its different manifestations, the nature of its inherent "Open-ness" and the many contexts in which it is applied.

The literature review was also personally illuminating, helping the researcher to understand Open Design and to investigate the role of "designers" and "users" in the processes of Open Design. As an unintentional consequence, through the literature, the research helped identify design practices and contexts that carried the principles of Open Design without the "label" of Open Design itself. As a process of discovery, the literature review highlighted specific contexts and cultures where design-and-make activities are carried out under practices that resemble aspects of Open Design, with the distinction that there is (currently) no intention for them to be "Open" or described as "Open" by their originators. However, the potential of framing of these practices

through the lens of Open Design was considered a valuable design research proposition that emerged through the literature review.

Jugaad and *Halletmek* were two such practices that were framed as adjacent to or useful for enquiry in the arena of Open Design (Kohtala, 2019). They became the focus of investigation in the second phase of the literature review, regarding a deeper understanding of the way they are implemented and how they shape roles of designers and the masses. These concepts were understood through a case study and a review of *Jugaad* through the lens of Open Design.

The literature review helped establish a multi-faceted direction to take the research. Since the "Open-ness" of design processes and refinement of design outcomes (deliverables) manifests as continuous, recurring processes, they cannot easily be investigated unless there is a controlled setting having limits on time and resources. Accordingly, a workshop was planned as the main source of original data for investigating the Jugaad / Open Design relations in a practical situation.

The workshop was in fact conducted twice with a conscious decision to recruit participants who had a design background (training). The aim of the workshop was to address the research questions of the thesis, as mentioned in Chapter 1. While some of the questions were answered through the literature review in Chapter 2, some could not be addressed without empirical investigation and organizing participants to engage in, and reflect upon, *Jugaad*. A workshop was considered as the most appropriate way to carry out such an empirical investigation, allowing a combination of briefing, generative (design) activities and debriefing within controlled conditions. The participant selection decision was also impacted by the cultural constraint of needing to understand 'Jugaad' as a cultural practice. Hence, since the workshop was conducted whilst the researcher was resident in Pakistan – with access to undergraduate students of Industrial Design at the School of Art, Design and Architecture (SADA), NUST, Islamabad – Pakistani nationals were considered ideal participants to work with. The first workshop was conducted with twelve participants, each of whom was a final year Industrial Design student at NUST. Similarly, the

second round of the workshop was conducted with nine participants from the same institution.

Both editions of the workshop included debriefing sessions that were conducted a week after the generative (design) activities had been carried out. The debriefing sessions were intended as critical consultations with participants, asking for reflections on their experiences and achievements during the workshop.

3.2 Literature Review

As mentioned in the introduction to this chapter, the literature review helped establish an understanding of Open Design as a co-creation process, as a new avenue of democratizing design activity, and a consequence of open-source principles being integrated into design. The literature also revealed the various contexts that Open Design is applied to, which paved the way for the research to concentrate on the relatively under-investigated tangential concepts of *Jugaad* and *Halletmek* (Horsanalı, 2018). From that point, an overview and comparison of the role of designers and users in conventional design practices versus the open principled practices was carried out.

The planning of the literature review (Chapter 2) was initially made with the help of flow charts and diagrams displaying connections between the various topics and sub-topics. The process of visualization helped to establish a basis for further avenues for the literature review, as well as the planning of later stages of the research. Figures. 3.1 and 3.2 show examples of the flowcharts that helped develop a hierarchy of topics to be reviewed in the literature.

Figure 3.1: Flow Chart to create hierarchies for Literature Review

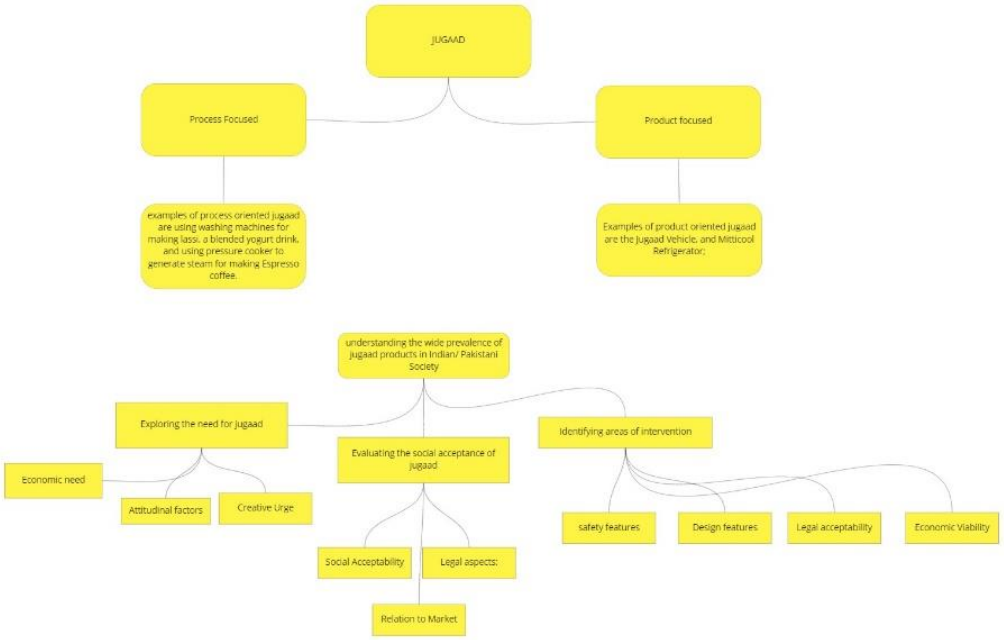


Figure 3.2: Flow Chart to create hierarchies for Literature Review specific to Jugaad

3.3 Research through Collaborative Designing

As previously mentioned, the "Openness" in Open Design can be in terms of the process, outcome, and contribution. In order to understand the implications of Open Design and what its contributions can be, it is essential to involve the stakeholders and engage them in a collaborative process to fully gauge the manifestations of an Open Design process. Hence, for this study, it was decided to create an environment for research through collaborative designing.

The concept under central investigation in this research is *Jugaad. Jugaad* inherently is a process deployed on the streets, by the people for the people. It is a way of hacking existing products and customizing them on very particular and very contextual basis. It, hence, makes particular sense for the field study in this research to be conducted as 'research through co-design', where the process of design is collaborative and the outcome is produced and analyzed with the people (participants) as co-designers. Selecting Industrial Design students from Pakistan, hence, was a good fit for this research since they were culturally aware of the concept of *Jugaad* and could also very

well understand participatory design approaches, the ability to carry out collaborative design and be able to report on their critical findings and experience through the final design outcomes that they delivered. The debriefing session was planned as an effective way for participants to reflect upon and describe their experiences, with the perspective of both a user (of a new product design) and a designer (of that new product design).

However, the aim of this study was not to use research through co-design to develop a certain outcome that is beneficial to the participants at the end. Instead, the aim was to discover the opportunities and limitations of using *Jugaad* as a cultural probe for carrying out collaborative design in an Open setting.

This approach has similarities to the methodology adopted and tested by Bakırlıoğlu (2020), who investigated product part longevity in small kitchen appliances taking an Open Design approach. The aim in this current research was also to understand the practical implications of an Open Design process which could be best understood by simulating a practical Open design environment where all the contributors reflect on their experience while "in action" (during generative design sessions) and "on action" (during debriefing sessions). Figure 3.3 provides a distinction created between research through designing (carried out by the researcher or research team) and research through co-designing (carried out in collaboration with contributors who are outside the research team).

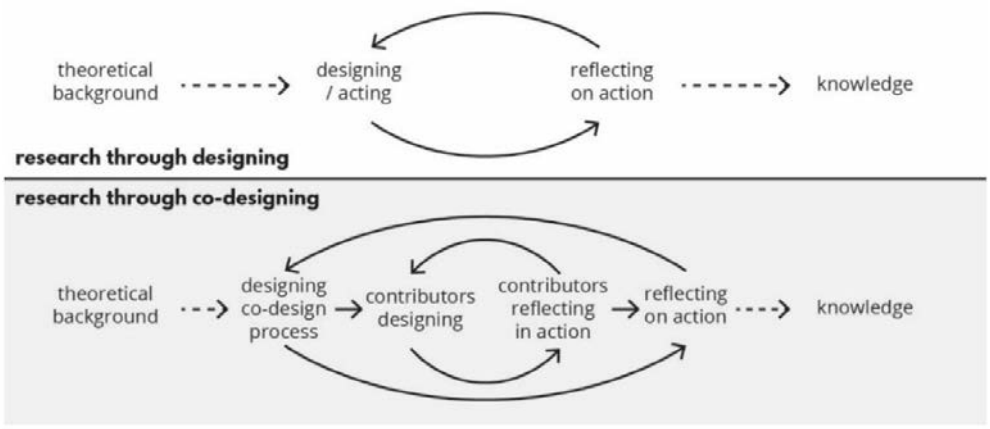


Figure 3.3: Differences between 'research through designing' and 'research through co-designing' (Bakırlıoğlu, 2020).

On a similar basis, the theoretical background (Figure 3.2) was developed through case studies and literature review to prepare the structure of the workshop and to ensure that it facilitated participants to reflect on their experiences during the generative activities and the debriefing session. The theoretical background that helped develop the structures of the co-designing workshops were the literature review and a case study that has been discussed in the next section (section 3.4)**.**

Halletmek (Horsanalı, 2018)*,* analyzed in Chapter 2, was found useful for designing the certain generative tools and creating templates for the participants to work with during the workshop. Participants worked in groups, carrying out exercises, generating design ideas, and creating prototypes that were then iterated upon by the members of other groups. The workshop involved formal presentations and group discussions as part of the process. This was followed by an analysis of the prototypes that the participants had created, and a follow-up session each a week after the workshops, with the participants to understand how they responded to the entire structure of the workshop, how they felt about their role during the process and what they felt about *Jugaad* as a cultural probe in an Open Design process. At the end of this co-design process, the research uncovered valuable findings that could be used to conclude on the feasibility of adaptation of *Jugaad* to a design practice.

3.4 Design Workshop

Design workshops are usually settings for generative research where participants from any background can come together and be involved in different activities to produce different outcomes. Co-Design workshops, specifically, are ideal when used with generative tools like probes, toolkits, and prototypes. (Sanders & Stappers, 2014). Workshops can be productive in terms of group involvement where different ideas can be tested in a controlled setting with different kinds of outcomes and different interpretations on a shared experience. It is ideal to work with prototypes in settings that require collaboration in terms of 'making' as suggested by Sanders & Stappers (2014), creating iterations of which can be particularly fruitful since prototypes can start discussions and help test theories out. The aim for the workshop was precisely to simulate an otherwise impossible to measure, recurring and endless process of design i.e., Open Design. It was, hence, imperative to control certain aspects of the research that could remain constants, leaving room for many other variables to be freely iterated upon. For instance, the product library (refer to Chapter 4: Workshop 1 Jugaad a Do what Jugaad a Do) for each participant to utilize was similar, they were all given the same product type to work on (Upright Cleaners), and all had access to the same probe cards.

Probe cards, as described by Sanders & Stappers (2014) are tools designed to provoke participants to elicit response. It is not necessarily up to the designer (researcher in this case) to predict or curate how the designers will utilize these tools, however, how every participant utilizes them can be extremely insightful for the researcher. Similarly, the probes for this workshop were essentially the probe cards and the product library (see Figure 3.7).

All the major tools utilized for planning this workshop were kept in mind based on the need to make and collaborate and be able to iterate based on discourse. The utilization of a design workshop like one by Bakırlıoğlu & Doğan (2020) circles around inquiring the adaptation of Open Design approach for sustainability concerns of product/part

longevity. This was particularly useful since the subject matter of research was tangential to this thesis and, hence, helped lay a basis.

Phillips, Baurley, & Silve (2014) utilize Design Workshops using probes to investigate Open Design (OD), Digital Manufacture and Citizen Science (CS) together and present findings. Workshops, in this research, were utilized and reported to have helped in understanding people's motivations and for reviewing the processes for sharing gathered data.

All these observations gave retrospective justification into a workshop design that resulted in a fair and accessible approach to *Jugaad* as a cultural probe for each group. The structure of the workshop is covered in greater detail in Chapter 4. However, at this point, it is imperative to give a general understanding of how the workshop was structured based on the factors behind its conception.

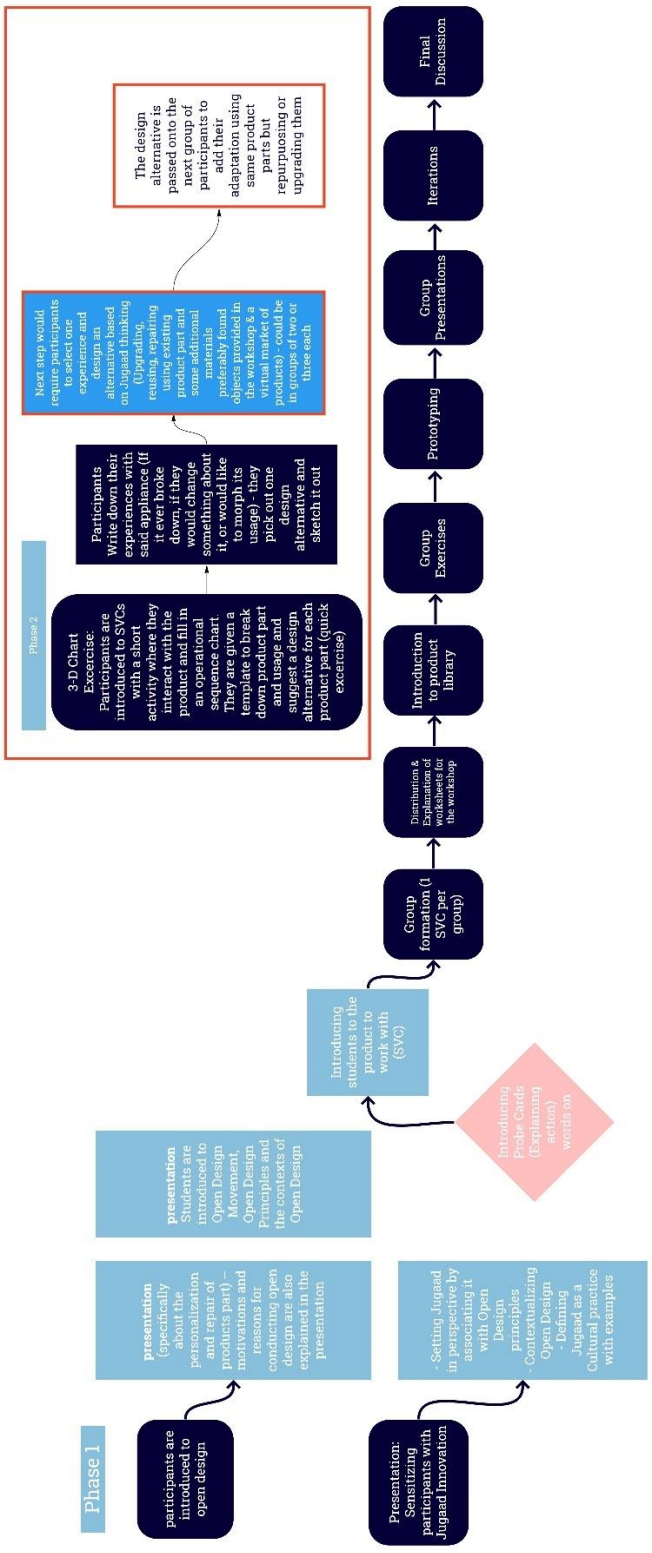


Figure 3.4: Workshop Structure Designed for this thesis.

The workshop structure is visualized in Figure 3.4. Initially, the participants were sensitized to Open Design, its origin, and its manifestations. The Open Design Movement, Maker Movement, FabLabs, Maker and hacker spaces Braida, Chagas, Almeida, & Castro (2018), Richardson (2016) were also explained as avenues where Open Design has manifested itself. The contexts of Open Design were also explained, which brought the briefing onto the main topic of conversation: the practice of *Jugaad.* Participants were introduced to the appliance they were asked to work on and were also explained why this device was chosen.

3.5 Product Selection for Design Workshop

This phase of the study was extremely pivotal in terms of setting the tone for how the workshop would be conducted and what kind of outcomes could be predicted, based on the expertise of the participants. Selecting the product category was, hence, a very conscious and crucial choice.

It is to be noted that the product was required to be something that participants were able to interact with, provide design alternatives for, and create prototypes with (using the product part library provided to them during the workshop). Hence, it had to be ensured that the candidate product:

1) affords being redesigned.
2) provides various ways of someone approaching it.
3) has multiple features and functionalities.
4) has a mildly complicated morphology.
5) has a usage that can be "personal" or be a part of everyday life.

Based on the probe cards (See "Probe Cards" in Chapter 4), the possible "actions" that a participant could use for iterating on the original product were "upgrading, reusing, customizing, repurposing or personalizing". Due to these, the foremost priority was to select a product that had a regular usage or intervenes in the personal lives of every participant involved in the workshop, so that each could express valid opinions about

what they would possibly want to “upgrade, reuse, customize, repurpose or personalize” in the product. This helped in limiting the options down to home appliances only. The second concern was the product morphology and multi-functionality, to ensure there was an array of possibilities for the kind of iterations a large group of students might work on and provide iterations for. After thorough consideration, two products were shortlisted based on the reasons mentioned.

The motivations for selecting these two products were as follows. It was considered that personal usage makes designing alternate solutions easier. Hence, home appliances were selected because they can be more relatable in terms of usage for participants. In this way, the alternate solutions that participants would provide were expected to be more grounded in first-hand experiences, more honest and more accurate.

3.5.1 Product Option 1: Coffee Makers

A coffee maker is first divided into its different functions, based on its mechanics, e.g., it holds coffee, has a filter, it heats up, it brews coffee, it contains coffee, it is also used to pour coffee. Every participant is supposed to pick one function/ feature of the entire product and alter that. They will study the product part they are supposed to change and how they want to change its functionality. They will be required, however, to use the same product part (or another found object and repurpose it) with additional material to morph the usage. They will be asked to make prototypes of their final proposition. Coffee Makers also come in different shapes, sizes, and arrangements, all the while having the same essential function i.e., to make coffee. People also tend to have opinions about coffee makers considering the frequency of usage it has in their daily routine.

3.5.2 Product Option 2: Upright Stick (Vacuum) Cleaners

Upright vacuum cleaners have so many ways of use and areas of usage. Existing designs in the market have many different arrangements for the joint vacuum unit, some are upright designs (but the handheld unit is on the top), whilst others have the handheld unit at the bottom. Participants would be asked to study each part, select one function they would like to alter and then morph the usage according to their own liking, but using the same existing product part (or another found object and repurpose it). They will be asked to make prototypes of their final design proposition.

3.5.3 Product Option 3: Transportation Vehicles

Another category of product as a candidate for use in the workshop was transport (bicycles, tricycles, related because there is a lot of *Jugaad* deployed on them locally, hence they can be called *Jugaad*-friendly). Participants would need to sensitize themselves with the existing transportation to upgrade it, e.g. designing an alternate way of transporting chickens so they do not die from suffocation but not redesign the entire carriage but merely improve on it only while using *Jugaad* as a probe (upgrading/ repairing the current transportation carriage), one group provides one solution and the next groups either alters/ upgrades or redesigns the solution that the previous group gave.

A major motivation for selecting this product was its presence on the local Jugaad scene. It represented a real-world problem that needed addressing and which could be investigated with the Jugaad approach in an Open Design setting.

The final decision was to opt for the upright vacuum cleaner. The reason for its adoption was also explained to the participants of the workshop. Figure 3 below is a slide from the presentation given to the participants during the workshop.

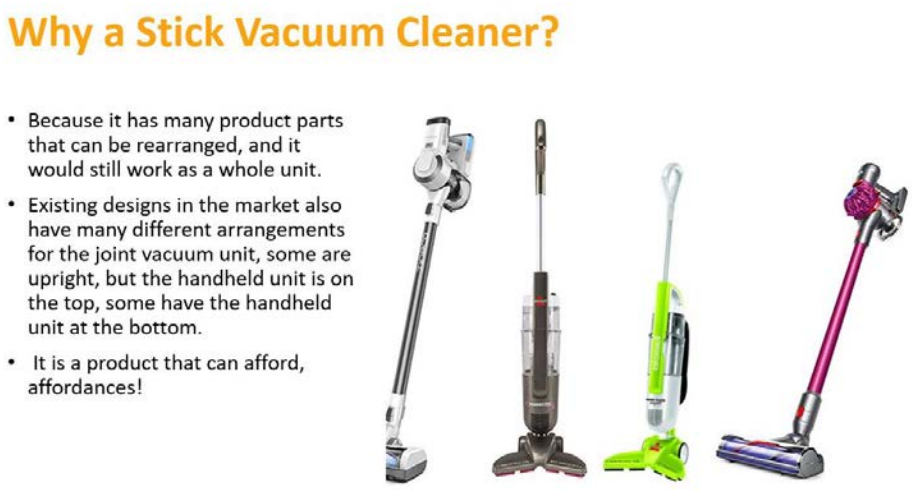


Figure 3.5: Explanation to workshop participants on why stick vacuum cleaner was chosen

3.5.4 Product Library Sampling

While this topic is covered in more detail in Chapter 4, a brief description is provided here to place its role within the workshop design. In order for the participants to prototype design iterations based on their generative exercises (see Chapter 4), a physical library of products was curated to be present in the workshop space. The library was provided for the students to either take inspiration from or utilize directly for prototyping their final designs. These products were collected from a flea market called the *Itwar bazar* in Islamabad, where discarded or secondhand products or product parts are readily available. The researcher personally conducted a short morphological review of the three upright vacuum cleaners to be used in the workshop, and listed a few features that their morphology contains.

- Containment
- Maneuverability
- Absorbent surfaces
- Textured surfaces
- Expansion and contraction

- Stability
- Modularity etc.

These points were noted when visiting the *Itwar bazar* in search of products or product parts that could offer these qualities in one way or another. The product library was also intended to act as a probe for students to decontextualize the product and view it in a different light. This also helped in distinguishing the morphology of a product from its functionality. The product library was intended to make participants think like the "*Jugaad* innovators" (Prabhu, Radjou, & Ahuja, 2012) of the streets who utilize found objects for repurposing, reusing, or upgrading. Below is an image of the curated products that were spread on a table for the participants to look at or utilize as per their need.

Figure 3.6: Product Library

Figure 3.7: Product Library Spread

3.6 Participant Selection

As already briefly mentioned in the introduction, the participants that were selected for this research were final year Industrial Design students from the School of Art, Design and Architecture (SADA, NUST), Pakistan. Sampling of participants for this research was relatively convenient, since it was clear based on the experiences of Bakırlıoğlu (2020) that contributors to the process of Open Design should be people who come from either an engineering or a design background. This is so that they understand product and product parts for their morphology while also understanding Open Design as a method of designing. Designers are also savvier in terms of communicating their experiences and in having opinions on how a product could better perform a certain function.

However, another search filter that had to be applied while sampling participants for this research was the culture and nationality. Having Pakistani participants was ideal, since they would be already acclimatized to the concept of Jugaad since their childhoods. They were aware of this concept and were, hence, more efficiently able to apply this concept as a probe for idea generation and iteration.

Another aim of this research was to understand how the application of Jugaad and the constant "design after design" approach results in a shift of the autonomy over a design, and a change in the role of a designer compared with their conventional setting. At the end of the research, it was considered very important to be able to determine how designers respond to a shift in their role as "owners" of the design process. Hence, inherently, the need for the participants to be from a design background was crucial.

While the goal was to conduct just one workshop with a full batch of participants, due to the ongoing COVID-19 pandemic, the workshop had to be conducted twice to fit to the regulations of fewer participants in a physical space at any given time. The first workshop was conducted with twelve participants (divided into 3 groups), with the second having nine participants (divided into 2 groups).

3.7 Data Collection

The kind of data that was collected differed depending on the stage of the workshop. The generative templates provided to the participants (see Chapter 4) were utilized for documenting the process but the most essential information that was utilized in analysis were the probe cards and how each participant group made use of them. The workshops resulted in many valuable findings, not only from the perspective of research results but also personally for the researcher, who curated the entire process and was involved at every step of the workshop. At the end of the workshop, a debriefing session was carried out with the participants (see Chapter 4). This session was a major source of primary data for answering the research questions.

Upon completion of data collection from all sources, i.e. generative tools for the workshop, debriefing session, action words on probe cards utilized by participants in their final design sheets (see Chapter 4), a visual was prepared in MIRO where all avenues of data were compared to each other and reviewed in terms of the plan of action the analysis will take. In MIRO, the first step was laying out all the information available for review in the order of occurrence, after which a prioritization was made for what to utilize and how to analyze.

Figure 3.8 and figure 3.9 show a data spread that was created specifically for the generative tools utilized during the workshop 1 and workshop 2, respectively. The three main avenues of data were defined in Figure 3.10. The data were compared side-by-side with the research questions of the thesis and a prioritization was created for the different levels at which the data needed to be filtered and decluttered.

Figure 3.8: Data Spread on MIRO archiving the utilized generative tools for Workshop 1

Figure 3.9: Data Spread on MIRO archiving the utilized generative tools for Workshop 2

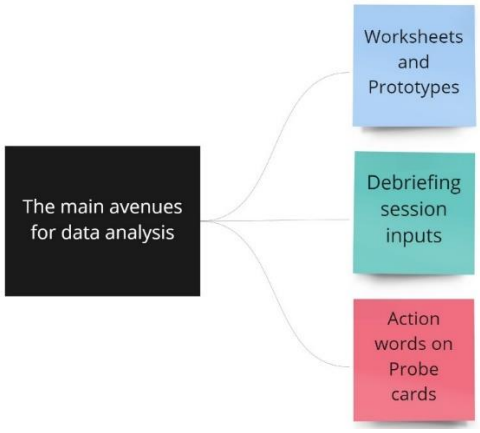


Figure 3.10: Three main avenues for data analysis

3.7.1 Generative Tools for Research through Co-Design

The Generative tools were a way for documenting the process of design that participants followed and they were reflected upon in the Chapter 4: Workshop 1, Chapter 5: Workshop 2 and discussed in the Chapter 7: Conclusion where some comments by the participants themselves are also shed light upon. The Generative tools utilized were Operational Sequence Charts, Design Alternative Charts, Probe Cards, Product Library and Design Iteration Sheets (See Chapter 4).

3.7.2 The Debriefing Session

The debriefing session proved to be the most comprehensive source of data, since it was included in the workshop specifically for the purpose of analyzing participants' experiences. The session was arranged one week after each Workshop concluded. While the workshops were conducted physically, the debriefing session was conducted online. Participants were interviewed in their respective groups (the ones formed during the workshop), online. All of the questions posed at the debriefing sessions were intentionally phrased as off-shoots of the thesis research questions. Table 1 contains the parent and sub research questions of the research, corresponding to the various questions that were posed to participants during the debriefing session.

Table 1: Research Questions vs Corresponding Debriefing Session Questions

Research Questions	***Corresponding Debriefing Session Questions***
RQ1. **Can *Jugaad* be adopted as a particular approach towards open design?**	• How is *Jugaad* used for solving problems locally?
RQ1a. How does the role of the (trained) 'designer' change when using *Jugaad* as a method for designing?	• How do you think the role of a trained designer would change if Open Design were used as a method for designing?
	• How did you feel your autonomy over your design changed when other people kept iterating on it?
	• What was the experience of iterating on each other's design like? (Possibly repetitive)
RQ1b. What convenience/ inconvenience does *Jugaad* create in creating an Open process of designing?	• How do you feel about *Jugaad* as a cultural practice?
	• How do you think *Jugaad* can be applied on products in Pakistan where there is hardly any manufacturing?
Research Questions	***Corresponding Debriefing Session Questions***

	• What convenience/ inconvenience, do you think, *Jugaad* can create in an open process of designing?
RQ1c. In what ways is *Jugaad* similar/ dissimilar to Open Design Practices?	• In what ways do you think *Jugaad* are similar/ dissimilar to Open Design Practices?
RQ2. What categories of problems is *Jugaad* applied to (e.g., problem solving**, value addition**, enhanced user experience), and what are typical outcomes? (e.g., types of products…)	• How is *Jugaad* used for solving problems locally? (i.e., repeated question)
	• Do you think *Jugaad* can be used for **value addition** or **enhanced user experience?**
RQ2a. How is *Jugaad* used for solving problems locally? RQ2b. Who practices *Jugaad*?	• How do you feel about *Jugaad* as a cultural practice? (i.e., repeated question)
	Workshop Specific Questions to understand effectiveness of the tools during the workshop
Research Questions	***Corresponding Debriefing Session Questions***

	• Which of the two products provided to you in the workshop was more successful in terms of Open application of *Jugaad*?
	• How did the physical library of products direct you into redesigning/ iterating your product?
	• How did the probe cards help you in designing/ redesigning? You can quote specific examples.

The questions at the debriefing session were asked keeping in mind the caliber of the participants and the kinds of input they had already given during the workshop. All the responses were recorded into Air Table (online hybrid database-spreadsheet) during an online interaction with the participants. Figure 3.11 contains a screenshot of Air Table for one of the records of the debriefing session.

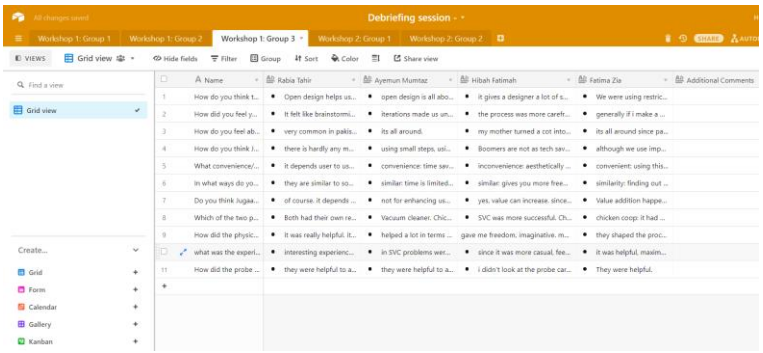


Figure 3.11: Screenshot of records collected through the Debriefing session in AirTable.

3.7.3 Probe Cards

As mentioned in section 3.12, probe cards were an essential tool for gauging and shaping participant's experiences. They were utilized to evoke participants into utilizing these cards in whatever they possibly could. While each probe card contained 3 elements: A picture of a Jugaad practice, Action words and an explanation of the action, participants were asked to pay special attention to the action words. Since, the action words were descriptive of the act of Jugaad that are similar to Open Design practices, it was primal to use them as a vocabulary for all the designs that are created during the workshop. The 'action words' contained on the probe cards were, hence, a third avenue of data to analyze, holding considerable significance on the quality of design outcomes from the workshop. However, the action words were considered as a supplementary source of data since the probe cards were repeatedly mentioned in the debriefing sessions as well. The most quoted probe cards, however, were spread out in the Miro board to facilitate discussions in the thesis.

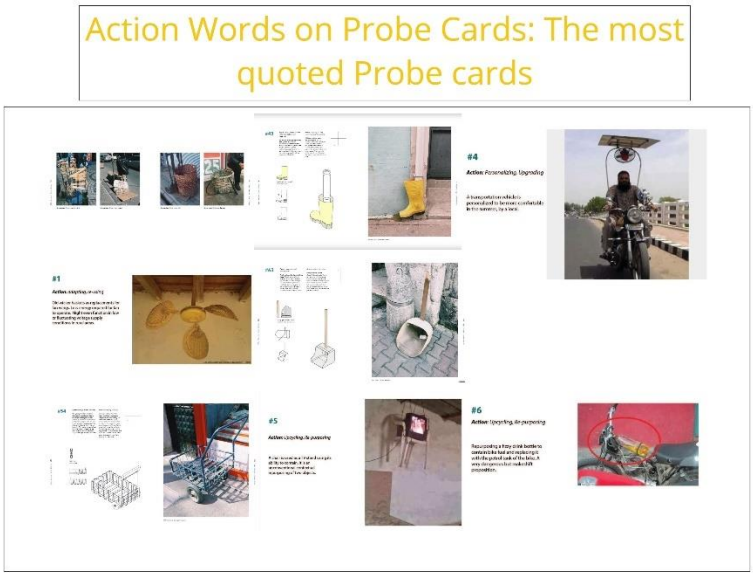


Figure 3.12: Screenshot of most quoted probe cards collected in MIRO.

3.8 Preparation of Data for Analysis

While the topic of data processing will be covered later in the thesis in detail, it is to be mentioned that the responses gathered at the debriefing session were coded under tabs that were specific to each question asked of every participant. To do this, all the participants' responses were rearranged from being organized by session to being organized by question. Air Table was an ideal tool to build the analysis around, being equipped with coding, filtering, grouping, and sorting functions to help extract key findings. Codes and code details relating to textual extracts from the debriefing session responses (the 'raw data') were written under relevant columns. Finally, the coded data were sorted by codes, by questions, and by tags for sessions, to help make connections amongst the raw data (see Figure 3.13). The insights and findings gathered from this process will be explained further in Chapter 6: Data Analysis.

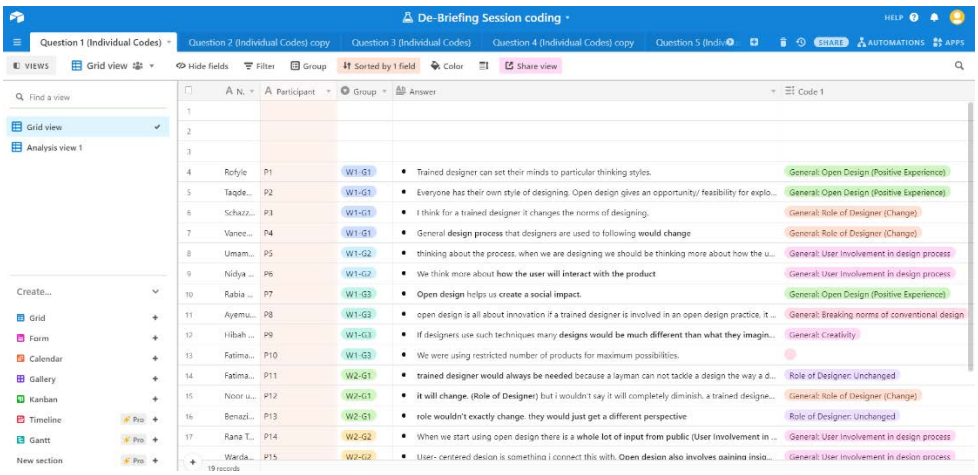


Figure 3.13: Screenshot of Data Coding of Debriefing session in Air Table.

CHAPTER 4

WORKSHOP 1

4.1 Introduction

Considering the overlapping attributes of Open Design and Jugaad innovation, a workshop was planned to investigate the possible democratization of design activity using *Jugaad* as a cultural probe. Two workshops were conducted with final year students from the School of Art Design and Architecture (SADA), NUST, Islamabad, Pakistan.

The workshops were conducted inside the fourth year studio of the Department of Industrial Design. Participation at the workshop was declared mandatory for the students and Figure 4.1 is a poster of the workshop that was displayed around the department.

Figure 4.1: The Poster for the Design Workshop that was displayed around SADA, NUST

Each workshop was planned to be delivered in two stages. They were designed in a manner that students could understand the relation that the thesis research intended to build between Open Design and *Jugaad*. To begin, participants were given a short presentation about Open Design, its origin, definition, and implications. This was followed by a brief walk through of the local practice of *Jugaad* with its definition and examples in the local context. Participants were then shown probe cards that were inspired and designed based on *Halletmek* (See Chapter 2: Section 2.10). The cards were displayed in a loop on the projector throughout the duration of the workshop with the intention to probe participants to use them in whatever way they could. They were specifically explained all the elements of each probe card i.e., the act of *Jugaad / Halletmek*, the pictorial references and the 'action words.' (See Chapter 3: Section 3.7.3). The other generative tools utilized in the workshop are covered in more detail in the sections to follow.

There was a total of twenty-two students in the class but only twelve of them were present in person due to the on-going COVID-19 pandemic. The remainder joined the session online but were unable to contribute to the process. A second workshop was, hence, conducted with the remainder of the students. It is to be noted that the second workshop was not planned as an essential part of the methodology; rather, it was organized in response to the restrictions that arose because of COVID-19 precautions.

The twelve participants in the first workshop were divided into groups of four, resulting in three groups in total. Participants were given three different kinds of upright cleaners. Two of them were stick vacuum cleaners and one of them was an upright mop. These three objects were consciously chosen considering the familiarity of usage and the flexibility in redesign they offered due to their many parts and multiple functionalities (Refer to section 3.5 of Chapter 3: Methodology).

Students interacted with all the appliances and were then asked to pick one appliance to work on as a group. From here on, the students began working within their groups and tried to understand the functionality and structure of their respective appliances. The following is a list and description of all the generative tools that were utilized

during or for the workshop, with a description of why and how they were utilized. The template of each tool is also shown along with the description.

4.2 Workshop Structure

4.2.1 Pre-Workshop Worksheet

Before the workshop was conducted, a worksheet was sent to all the students to fill in and bring with them to the workshop. This was done as an effort to sensitize the participants about what they will be doing during the workshop. The selected product (upright cleaner) while being an ideal specimen for conducting the activities around, is not readily available or utilized in Pakistan. This worksheet was designed to introduce the participants to this product so that they could start developing opinions about it and come to the workshop space with said opinions, so it is easier for them to provide design alternatives later. Figures 4.2 and 4.3 show the worksheet that students were asked to fill before coming into the workshop. The content of the worksheet was not utilized for analysis. It was solely for sensitization purposes.

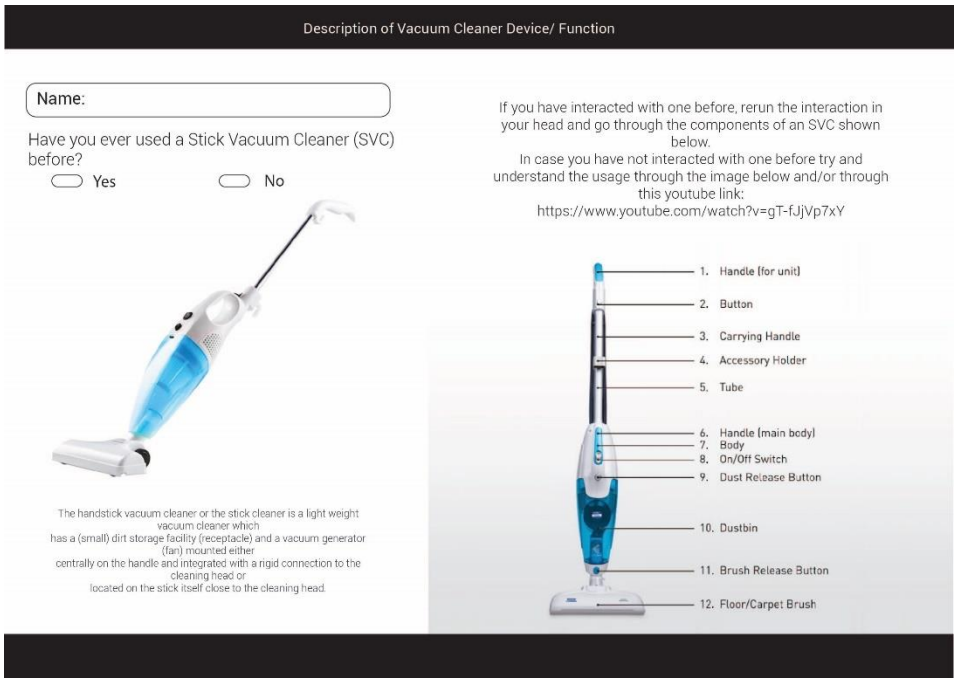


Figure 4.2: Front side of the worksheet.

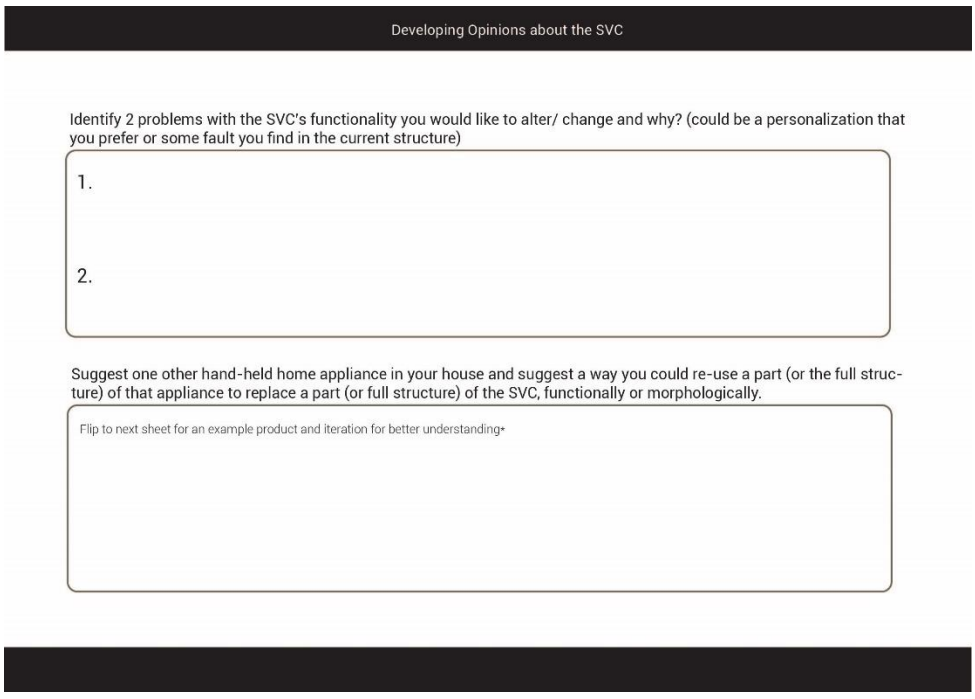
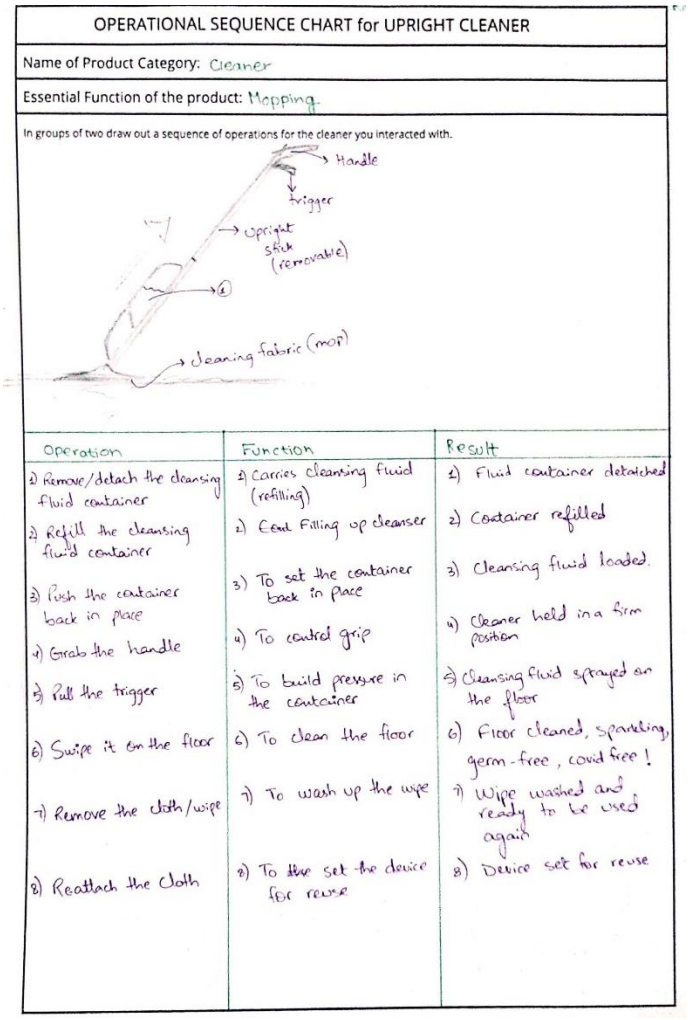


Figure 4.3: Back side of the worksheet

4.2.2 Operational Sequence Charts

After a presentation and briefing of the entire process, each group was given an Operational Sequence Chart for them to note down the steps of interaction with each appliance. Similar to the worksheet in the previous section, this chart was solely used for participants' better understanding of the appliance and its different parts so that they could develop opinions about the usage and morphology of it. None of the outcomes from the use of the Operational Sequence Chart were utilized in the data analysis. Figure 4.4 shows the template for the Operational Sequence Chart for reference.



OPERATIONAL SEQUENCE CHART for UPRIGHT CLEANER

Name of Product Category: Cleaner

Essential Function of the product: Mopping

In groups of two draw out a sequence of operations for the cleaner you interacted with.

Operation	Function	Result
1) Remove/detach the cleansing fluid container	1) Carries cleansing fluid (refilling)	1) Fluid container detached
2) Refill the cleansing fluid container	2) Cont Filling up cleanser	2) Container refilled
3) Push the container back in place	3) To set the container back in place	3) Cleansing fluid loaded.
4) Grab the handle	4) To control grip	4) Cleaner held in a firm position
5) Pull the trigger	5) To build pressure in the container	5) Cleansing fluid sprayed on the floor
6) Swipe it on the floor	6) To clean the floor	6) Floor cleaned, sparkling, germ-free, covid free!
7) Remove the cloth/wipe	7) To wash up the wipe	7) Wipe washed and ready to be used again
8) Reattach the cloth	8) To the set the device for reuse	8) Device set for reuse

Figure 4.4: Filled Operational Sequence Chart by Group A

4.2.3 Probe Cards

While the students continued interacting with the provided appliances, they were simultaneously introduced to probe cards that were partially designed by the researcher for this workshop. There were nineteen cards in total. Thirteen of these cards were directly taken from *Halletmek*, (Horsanalı, 2018) (See Chapter 2: Section 2.10) whilst the remaining six were images of *Jugaad* practices deployed in the streets of Pakistan adapted in a similar fashion to the *Halletmek* cards. The cards were explained to the participants based on the briefing they were given previously about *Jugaad* and *Halletmek* practices. They were also instructed to pay special attention to the "Actions" mentioned on each probe card and were asked to be mindful of them throughout the exercises. Each card included a picture of a *Jugaad* practice implemented by a native on the streets of Pakistan and Turkey. Figure 4.5 shows one of the probe cards from *Halletmek* that were explained and provided to students as a means to 'probe' them to think along the Action words mentioned on the cards e.g., adapting, re-using, upcycling, decontextualizing. These Action Words proved to be the common points between conventional open design practices and un-conventional ones. Figure 4.6 shows one of the probe cards designed with the Pakistani *Jugaad* practices explained along with the Action words.

Figure 4.5: A probe card based on the template used in *Halletmek*

Figure 4.6: A probe card created (by the researcher) using a local *Jugaad* using *Halletmek* template as inspiration.

4.2.4 Design Alternatives

After their interaction with the upright cleaners and filling the Operational Sequence Chart, the students were asked to fill out a Design Alternative/s Chart. Each group was asked to provide five design alternatives each, and to explain their motivations behind each alternative. Participants had discussions with one another within their groups about what they would like to change in their appliance in terms of convenience, ease of disassembly, or ease of maintenance etc. and then filled out the Design Alternatives Chart as a group. Figure 4.9 shows a filled template of the Design Alternatives Chart filled by the group that was given an upright cleaner to work with. Participants gave alterations to the current structure, keeping the probe cards and action words in mind.

4.2.5 Final Designs

After the exercise with the Design Alternatives Chart, each group was instructed to either pick one of the alternatives or morph a couple of them to provide one final solution. This time they were also instructed to attach each probe card that they took inspiration from with their Final Design sheet and explain in a group presentation how they utilized the probe card to reach their final design.

4.2.6 Physical Library of Products/ Prototyping

A collection of carefully selected found objects were laid out on a table to act as a product library for the participants to utilize while ideating their final designs and while prototyping their final designs (Figure 4.7). The product library was also curated to act as a probe and allow the participants to get inspired by them in whatever way they can. Participants were introduced to the product library during the ideation process and were asked to utilize them while prototyping as well. The intention was for the participants to view the products for their morphology and functionality for ideating with actual discarded products to be used in a final design or ideating on the

principle that a discarded product could probably be found to fit the job, after the design is created.

Participants were asked to create prototypes of their proposed final designs with these found objects and any other assistive material they deem worthy of creating a low-fidelity prototype. Basically, these products were there for participants to browse through as a source of inspiration for new ideas and/ or to search through for implementing an already worked-out idea. This was intentionally done keeping the tendency of the act of *Jugaad* also working on similar lines. Participants were, hence, given the freedom to experiment in whatever of the two ways they wished.

Figure 4.7: A few of the products in the physical library that were provided to the students.

The products for the library were selected keeping the product to be modified (upright cleaner) in mind. Each upright cleaner was understood in terms of its functionality, morphology etc. For instance, parts of it require containment to collect dust, parts of it need to be absorbent surfaces and parts of it also need to be textured to allow

cleaning of other surfaces. Hence, found objects with similar attributes were carefully selected to help probe the students to repurpose, adapt, reutilize, or upgrade them while making their low-fidelity prototypes.

4.2.7 Prototyping

After finalizing their designs, the participants started prototyping them using the physical library of products and other products/ product parts they deemed necessary. They collaborated and the ideation continued during the prototyping phase as well. Participants utilized the probe cards and their personal experience and observation with *Jugaad* while prototyping. The following sections describe all the steps taken by each group, along with documentation on the product that the group chose to work on. The utilized generative tools for each product are also explained in the following sections.

- Group A chose the green mop to work with.
- Group B chose the white stick vacuum cleaner (SVC) to work with.
- Group C chose the grey stick vacuum cleaner (SVC) to work with.

4.3 Summary of Group A Design and Prototype Activities

Group A worked on the green mop (Figure 4.8), which is a manually operated mop with a detachable unit for refilling water.

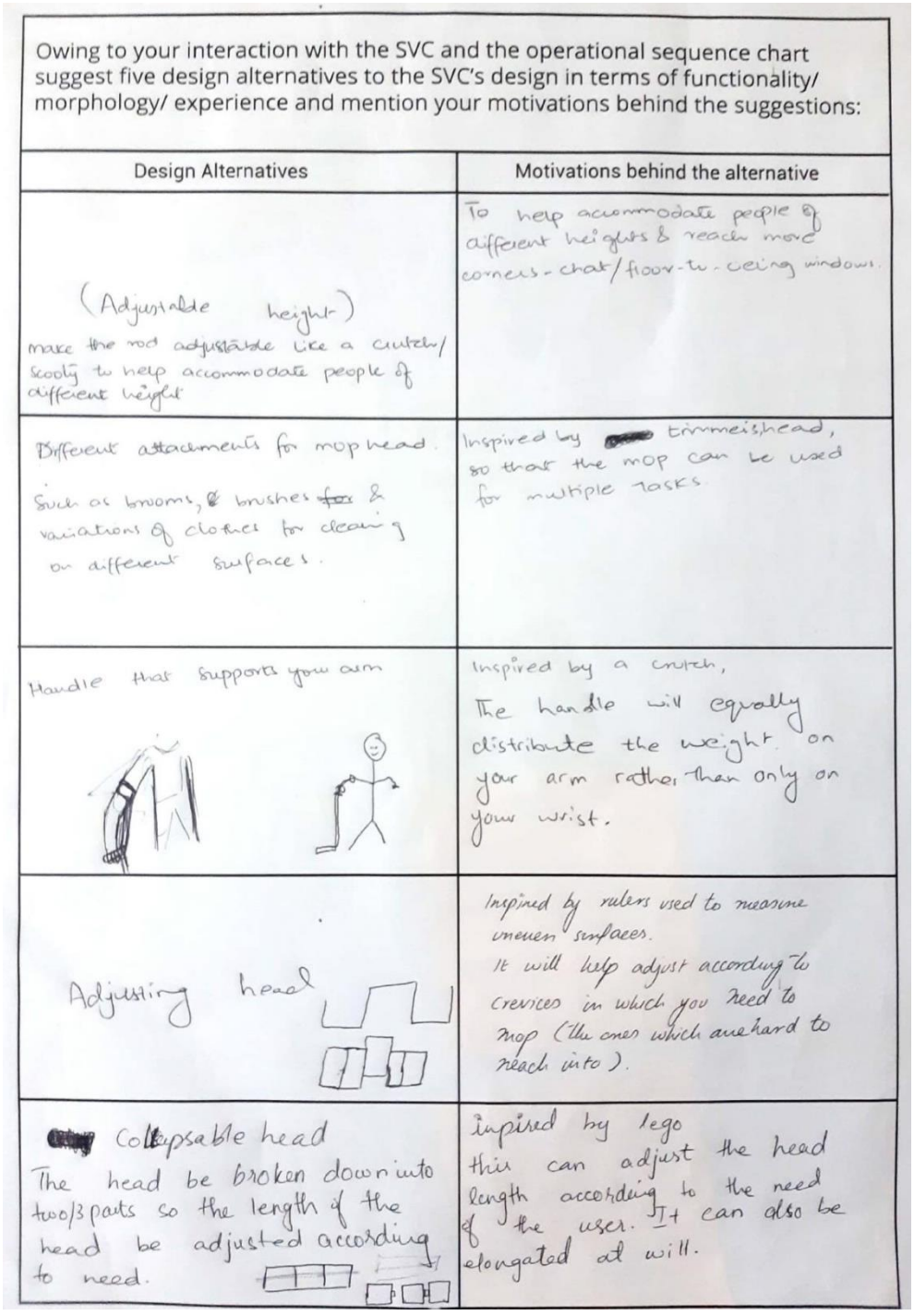
Figure 4.8: Green mop worked on by Group A

4.3.1 Design Alternatives

Participants generated design alternatives and documented them in the left column of the Design Alternatives Chart (Figure 4.9). In the right column, the participants wrote down a statement on their motivations behind each design alternative with respect to their interaction with the upright cleaner and their use of probe cards and action words. The alternatives were proposed after identifying problems in the current design that needed addressing. The first alternative was to propose adjustable lengths to the mop so it would be usable by people of different heights. Secondly, an alternative was to

introduce different attachments for mopheads to increase the surfaces and spaces that the product could be used on and around. The third alternative was identified after a longer, thorough interaction with the mop where participants noted a strain in their arms. They proposed introducing an arm support on the mop that enhances the experience and can allow the mop to be also used on vertical surfaces.

The fourth alternative involved having a mop head that adjusts to the surfaces it is used on. This proposition was inspired by an object that the participants mentioned using in their childhood (a ruler that used to adjust itself on uneven surfaces). This way the mop would be able to reach crevices, nooks, and crannies that it was otherwise unable to reach. Finally, the fifth alternative was inspired by Lego, where the proposed mop head was collapsible based on the surface it is supposed to be working on, or the tool required to do the job. This would help adjust the head length according to the need of the user.



Owing to your interaction with the SVC and the operational sequence chart suggest five design alternatives to the SVC's design in terms of functionality/ morphology/ experience and mention your motivations behind the suggestions:

Design Alternatives	Motivations behind the alternative
(Adjustable height) make the rod adjustable like a crutch/ scooty to help accommodate people of different height	To help accommodate people of different heights & reach more corners - chair/ floor-to-ceiling windows.
Different attachments for mop head. Such as brooms, & brushes ~~for~~ & variations of clothes for cleaning on different surfaces.	Inspired by [redacted] trimmer's head, so that the mop can be used for multiple tasks
Handle that supports your arm 	Inspired by a crutch, The handle will equally distribute the weight on your arm rather than only on your wrist.
Adjusting head 	Inspired by rulers used to measure uneven surfaces. It will help adjust according to crevices in which you need to mop (the ones which are hard to reach into).
[redacted] Collapsable head The head be broken down into two/3 parts so the length of the head be adjusted according to need. 	Inspired by lego this can adjust the head length according to the need of the user. It can also be elongated at will.

Figure 4.9: Design Alternatives Chart completed by Group A

4.3.2 Final Design

In this stage, the participants were asked to utilize the probe cards that were provided to them and propose a final design solution that is prototyped keeping both the probe card content and the product library into consideration. The participants used a Final Design Sheet template, which asked participants to consider the design alternatives that they previously worked on along with the probe cards that some of them already started utilizing during the design alternatives exercise. They were asked to give special attention to the Action words mentioned on the probe card. Figure 4.10 shows the final design sketch of the Group A with the modifications they designed for the green mop, based on the design alternatives (Figure 4.9).

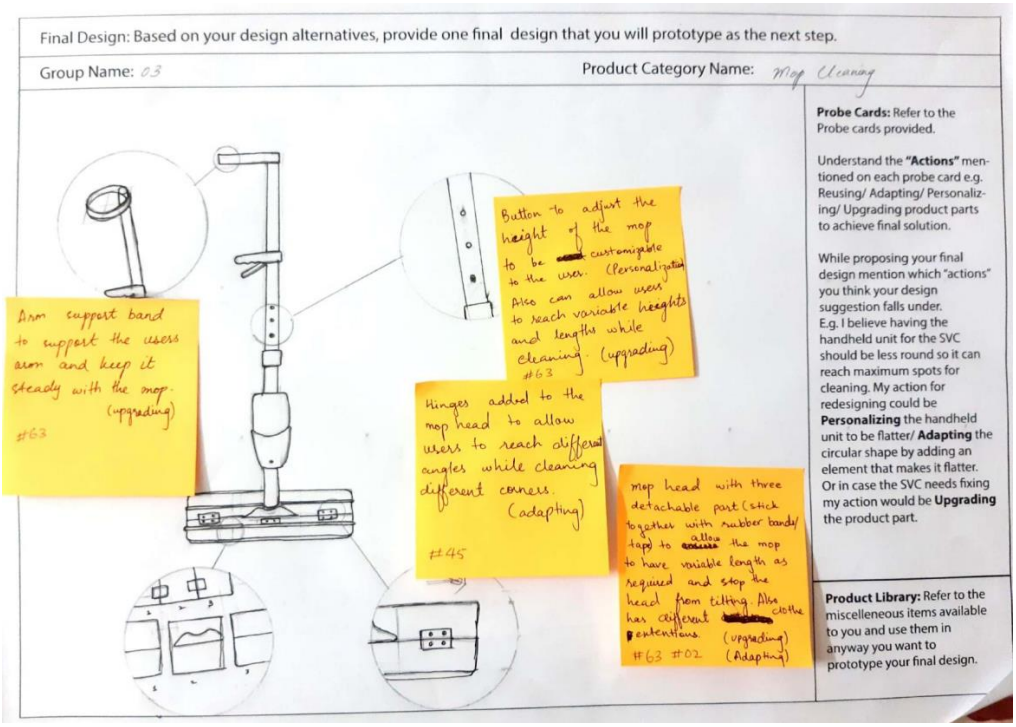


Figure 4.10: Final Design Sheet of Group A (Green Mop)

The probe cards that Group A utilized for their final design was #02, #63, #45, #6 and #4. While presenting their final designs, students mentioned the Action words from the probe cards that they took inspiration from. The respective probe cards the students selected are introduced in the following section.

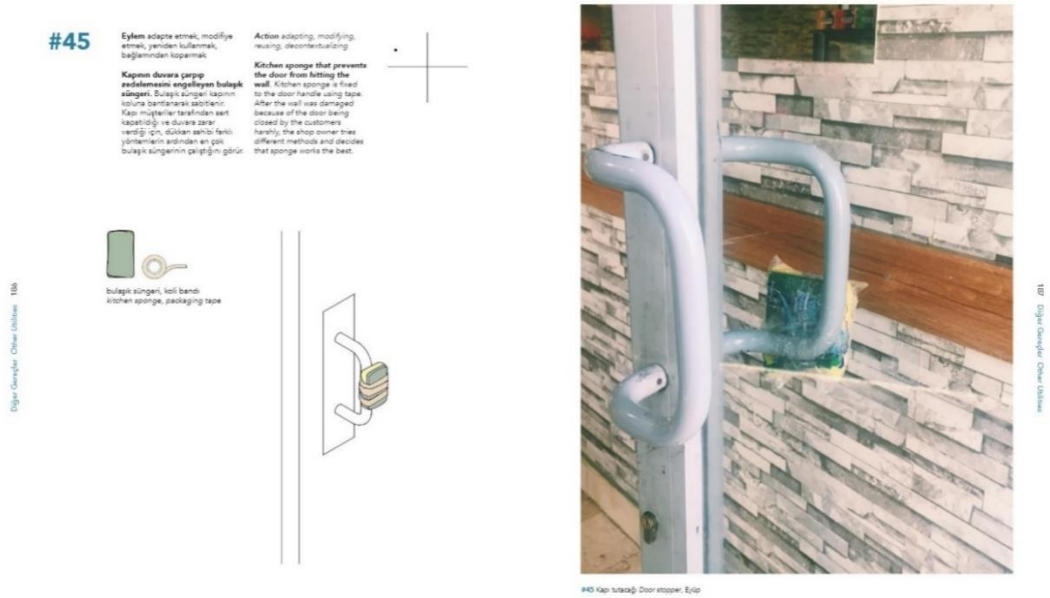


Figure 4.11: Probe Card #45

Students utilized probe card #45 (Figure 4.11) as an inspiration to use different textures and different objects as replacements for the mop-head, to reach different angles and different corners during use. The idea was to adapt found objects at home like the sponge shown in this probe card, offering different textures and surfaces, and serving different functionalities based on its structure. The action words associated with this probe card were: adapting, repurposing.

Using probe card #63 (Figure 4.12) and probe card #6, both (Figure 4.14), students were inspired to consider upcycling and reutilization of existing products based on the product morphology. The participants used it while proposing the idea of repurposed crutches as replacements for the mop's handle and reusing discarded plastic bottles in place of the water containing unit of the mop, in case of damage to the original component. The action words associated with this probe card were upcycling, repurposing, building.

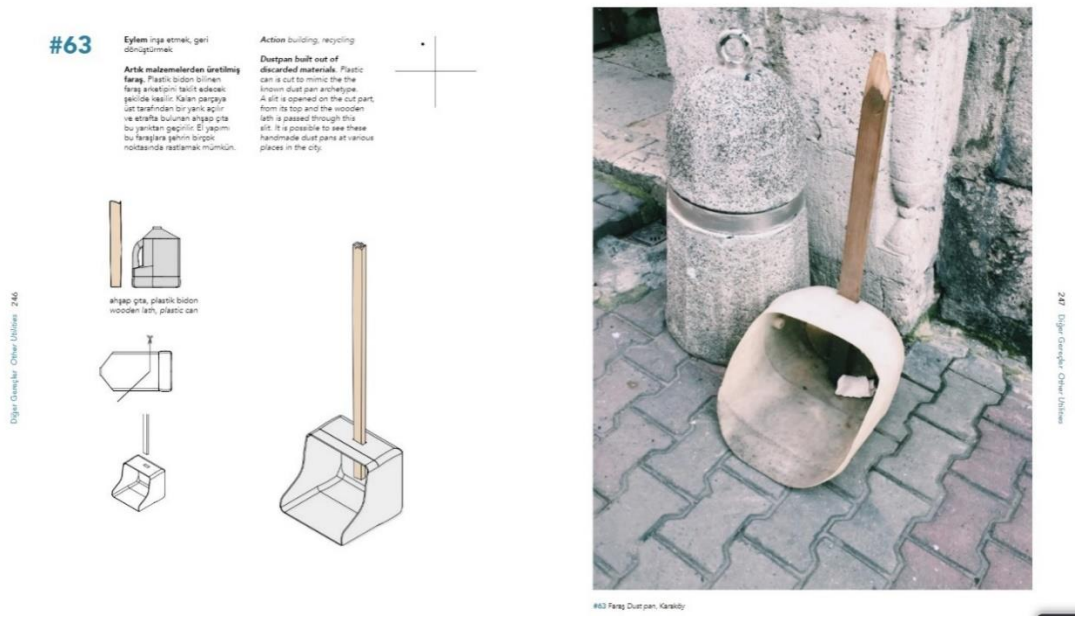


Figure 4.12: Probe Card #63

Probe Card #02 inspired the participants towards creating an arm support by repurposing a crutch and therefore upgrading the mop (Figure 4.13). Students took inspiration from the steady support that had been created with the help of duct tape and conceived the idea of a similar upgrade that could make the structure of the mop steadier, provide support to the arm, and provide enhanced maneuverability if using the product for extended periods of time.

The example shown in Probe Card #4 was mentioned by the participants as a reminder for the act of personalization that Jugaad offers. Group A students mentioned using this probe card while proposing the adjustable length feature in the mop, so it suits the need of every user according to their body structure, which was initially lacking from the original design. The associated action words were: personalizing, upgrading.

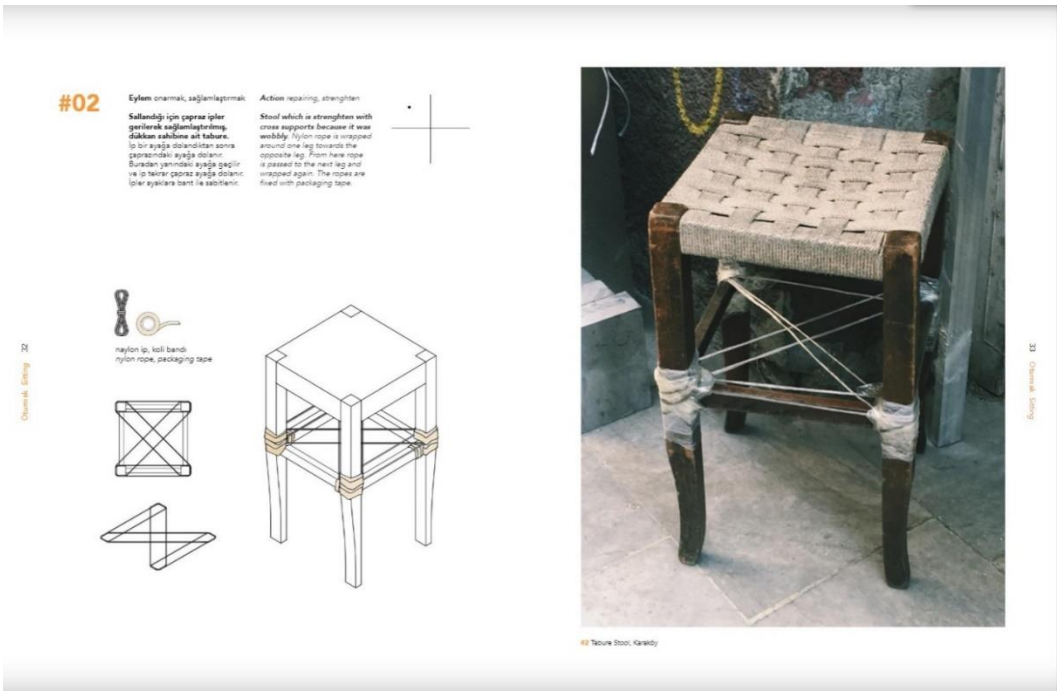


Figure 4.13: Probe Card #02

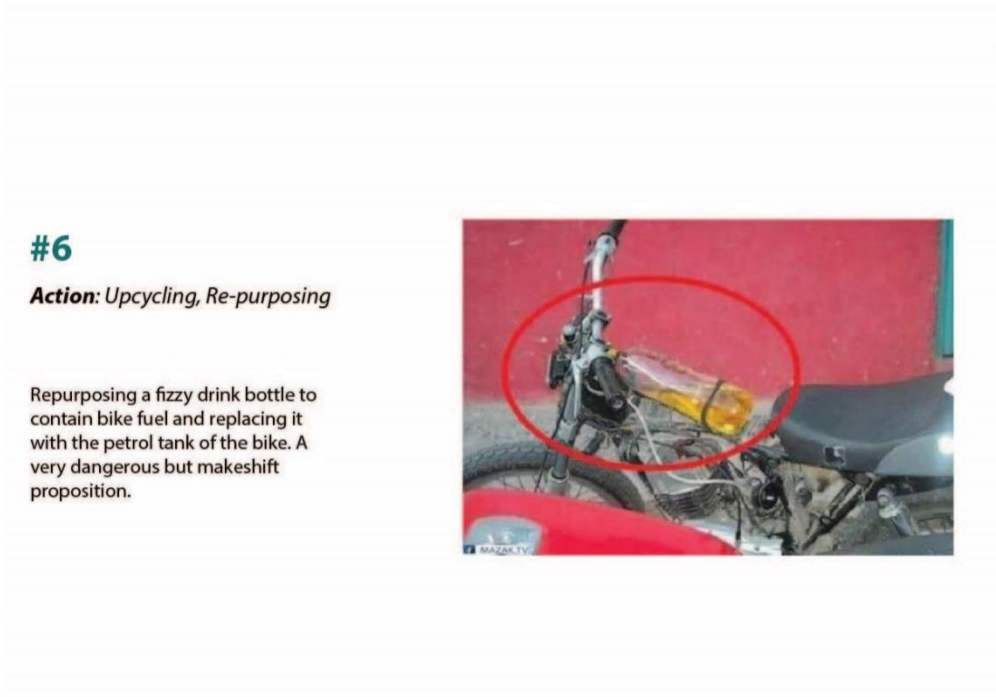


Figure 4.14: Probe Card #6

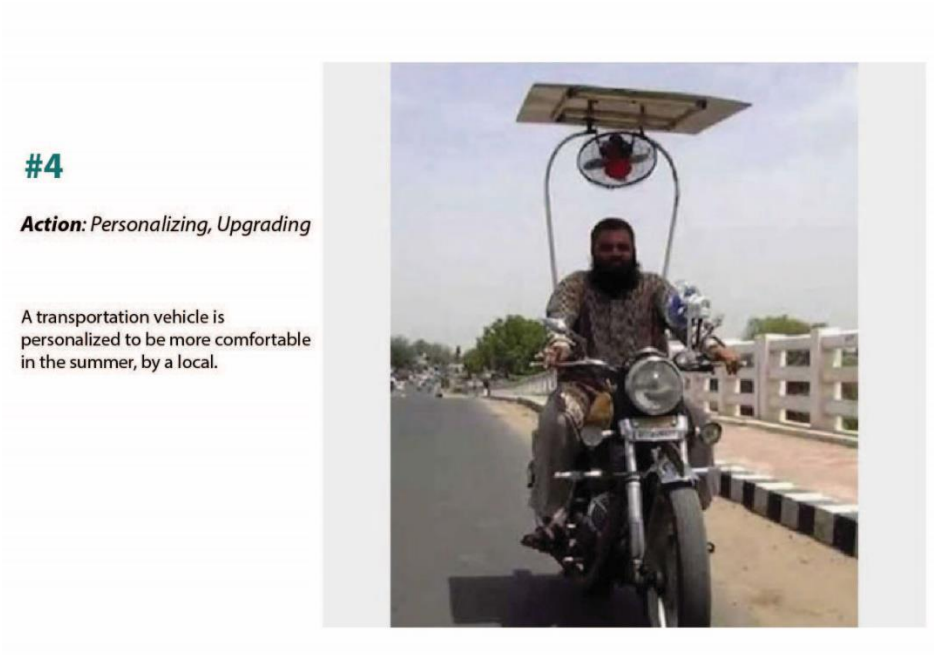


Figure 4.15: Probe Card #4

4.3.3 Prototyping by Group A

Figure 4.16 shows the original green mop and the prototype created by Group A at the end of the first phase of the workshop. The materials used to put this prototype together were taken from the physical library of products (Figure 4.7) available to the participants during the workshop. The products used were crutch stick, a vodka shaker/ container, fabric with an absorbent texture, pipe joints, and spare plastic handle.

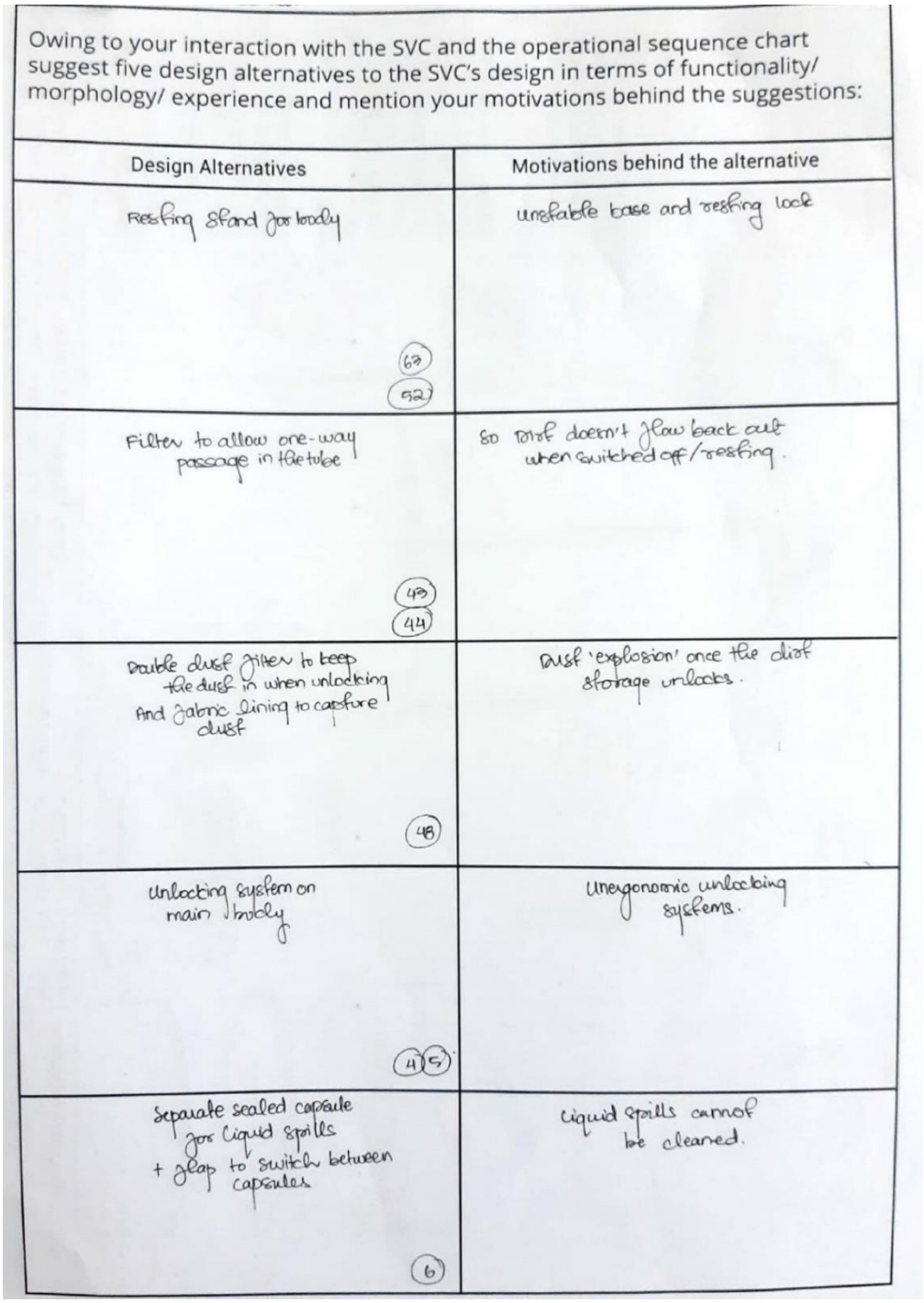
Figure 4.16: Group A prototype (left) and original product (right) at end of first phase of workshop

4.4 Summary of Group B Design and Prototype Activities

Figure 4.17: Upright Stick Vacuum Cleaner worked on by Group B

4.4.1 Design Alternatives

After interaction with and working on the Operational Sequence Chart for the white SVC the students proposed the design alternatives shown in the image below. Students also mentioned the number of each probe card that inspired them to suggest a certain alternative.



Owing to your interaction with the SVC and the operational sequence chart suggest five design alternatives to the SVC's design in terms of functionality/ morphology/ experience and mention your motivations behind the suggestions:

Design Alternatives	Motivations behind the alternative
Resting stand for body (63) (52)	unstable base and resting lock
Filter to allow one-way passage in the tube (43) (44)	so dust doesn't flow back out when switched off/resting.
Double dust filter to keep the dust in when unlocking And fabric lining to capture dust (48)	Dust 'explosion' once the dust storage unlocks.
Unlocking system on main body (4) (5)	Unergonomic unlocking systems.
Separate sealed capsule for liquid spills + flap to switch between capsules (6)	Liquid spills cannot be cleaned.

Figure 4.18: Design Alternatives by Group B

Similar to the previous group, participants listed down the design alternatives they would want to propose in the SVC based on their interaction with it.

- The first alternative was centered on the fact that the SVC has an unstable base and tends to topple over considering a higher center of gravity. The handheld unit on the top keeps wobbling and the lock in the base to keep it into place is unstable.
- Second alternative was based on an interaction where each time after vacuuming, the participants put the cleaner back in its standing position, the dust/ dirt would flow back down through the vertical pipe and come out from the bottom. Participants proposed a filter to allow one-way passage of the dust only to tackle this problem.
- Third alternative involved proposing a double-dust filter to keep the dust inside while unlatching the dust collector and having a fabric lining to absorb it to avoid the "dust explosion" that was currently happening while unlocking it.
- Fourth alternative was proposed to address the issue of un-ergonomic unlocking systems. The red buttons to detach the units apart were very stiff and would cause immense amounts of effort to open.
- The final alternative was to add a functionality in the SVC where it is also able to collect liquid spills/ waste. For this, participants proposed separate sealed capsules and flaps to switch between the capsules.

4.4.2 Final Design

Students proposed a final design based on the probe cards and product library keeping the action words in mind.

The probe cards utilized in the final design were #63, #43, #44, #48, #4, #5, #6.

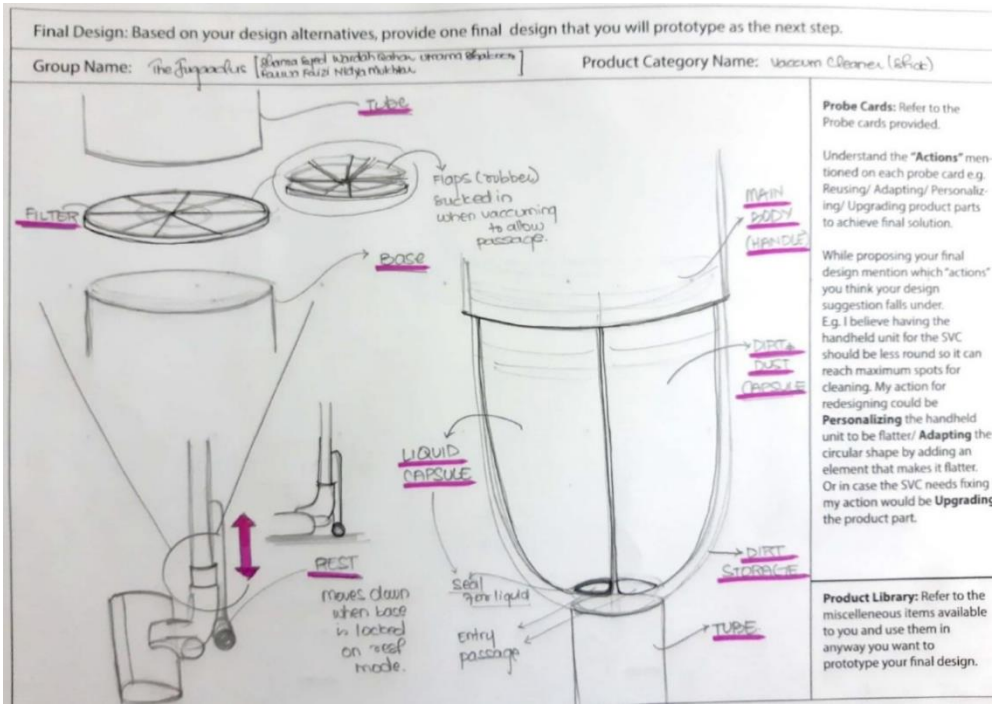


Figure 4.19: Final Design Sheet by Group B (White SVC)

Participants mentioned similar structure of the form in this probe card #63 (Figure 4.20) and the how it made them think of ideas to provide a broader base to the SVC like the one shown in the image above. Secondly, the joinery of the wooden stick with the PVC bottle led them to propose a similar joinery that apart from acting as a joint, also enhances stability. In their final design proposition participants re-utilized a T-shaped pipe joint that could be moved up and down shifting between mobile and dormant positions of the SVC (Refer to Figure 4.22).

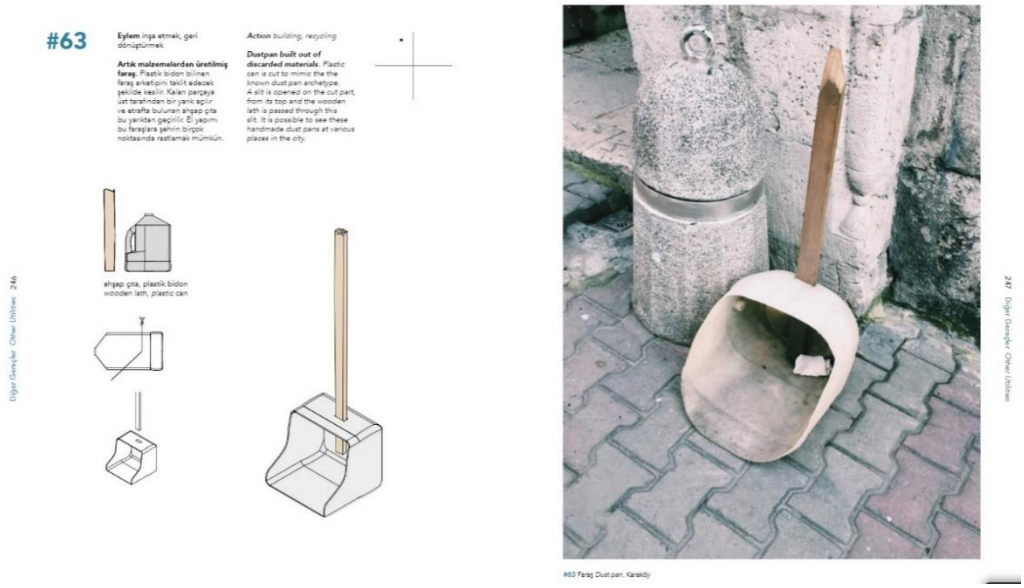


Figure 4.20: Probe card # 63, Actions: Building, Recycling

Probe card #43 (Figure 2.1) was used as an inspiration for decontextualizing an object and re-using/ re-purposing it for performing a different function. Participants re-utilized a hand blender unit (Refer to Figure 4.22) in the prototype they created and divided the blender unit into two sub-units. One was utilized to collect dirt in it and the other to collect liquid spills.

Another feature that was addressed through this blender unit was also the rotation that it offers. The push-open function of the dust collector caused many spills, so it was proposed that the opening motion of the hand blender unit be utilized for that.

Action words: Adapting, re-using, decontextualizing

Figure 4.21: Probe Card # 43, Action words: adapting, re-using, upcycling

4.4.3 Prototyping by Group B

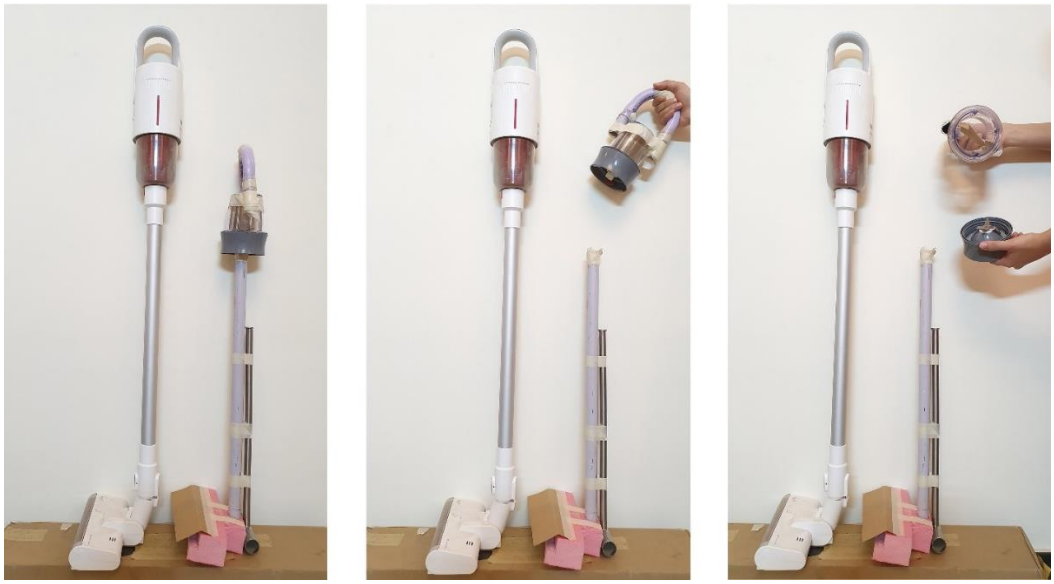


Figure 4.22: Prototype by Group B

Figure 4.22: The original product provided to the students of Group B (left) and the prototype they created at the end of the first phase of the workshop (right).
The materials used to put this prototype together were taken from the physical library of products (See Fig. 4.7) available to the participants during the workshop.
Products Used: Students used a hand blender unit proposing ease of maneuverability thanks to the pivotal movement the blender joint offers. They also utilized a pipe joint (silver pipe) for ensuring a free-standing structure. Pipe joints, SVC handles.

4.5 Summary of Group C Design and Prototype Activities

Figure 4.23: Upright Stick Vacuum Cleaner worked on by Group C

4.5.1 Design Alternatives

After interaction with and working on the Operational Sequence Chart for the white SVC the students proposed the design alternatives shown in the image below. Students also mentioned the number of each probe card that inspired them to suggest a certain alternative.

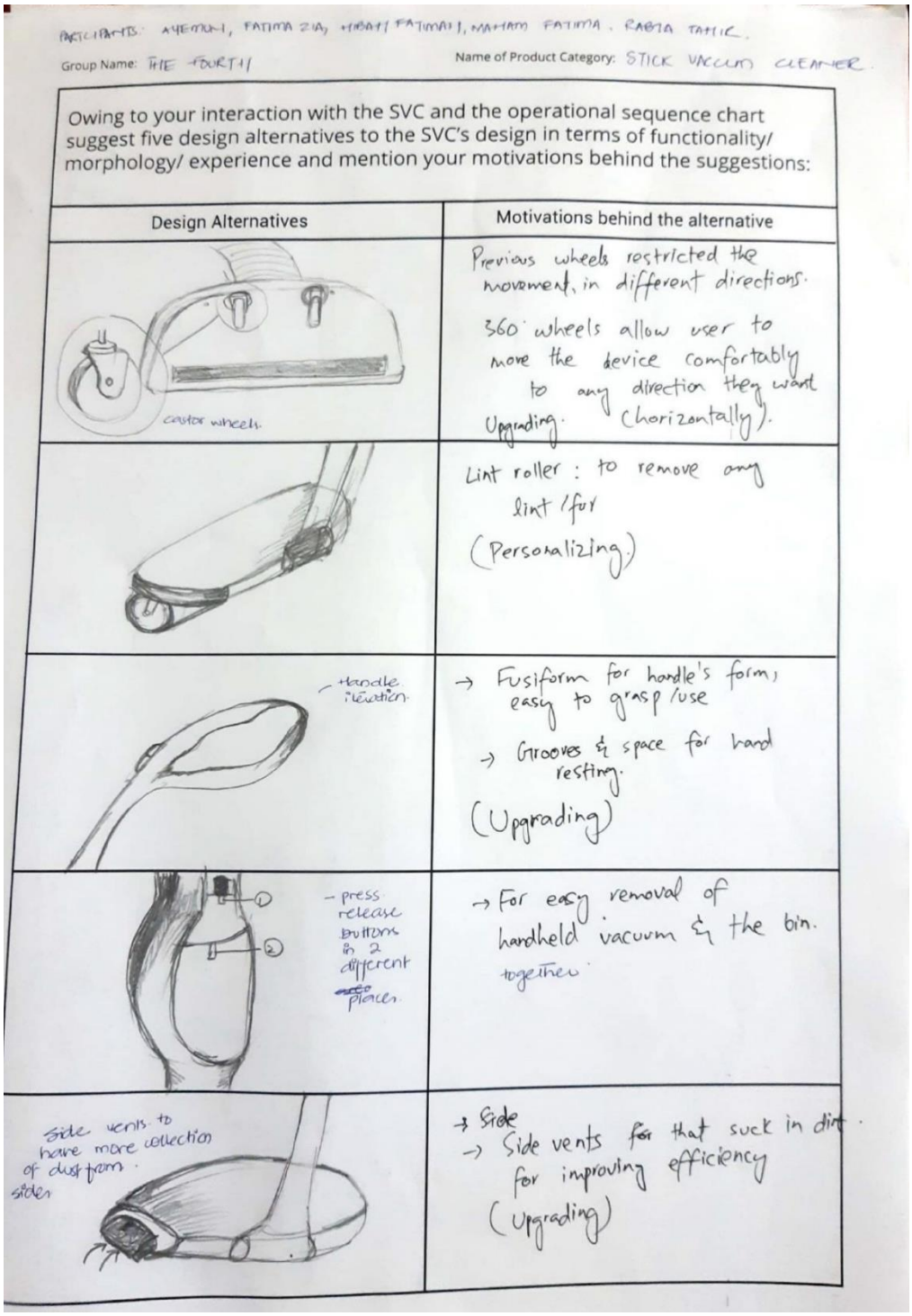


Figure 4.24: Design Alternatives by Group C

Participants noted down the design alternatives and mentioned their motivations behind suggesting said design alternatives.

- The first design alternative is mostly an upgrade. It is based on the identified problem that the wheels underneath the cleaner only allow one sided motion. Students proposed an upgrade that offers 360-degree rotation.
- The second design alternative is a personalization where students proposed using lint rollers since its more useful on carpets and collecting hair, which is the most painstaking process in Pakistani households.
- Another upgrade was a more ergonomic handle.
- The fourth iteration was about having two touchpoints to remove the handle held unit from the entire standing unit and the final iteration involved adding side vents on the base to increase the surface area of dust collection and require minimal movement of the entire unit overall.

4.5.2 Final Design

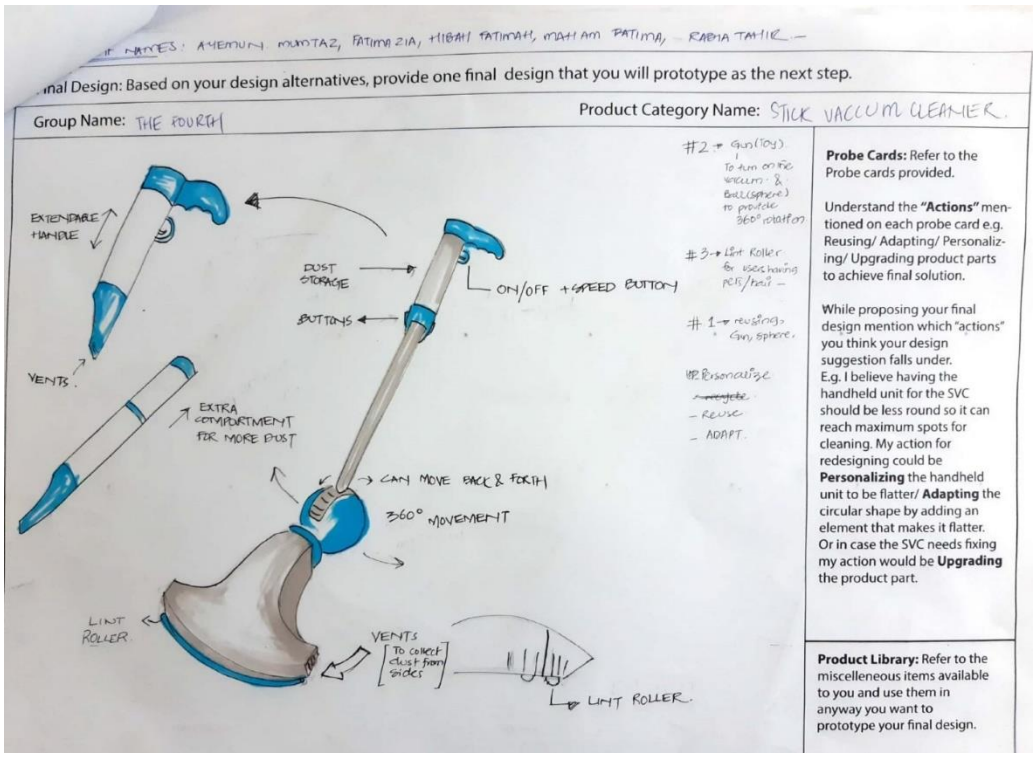


Figure 4.25: Final design sheet by Group C

The probe cards they used for prototyping were #2, #4, #1

Probe #2 was used while prototyping the proposed design. Participants picked out a water gun from the product library and adapted/ reutilized it as the handle of the vacuum unit. (Refer to the prototype section below). Participants mentioned that the modularity and the extendable structure of the water gun deemed fit for making a more ergonomic handle.

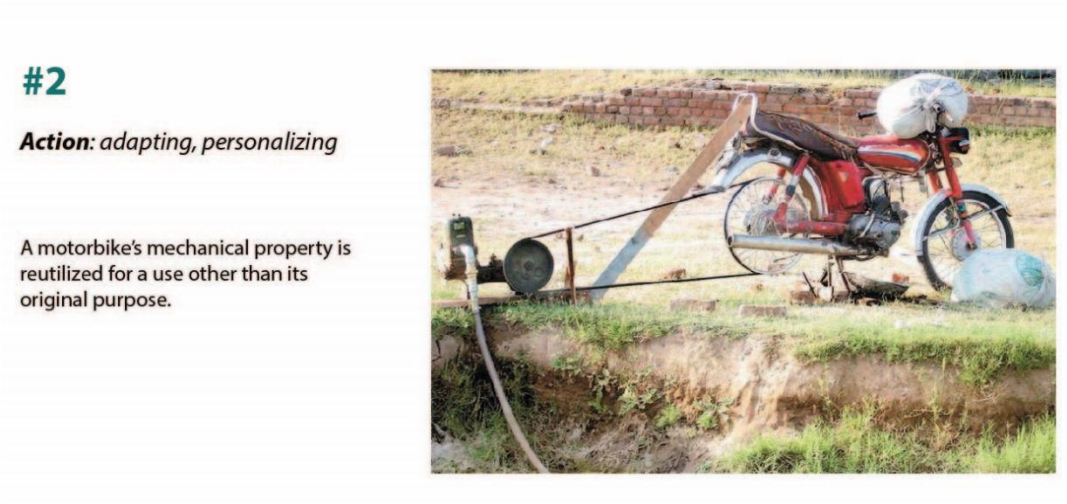


Figure 4.26: Probe # 2, Action words: Adapting, personalizing

Probe #4 was utilized while referring to the personalization aspect of it. Students introduced lint rollers as part of the vacuum unit for people who own pets at home. This personalization feature was inspired by the probe card shown above.

Figure 4.27: Probe # 4, Action words: Personalizing, upgrading

Participants incorporated a ball in the joinery of the vacuum cleaner to ensure better maneuverability and they mentioned the probe card #1 for the re-using, adapting, and decontextualizing element that design alternative offers.

Figure 4.28: Probe #1, Action words: Adapting, Re-using

4.5.3 Prototyping by Group C

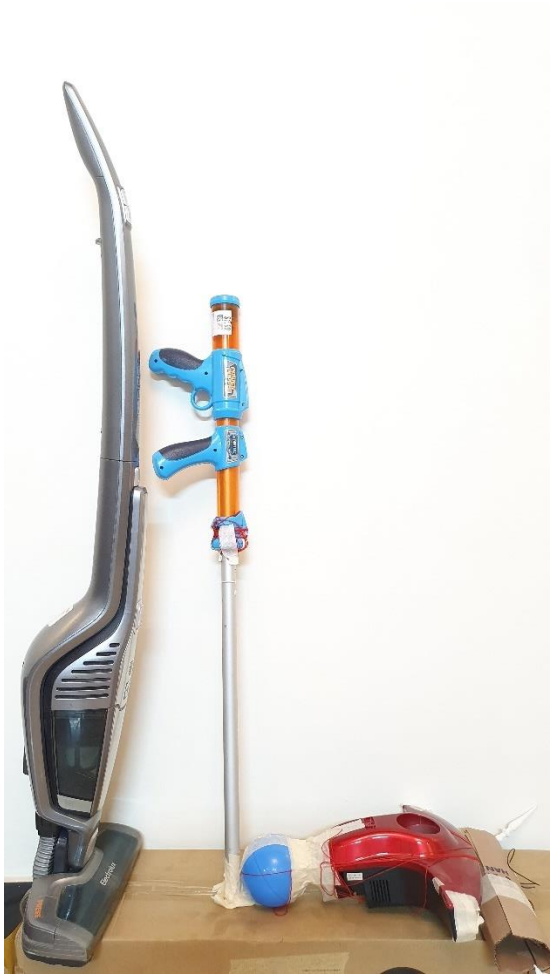


Figure 4.29: Prototyping by Group C

Figure 4.29: The original product provided to the participants of Group 1 (left) and the prototype they created at the end of the first phase of the workshop (right).

The materials used to put this prototype together were taken from the physical library of products (See Fig. 4.7) available to the participants during the workshop.
Products Used: Participants used a water gun to represent a handheld unit similar to the structure of said water gun. A ball was used as a joint to control the maneuvering and offer as much free movement without having to lift the unit possible.

4.6 Group Presentations

Each group presented their final designs with explanation of the entire process to the other two groups. Participants explained their interaction with the upright cleaner, the problems they encountered upon usage, the iterations they came up with, and the probe cards they used that helped them propose the final solutions and the resulting prototypes. This was an interactive session where all participants commented on each other's approaches and asked questions to understand the design process. The group presentations were significant in terms of bringing everyone on the same page which was important for the next phase.

4.7 Iterations

The third and final phase of the workshop involved each group passing on their final design sheet and prototype to the next group, who was given the task to propose an iteration to the original design (Table 1). Design iterations were an attempt at recreating how Open Design or Jugaad is usually implemented. Since the beginning, each group of participants was asked to provide an alteration in terms of a reuse, an upgrade, or an extension to product longevity. However, in this exercise groups were asked to further iterate on the original alteration. This activity also acted as a controlled simulation of the design-after-design approach that is seen to happen in Open Design contexts.

At the end of this exercise, students presented their iterations on each other's designs, which led to a discourse about the difference in approaches and a discussion on the feasibility of improvements. This part of the workshop was instrumental in terms of understanding the changing autonomy over each design and the advantages and disadvantages of design-after-design.

Table 2 illustrates how each group iterated once on the prototype that another group created. This resulted in two iterations per prototype. In the following sections the iterations done on each group by another group are presented.

	Iteration (Group A)	Iteration (Group B)	Iteration (Group C)
Group A Prototype	Not applicable	A→B	A→C
Group B Prototype	B→A	Not applicable	B→C
Group C Prototype	C→A	C→B	Not applicable

Table 2: Design iterations carried out by group of Workshop 1

4.7.1 Group A Prototype Iterations

Groups C (Figure 4.23) and B (Figure 4.17) made iterations on Group A's original design improvements for the green mop. For the length adjustment feature already introduced by the original group, Group C proposed adding a spring inside the joint where the length of the mop can be adjusted. This spring could extend the structure and bend inwards to make the crutch more ergonomic. One of the participants of this group commented that they wouldn't have thought of having an arm support feature had the original group not pointed this problem out. However, the crutch holds the arm in one place and adding a spring to make the joint moveable along with the arm's elbow joint was considered by Group C as a more efficient solution. Another enhancement by Group C was adding water nozzle inlets that seep directly into the mop and ensure a homogenous distribution of water around the surface. Group B simply added another functionality that was already proposed by the original group. i.e., to add the arm support for both arms.

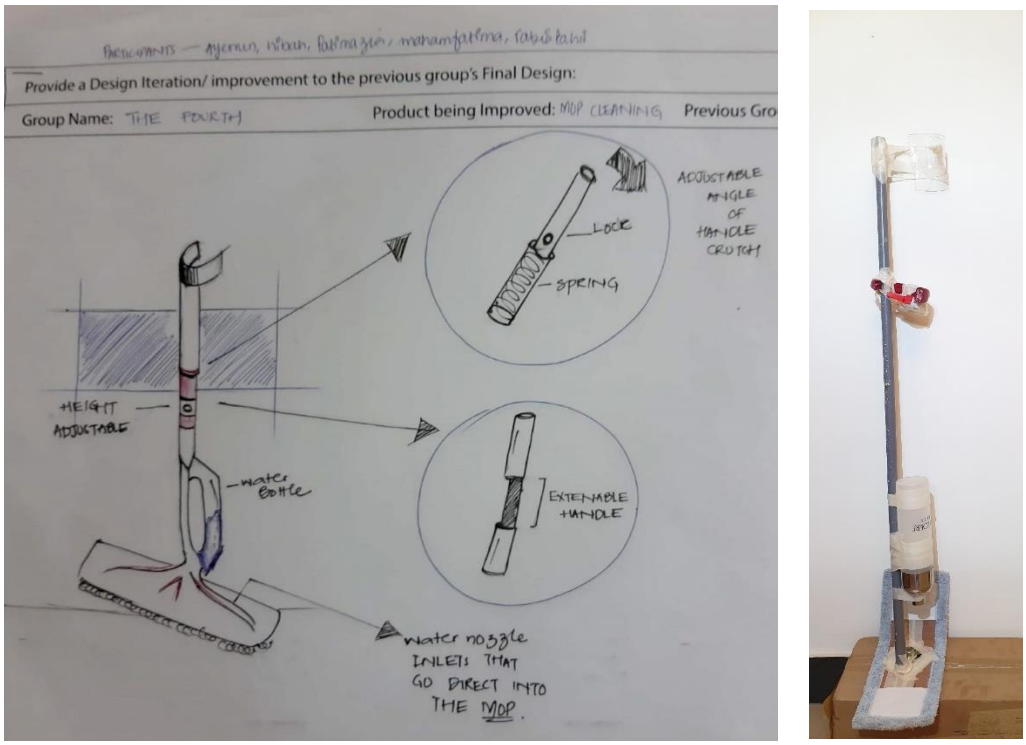


Figure 4.30: Iteration by Group C on the Group A prototype (right)

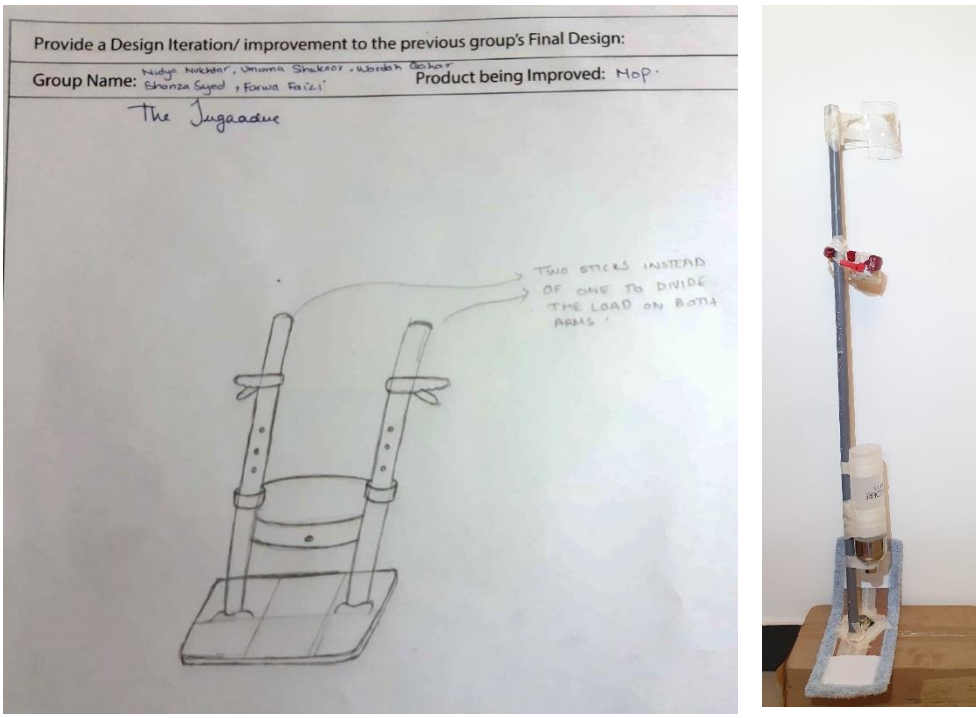


Figure 4.31: Iteration by Group B on the Group A prototype (right)

4.7.2 Group B Prototype Iterations

Groups A (Figure 4.8) and C (Figure 4.23) made iterations on Group B's original design improvements for the white stick vacuum cleaner (SVC). Group A provided an alteration to the original proposition where participants proposed water spills to also be cleaned by the vacuum cleaner. This group eliminated partitioning (for dust and liquids) from the dust collector because of the possibility of them mixing and turning into mud and simply added an accessory with a fabric lining in the mop-head to absorb liquids. Group C addressed the concern of length adjustability that they faced interacting with the prototype. They changed the shape of the handle and made the dust compartment rotatable. They also added a 360-degree rotation flapper in the design.

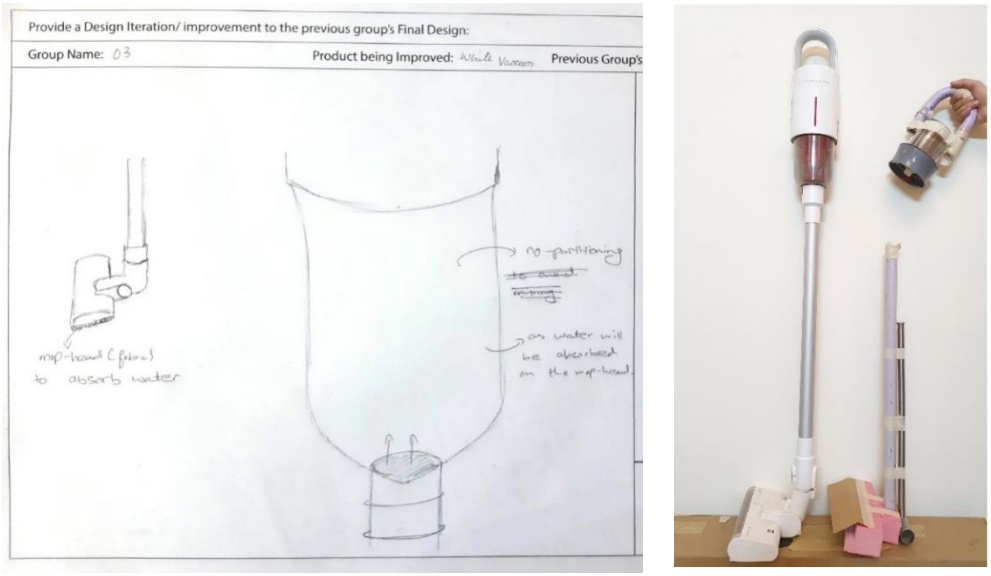


Figure 4.32: Iteration by Group A on the Group B prototype (right)

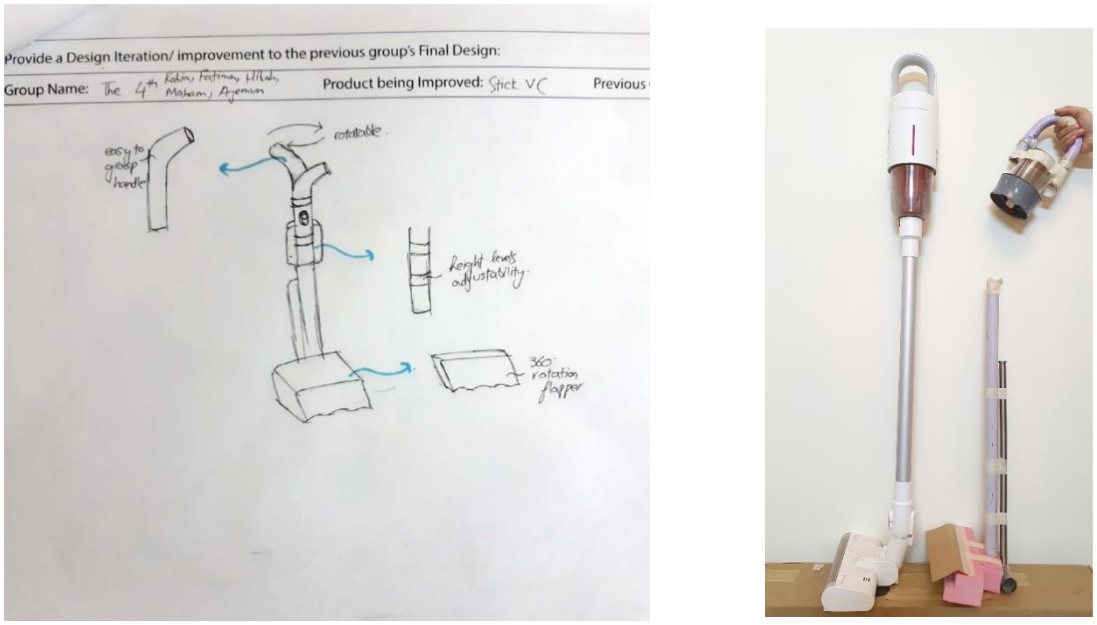


Figure 4.33: Iteration by Group C on the Group B prototype (right)

4.7.3 Group C Prototype Iterations

Groups A and B made iterations on Group C's original design improvements for the grey stick vacuum cleaner (SVC). Group B proposed having a less bulky base than the original group (Group C) proposed. They also proposed combing the head with the lint roller. Group A removed the lint roller from the design proposition altogether since based on their personal experience lint rollers were not considered that effective in collecting hair and they have a short life span. Also, they considered that the collected hair would travel up the pipe and could clog it from inside. Group A instead proposed for the "ball" to act as a dust collecting unit as well as an object for enhancing maneuverability, keeping the rest of the functionality the same as the originally proposed design.

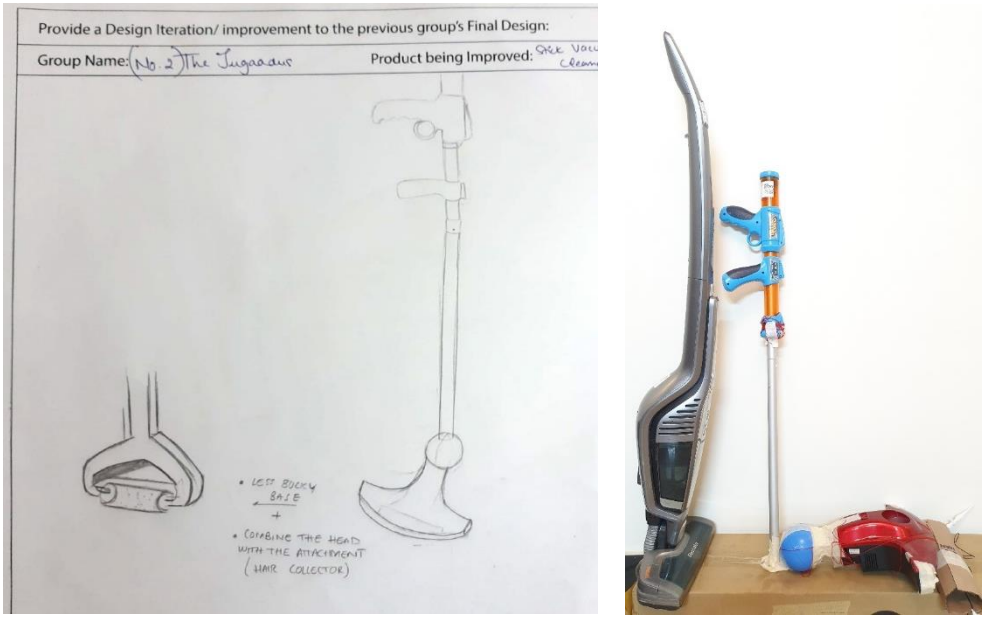


Figure 4.34: Iteration by Group B on the Group C prototype (right)

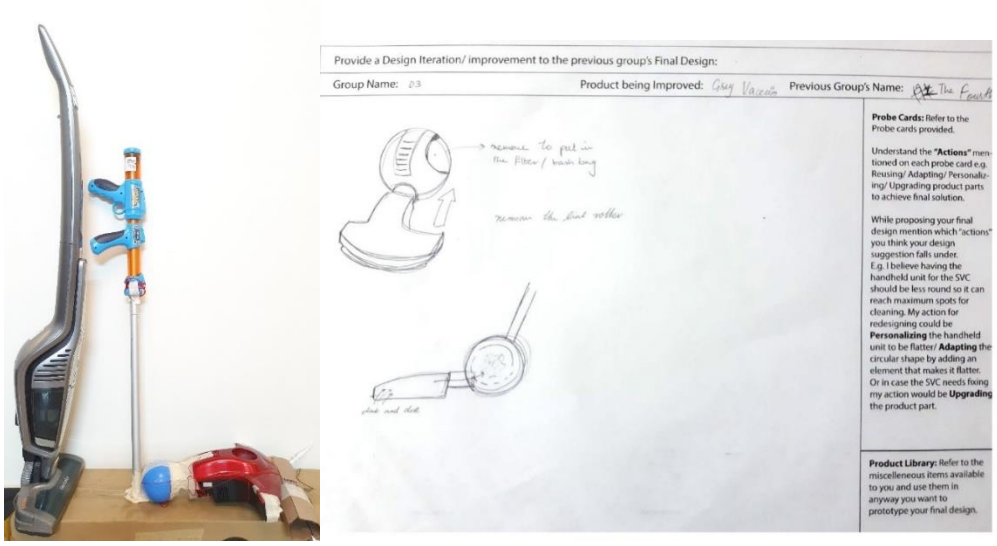


Figure 4.35: Iteration by Group A on the Group C prototype (left)

4.8 Stage 2: Design Workshop 1 & 2 - Chicken Coop Exercise (Not used for analysis)

A second stage of this workshop was also conducted where participants were introduced to a different product to carry out similar (to the first phase) activities with. The selected product i.e., chicken coop, was a transportation vehicle that is very contextual to Pakistan and is very *Jugaad*-prone. The intention to choose this product has also been mentioned in detail in Chapter 3: Methodology (Section 3.5).

This exercise was intended to investigate a reversal of the previous stage where participants attempted at applying Open Design principles on a *Jugaad*-prone product. A chicken coop van was brought into the vicinity where participants got to interact with it and did an analysis of the current structure based on which they would provide design alternatives. They also asked questions from the chicken coop operator to understand the concerns better. Among other reasons, this product was chosen for its simple yet modular shape and an affordance for improvement.

Figure 4.36 below shows participant interaction with the chicken coop.

Participants were given a template with information about a standard chicken coop used for transporting chickens (See Figure 4.37). Every group came up with 5 design alternatives (See Figure 4.38) each and presented a final design (See figure 4.39) along with the prototype (See figure 4.41): like the first stage of the workshop.

Each group iterated on the other groups' final designs (See Figure 4.40) and some very interesting outcomes were generated. This exercise was conducted in the second workshop as well. Although, some very interesting insights were generated, this stage of the workshop was not analyzed as part of the thesis since it fell beyond the scope. However, the findings have been recorded and shelved for now to be analyzed later. This section has not been repeated in Chapter 5, however, it was conducted in a similar manner in that session as well.

Figure 4.36: Participants observe the Chicken Coop Van Operator explaining the interaction (in SADA parking lot)

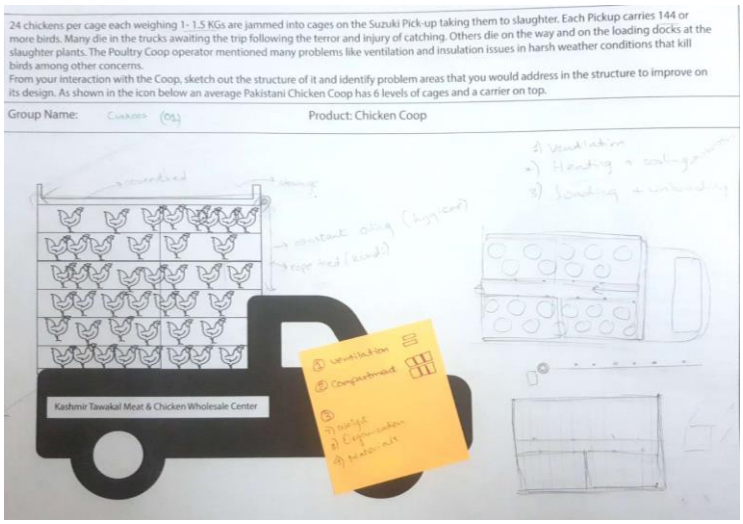


Figure 4.37: The template provided to participants with information about a standard chicken coop

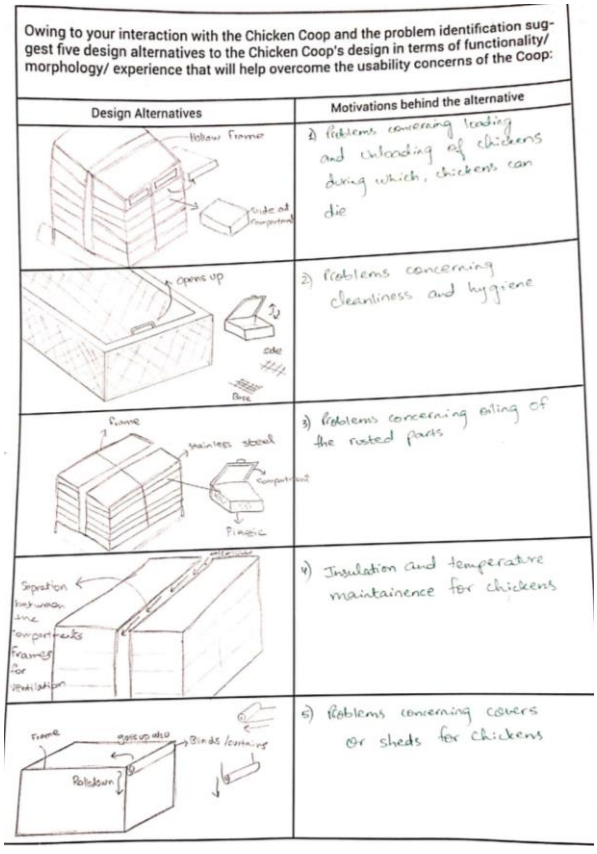


Figure 4.38: Design Alternative sheet by one of the groups

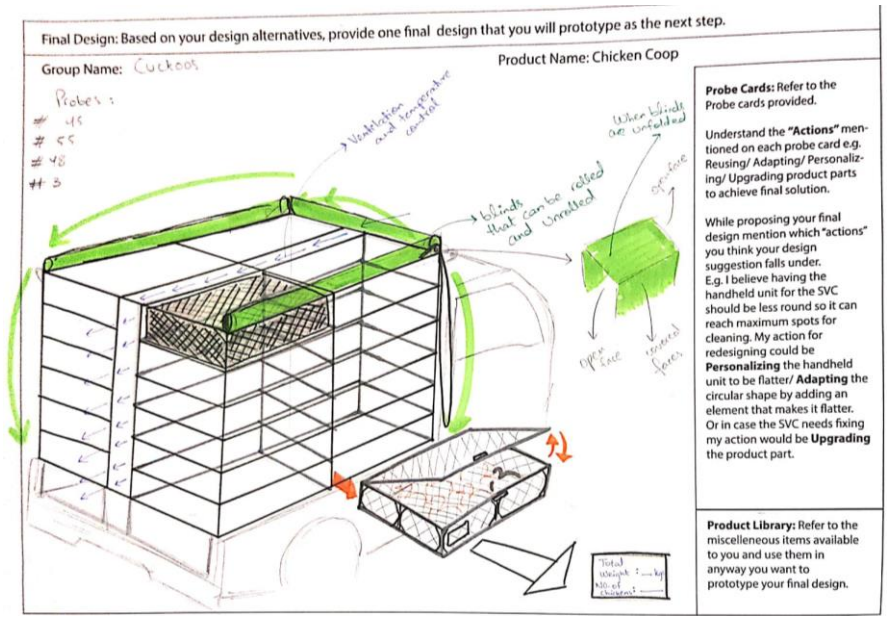


Figure 4.39: Final Design Sheet by one of the groups

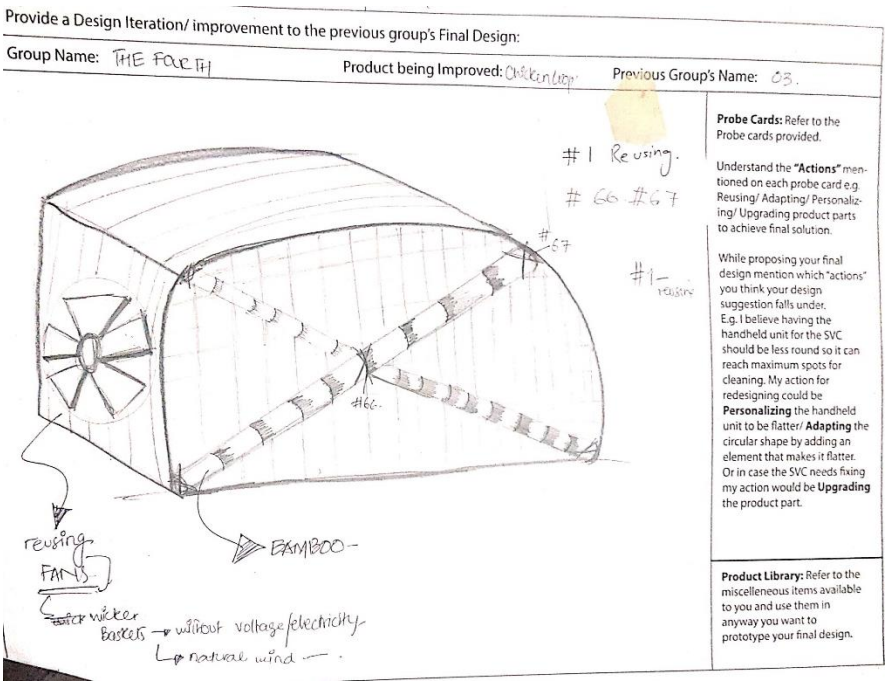


Figure 4.40: Design Iteration Sheet by one of the groups

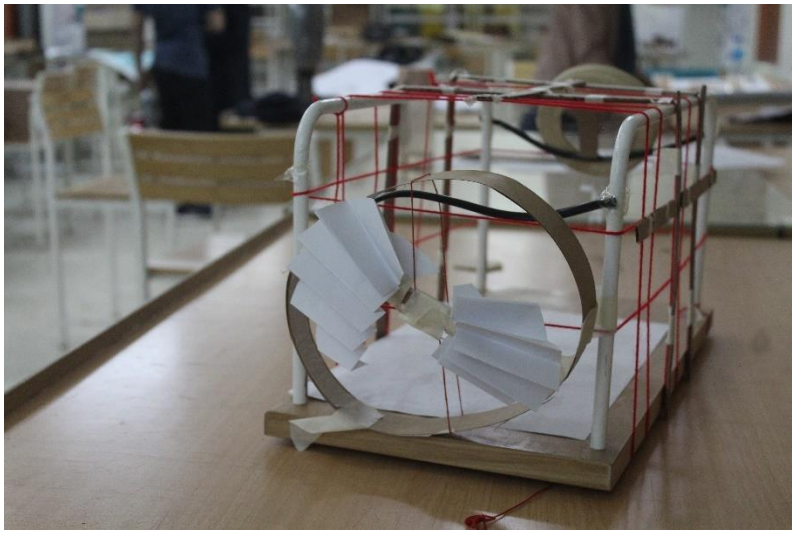


Figure 4.41: Prototype of the finalized design by one of the groups

4.9 Personal Reflections

The workshop was an eye-opener in many ways. A lot of planning went into designing the structure of it and I went into the workshop space with many preconceptions on how it should (but might not) work out. The results were, however, refreshingly surprising. The way participants responded to the workshop plan and the generative tools was in great alignment with what I hoped it to be.

During the discussion sessions, participants reported on the exceptional experience they considered the workshop to have brought them, enabling them to see products in a different light. This was nicely summarized by one of the participants at the end of the workshop:

> "After looking at the objects (Product Library), whatever ideas we had in the beginning, they added to it. I thought about how I could adapt it to the product that I already have. This (a product from product library) specific thing has a property that the product I am working with already had or something that

could enhance it in some way. So, even though it was restricted I think there is more creativity that came out of this entire process" (P13)

Another participant quoted an example of one of the product parts they utilized from the Product Library and a probe card that nudged them into thinking in a certain way. This validated my intention to use the Product Library as an opportunity instead of a limitation. This made participants act in a way similar to a person on the street would act deploying Jugaad: using whatever they have in front of them as opportunities instead of limitations.

Participants also talked about their control over a design process and how iterating on each other's designs made them feel less "threatened" by each other. They also mentioned how their designs got improved when somebody else iterated on it. One participant who iterated on a design after a first proposition by another group mentioned how the problem the first group identified alerted them to the presence of such a "problem". They said they would never have been able to identify and address that problem had it not been for the first iteration.

There were many other similar findings because of carrying out the workshop - and of course negative remarks showing areas for improvement and rethinking - that will be covered in detail in the section of the thesis reporting on the workshop Debriefing Session (see Chapter 6: Section 6.2).

CHAPTER 5

WORKSHOP 2

5.1 Introduction

A second workshop was conducted with another set of nine students from the final year Industrial Design batch at the School of Art, Design and Architecture (SADA, NUST), Islamabad, Pakistan.

Figure 5.1 The same poster as Workshop 1 utilized for Workshop 2

Considering the positive execution and outcome of the first workshop, the structure of the second one was kept similar. Some minor changes like time duration of certain activities were altered based on the response time of the previous group.

Based on the total number of participants in the second workshop (9), only two products (Green Mop & Grey SVC) were utilized for the generative exercises.

Participants were divided into two groups of three and four people respectively.

Since the structure of the workshop and description of generative exercises is already covered in the previous chapter (See Chapter 4), the sections to follow directly explain the activities and outcomes.

5.2 Summary of Group D Design and Prototype Activities

Figure 5.1: Green mop worked on by Group D

5.2.1 Design Alternatives

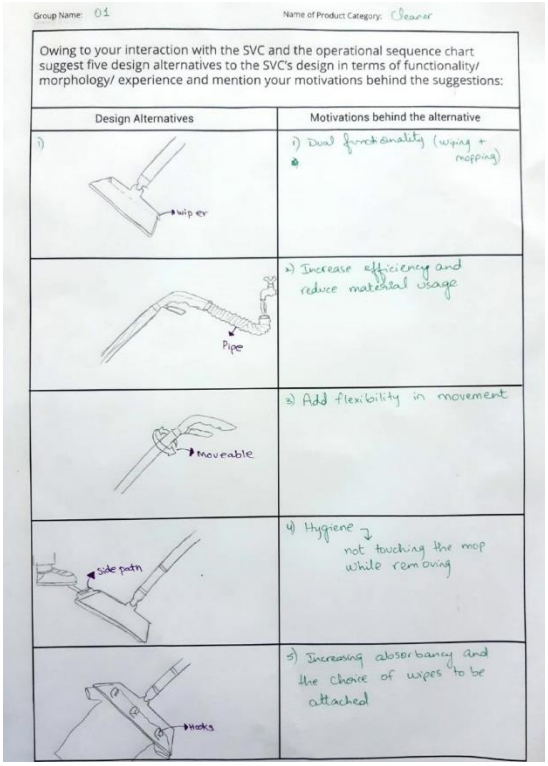


Figure 5.2**:** Design Alternatives Chart completed by Group D

Participants listed down the alternatives and the motivations behind each proposition with respect to their interaction with the upright cleaner and while keeping the probe cards and action words in mind.

The alternatives were proposed after identifying problems in the current design that need addressing.

- First alternative they proposed was to introduce dual functionality in the mop. (wiping & moping)
- Second one was to incorporate a collapsible/ extendable pipe to fill in water with. Participants suggested removing the water containing bottle out of the design and utilizing the pipe vessel as the water containing vessel as well.
- Thirdly, they proposed flexibility in movement by making the handle rotatable/ movable.

- Moreover, they noticed how removing the mop cloth post-use, by hand was unhygienic and inconvenient, so they proposed a latch that could be pressed on by foot to remove the cloth without having to touch it.
- Lastly, participants proposed a personalization feature which is also a pretty common practice in Pakistan where locals use discarded shirts, cloths, or towels for wrapping around wipers and utilizing it for mopping. Participants proposed hooks on the mop head that could be used for attaching any kind of fabric as per the liking of the user.

5.2.2 Final Design

In this phase, the students were asked to utilize the probe cards that were provided to them and propose a final design solution that is prototyped keeping them and the product library into consideration. (Refer to figure 5.4 below) the template asks participants to consider their proposed design alternatives in the light of the probe cards provided to them. They were asked to give special attention to the Action words mentioned on the probe cards and a scenario on how to utilize them while proposing the final design.

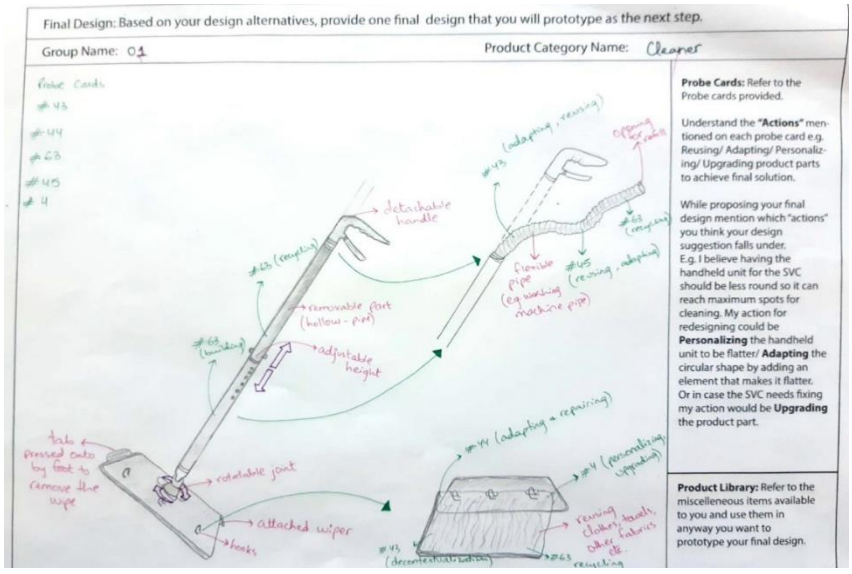


Figure 5.3: Final Design Sheet of Group D (Green Mop)

Based on the alternatives shown in Figure 5.3 this final design was proposed by group D with the green mop. Participants proposed detaching the rod from in between and providing an option to either use the mop in its full length or be used as a hand-held unit just like the arrangement of regular SVCs.

The probe cards they utilized for this design were #43, #44, #63, #45, #4. While presenting their final designs, students mentioned the action words from the probe cards that they took inspiration from. The respective probe cards the students selected are attached below.

Participants simply mentioned the act of upcycling that probe #43 (Figure 5.5) motivated them to think of. It was used while they proposed the feature of reutilizing/ upcycling discarded fabrics at home.

Figure 5.4: Probe # 43, Action Words: Upcycling, Adapting, Re-using

Probe 44 (Figure 5.6): Participants mentioned that this probe card inspired them to introduce the expandable/ collapsible pipe as a joint and a water container inside the mop.

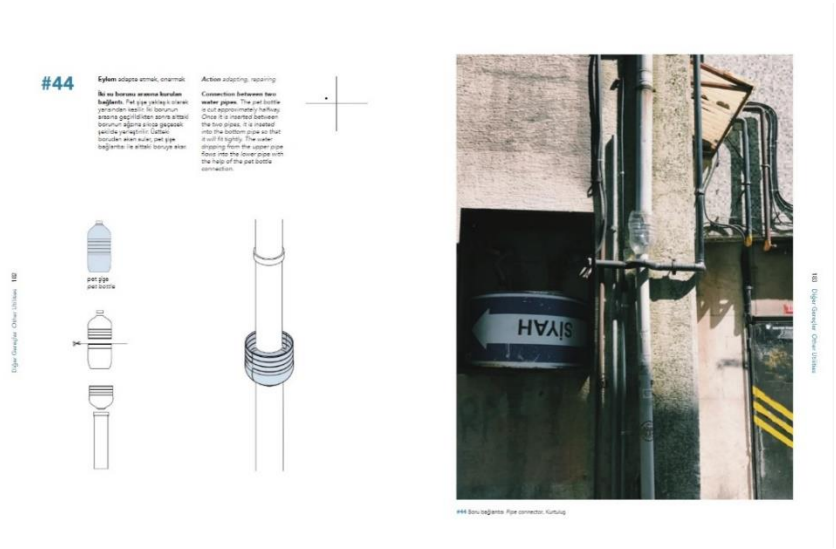


Figure 5.5: Probe # 44, Action Words: Adapting, Repairing

Figure 5.6: Probe # 45, Action Words: Adapting, Modifying, Re-using

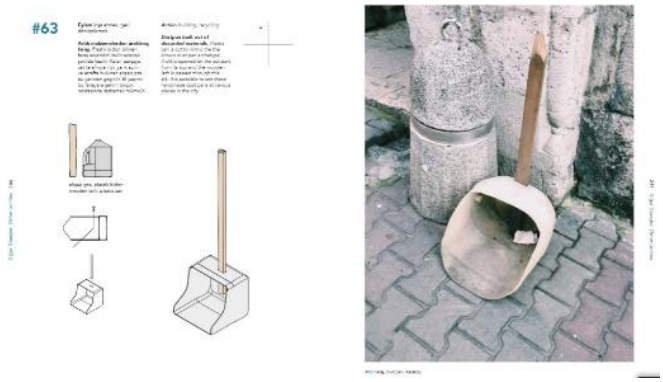


Figure 5.7: Probe # 63, Action Words: Building, Recycling

Figure 5.8: Probe # 4, Action Words: Personalizing, Upgrading

Probe 4 (Figure 5.9): The example in this probe card was also mentioned by the participants, as a reminder for the act of personalization that this *Jugaad* offers. Students of this group mentioned using this probe card while proposing the use of t-shirts wrapped around wipers as a personalized upgrade by many Pakistanis which they also proposed in their design alternatives.

5.2.3 Prototyping by Group D

Figure 5.9**:** Group D prototype and original product (figure 5.2) at end of first phase of workshop

The materials used to put this prototype together were taken from the physical library of products (See Fig. 4.7, Chapter 4) available to the participants during the workshop.

Products used: PVC pipes, plastic bottle, quilted fabric lining, water gun, spiral ring binder (utilized has hooks for attaching different kinds of fabric to the mop head)

5.3 Summary of Group E Design and Prototype Activities

Figure 5.10: Upright Stick Vacuum Cleaner worked on by Group E

5.3.1 Design Alternatives

After interaction with and working on the Operational Sequence Chart for the white SVC the students proposed the design alternatives shown in the image below. Students also mentioned the number of each probe card that inspired them to suggest a certain alternative.

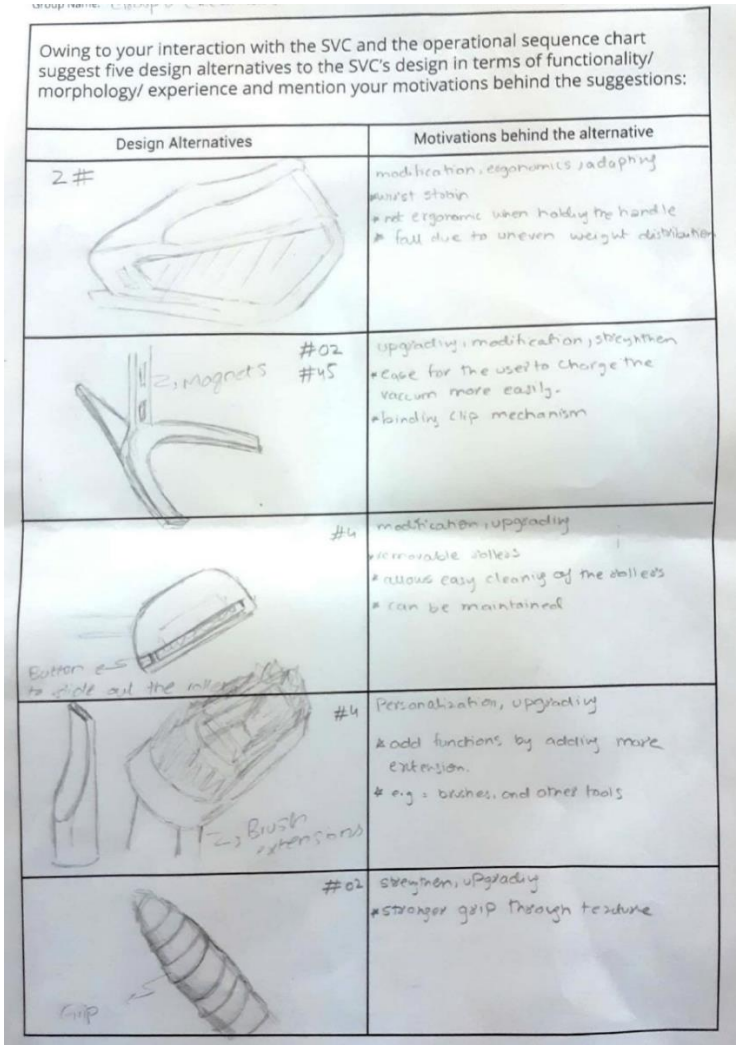


Figure 5.11: Design Alternatives by Group E

Participants noted down the design alternatives and mentioned their motivations behind suggesting said design alternatives.

- The first alternative by this group was to move the handle of the hand-held unit towards the center of the unit since the original placement caused a lot of strain on the hand since the handle is away from the center of gravity. (Action Words: Modifying Adapting)
- The current docking station required a lot of effort to lift the device and fit it on top. Participants proposed a magnetic docking station, as a second design alternative, that could easily have the SVC clasp onto it and would also conduct electricity (Action Words: Upgrading, Modifying)
- The third design alternative was a proposed modification and upgradation where participants replaced the clasps and clips with a button on the side of the mop-head, pressing onto which would ensure a simple pull-out of the roller. This would be more convenient and help in maintaining the device without causing a mess. (Action Words: Modifying, Upgrading)
- Fourth alternative proposed a range of accessories with different textures and surfaces. (Action Words: Personalizing, Upgrading).
- The final prototype proposed having a grip on surface of the handle to ensure better grip. (Action Words: Upgrading, Adapting)

5.3.2 Final Design

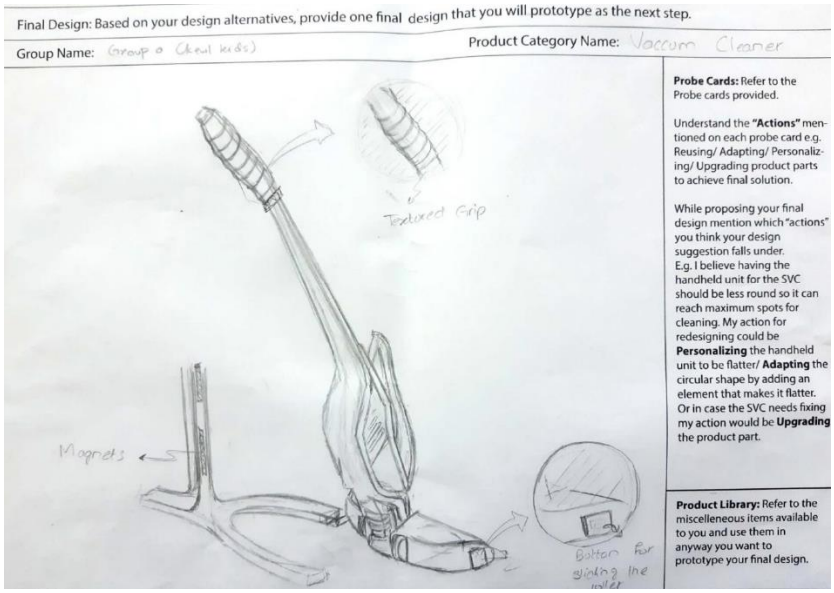


Figure 5.12: Final design sheet by Group E

The probe cards they used for prototyping were #2, #45, #4.

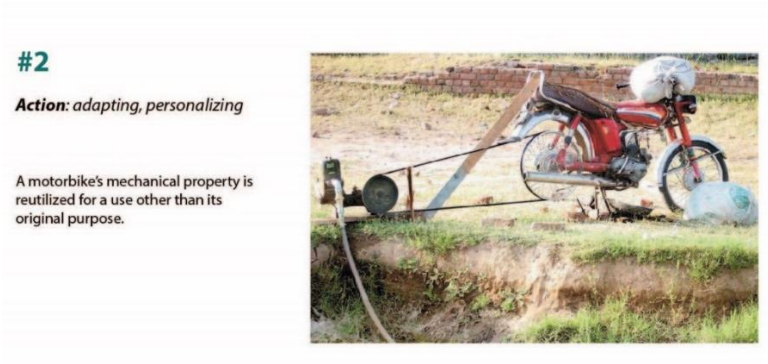


Figure 5.13: Probe # 2, Action words: Adapting, Personalizing

Figure 5.14: Probe # 45, Action words: Adapting, Modifying, Reusing

Figure 5.15: Probe # 4, Personalizing, Upgrading

5.3.3 Prototyping by Group E

The materials used to put this prototype together were taken from the physical library of products (See Fig. 4.7, Chapter 4) available to the participants during the workshop. Products Used: Participants used the spiral bind ring to create texture and grip on the handle (shown in Figure 5.17). A water thermos' heating base was used as the docking station, it already had a magnetic latching system, but the conduction was in terms of heat: participants proposed conduction of electricity through the magnets in the actual prototype. Participants utilized a vodka shaker as the main container for the hand-held unit. Simple PVC and metallic pipes were utilized to represent the rest of the structure.

Figure 5.16: Prototyping by Group E on the original product (Figure 5.11)

5.4 Group Presentations

Each group presented their final designs with explanation of the entire process to the other two groups. Participants explained their interaction with the Upright Cleaner, the problems they encountered upon usage, the iterations they came up with and the probe cards they used that helped them propose the final solutions and the resulting prototypes. This was an interactive session where all participants commented on each other's approaches and asked questions to understand the design process. This activity was significant in terms of bringing everyone on the same page which was important for the next phase.

In this session, however, there was some friction between the two groups about the feasibility of certain features in either of the group's propositions.

5.5 Iterations

This next phase involved each group passing on their final design sheet and prototype to the next group and each of them had to propose an iteration to the original design. Design iterations were an attempt at recreating how Open Design or Jugaad is usually implemented. Since the beginning, each group of participants were asked to provide an alteration in terms of a reuse, an upgrade, modification, on an original product. However, in this exercise they were asked to further iterate on the original alteration. This activity also acted as a controlled simulation of the design after design approach that is seen to happen in Open Design contexts.

At the end of this exercise, students presented their iterations on each other's designs which lead to a discourse about the difference in approaches and a discussion on the feasibility of improvements. This part of the exercise was instrumental in terms of understanding the changing autonomy over each design and the advantages and disadvantages of design after design.

In this round of the workshop, the iterations happened between the two groups: Group D & Group E.

The table (table 3) below shows that every group must iterate once on the prototype that another group created. This means one iteration per prototype. In the sections to follow, information is represented following a similar path.

	Iteration (Group D)	Iteration (Group E)
Prototype (Group D)	Not Applicable	D→E
Prototype (Group E)	E→D	Not Applicable

Table 3: Design iterations carried out by groups by Workshop 2

5.5.1 Group D Prototype Iterations

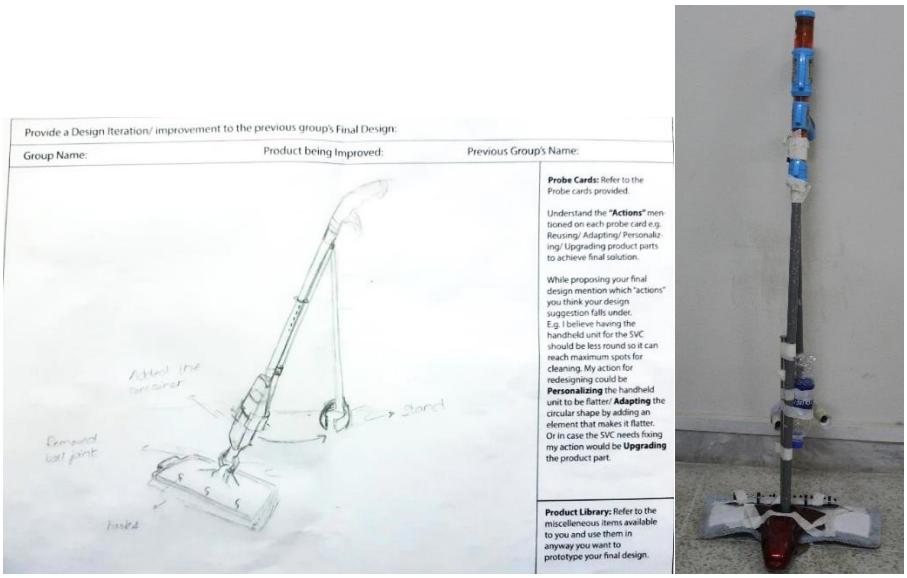


Figure 5.17: (Left) Iteration by the Group E on the prototype (right) by Group D

Participants of Group E identified problems in the proposed design for example:

- Participants of Group E mentioned a problem that they noticed with having the entire tube as a water storing/ pumping unit (as the initial group proposed). They proposed shifting back to the original design of the product which has a water container in it since they thought it would help with the stability of the overall structure and contain much more water.
- Group E also eliminated the rotatable joint that Group D initially proposed in their design with the justification that it does not provide the amount of stiffness a mop should have to clean hard surfaces.
- Group D also designed a stand in the entire design so it can be a free-standing structure if need be. (See Figure 5.19 – The prototyped iteration by Group D)

Figure 5.18: The stand can be seen latching on to the bottle, it also opens up to become a support for the structure so to not have to lean against a wall.

Participants of group D mentioned their specific liking for the personalization feature that Group E introduced (flaps for pushing the mop surface out by pressing on it with the foot and the hooks for attaching different kinds of cloths (see figure 5.10). They kept these two features in the iteration they gave as well.

5.5.2 Group E Prototype Iterations

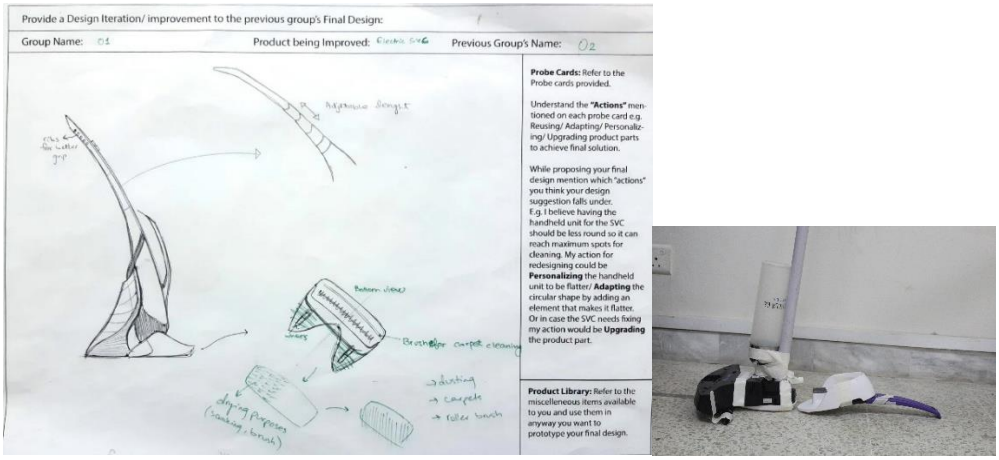


Figure 5.19: (Left) Iteration by the Group D on the prototype (right) by Group E

- Group D redesigned the docking station to be more curvilinear now and be a better fit than before.
- They introduced rollers for the entire vacuum unit's head for scrubbing surfaces while also collecting dust.
- Group D also proposed height adjustability and a joinery in the middle of the structure so it could be bent and pushed under furniture which it currently cannot be because of the bulky structure and no option for height adjustment.

5.6 Personal Reflections

This workshop was a bit different in terms of both the process and the outcomes than the first one despite having similar activities and participants from a similar background.

Participants approached the generative tools in a different way which was quite insightful for me as a researcher.

Unlike the first group they did not utilize the probe cards for the context the "actions" were being applied to. However, they utilized the action words just for the meaning of the words themselves. For instance, an action word "personalization" with the context of a man using a pushcart with his motorbike was mentioned by one group as a part of one of their design alternatives. However, there was no hint of understanding the probe or the cultural association of the act of "personalization" per se. They simply picked out the word "personalization" and used it for adding a personalized element in one of the alternatives. This was valuable in terms of understanding the levels of thinking and understanding people can have with visual cues or simple verbal ones. Because the previous group of participants (Chapter 4: Workshop 1) took conceptual inspiration from the probe cards, I assumed it would be the same for this group as well. This group, however, was more pragmatic with their approach and still able to produce some very insightful outputs.

Secondly, the reactions that each group had towards iterating on each other's designs was different than earlier. The group of participants in this session were more critical and more defensive about their design decisions and had rebuttals at the end of the session on why they deemed a certain design decision better than the other.

However, some very valuable insights were also generated due to this interaction. For instance, during a discussion session at the end of the workshop, a participant from Group E (Grey SVC Group) commented on the design iteration by the Group D (Green Mop), suggesting that they should revert their decision to eliminate the water container from the green mop. They pointed out how the original design had a container since spraying the water requires a vacuum to be created and in the design iteration, Group D did not leave any room for the vacuum to be created. Group E agreed to this insight and were quite presently surprised on how feedback from their peers turned out to be quite eye-opening for them. Something they did not realize before, according to them.

There were many other similar findings that were more systematically in the debriefing session.

However, as a researcher and an observer, I felt successful with my intentions while curating the generative tools for the workshop. Some very valuable outcomes were witnessed, and this was a very rewarding process.

CHAPTER 6

DEBRIEFING SESSION RESULTS AND ANALYSIS

6.1 Introduction

In this chapter, details of how the insights from the participants of the field study were gathered and analyzed are presented. After the workshops (Chapters 4 & 5), debriefing sessions were conducted with the participants with the session questions structured around the research questions of the thesis (Chapter 3: Methodology, Section 3.7.2). The debriefing session description, coding, analysis and results are presented in this chapter.

6.2 Debriefing Session

As briefly covered in Chapter 3, Methodology, a debriefing session was conducted one week after each workshop. The questions asked in the session were structured on their experiences during carrying out the workshop as well as their take-away learnings and reflections from the workshop. The sessions were conducted online and on a per-group basis. The software utilized for this activity was Air Table, an online hybrid data-base spreadsheet. One spreadsheet was allotted to each group and data (verbal responses) were recorded on that spreadsheet.

Students were asked questions based on three themes: their views about *Jugaad* and Open Design, their experience with the generative tools and exercises conducted during the workshop, and reflections on their experience of following such an un-conventional method of designing products and iterating on them. These three themes are derivatives of the research questions and a detailed review on the results of the data analysis based on questions is presented in the Chapter 7: Discussion.

The analysis presented in the following sections, however, spans under the three themes mentioned above, with sub-headings under each section that compile distinct responses/ opinions of the participants. Some questions of the debriefing session generated very descriptive responses and often the responses were distinct to a particular experience of a certain participant. The results are collected, analyzed and reported on accordingly.

6.3 Views about Jugaad and Open Design

This theme was particularly important since it encompasses the basis of putting *Jugaad* and Open Design adjacent to each other as processes and seeing them in each other's essence. This theme covers opinions of participants based on the field study they were involved in, which was essentially planned around this very theme as well. Participants were mostly asked open-ended questions which as a result promoted descriptive responses that were coded under the following sub-categories.

6.3.1 Jugaad as a Part of Design Process

This sub-category essentially inquired into whether participants thought *Jugaad* was applicable as a concept and as part of a design process. The result was 21 out of 23 coded responses mentioned *Jugaad* being positively applicable as a part of the design process. Of the 21 responses, 7 talked about the positive impact in terms of adding convenience to the design process, whereas 5 out of the 21 responses mentioned it as a means for problem solving. "The ability of thinking on one's feet and finding a solution" (P11) was regarded as a very productive way to go about a design process in some cases. Another set of 5 responses referred to *Jugaad* as a means for adding sustainability as an attribute to the process, since it involves making do with what is available and continuing to iterate or increase product longevity.

Only two responses, however, quoted the possibility of *Jugaad* being a dangerous element as part of a design, since if the person implementing Jugaad is not careful and

thorough enough with the feasibility of their "make-shift" outcome, it could go in a bad direction and become a liability for safety.

6.3.2 Similarities and Dissimilarities between Open Design / Jugaad

The responses under this sub-category had a very close ratio. 5 out of a total of 12 participants responding on this sub-category claimed similarities between Open Design and Jugaad. The similarities mostly involved the act of constant iteration that both the practices offer. Iterating with a motivation of personalization and iterating with a motive of repurposing were the two most quoted similarities.

Dissimilarities were coded for 7 out of the 12 participants, with the most quoted issue being the short- and long-term nature of the outcomes in either of these processes and the difference in resource availability.

6.3.3 Value Addition through Jugaad

This sub-category came from a simple yes or no question asking participants whether they thought Jugaad could add value to the design process. The result was 81% of participants responding with a 'yes'.

6.3.4 Convenience/ Inconvenience of Jugaad as a Process

The number of participants who gave responses in favor of Jugaad offering possible inconveniences as part of the process (11 out of 19) were greater than those who considered Jugaad to bring conveniences. Of these 11 participants, 9 attributed the inconvenience to a lack of feasibility or the need to carry out rigorous testing to ensure the feasibility of the outcome, due to the frugal nature of Jugaad. The remaining 8 of 19 that vouched for the convenience of Jugaad, did so in terms of Jugaad being a quick solution, being cost effective and being functional even in the case of limited resource availability.

6.3.5. Jugaad as a Cultural Practice

This sub-category was mostly concerned with taking opinions of participants on Jugaad as a cultural practice, within the context of the country that they were familiar with (Pakistan). While the intention of this was to warm them up to the debriefing session, the insights were in fact very valuable in terms of understanding the stand-point participants had for this practice. Most participants gave Jugaad expressions such as “asset of the common man” (P6) and the “design identity of Pakistan” (P4). Other responses included Jugaad being a “quick fix in the name of necessity” (P10) along with being “time and cost efficient” (P7). Since these responses mostly depicted very distinct and unique opinions of the participants, it was difficult to categorize them under generic categories without the responses losing their uniqueness, hence the most mentioned responses have been reported on in this sub-category.

6.4 Experience with Generative Tools and Exercise

This theme was of great significance since the generative tools of the field study (Refer to Chapter 3: Methodology) were designed specifically to test out the relation between Jugaad and Open Design. The generative tools were representative of real-life situations where discarded objects (provided as a (Product Library) are utilized for reusing, re-purposing, or upgrading another object. The following sections covering the sub-categories under this theme shed light on how participants responded to the said generative tools.

6.4.1 Product Library

Out of a total of 19 records that mentioned the product library, 18 clearly referred to the library having had a thoroughly positive influence on how participants approached the design process and the outcome. Of the 18 positive responses, 9 quoted the product

library to have “acted as inspiration”, so it can be regarded as a success within the research methodology.

“The brain instantly starts building connections. We started observing the structure, material and textures and built connections with the possible usage” (P8), said one of the participants. They emphasized on how the product library made them disconnect from the original functionality of a product/ part and made them focus on just the properties of it as a single unit, and how that could be utilized in a different way and as a part of their proposed solution. “Initially we were just working on the problems and not considering the functional attributes, looking at the library later helped in figuring out how to use the available resources in a limited amount of time to achieve max results” (P3), said another participant.

Furthermore, 6 out of the 18 records mentioned the product library to have acted as an opportunity to view products from a fresh perspective. Participants mentioned having the product library as a means to unlearn the previous usage of said products and see them in a different light. As mentioned by one of the participants, “it’s not necessary to pick a whole product, a part could also be helpful. This made us see products in a different light” (P5). Additionally, 3 out of the 18 records mentioned the product library as a challenge that pushed them to do more with less.

6.4.2 Role of Probe Cards

Probe cards were a significant part of the process of the workshops, with many informative elements per card. Any of the elements could have impacted on how the participants responded to the usage of the cards, and so the insights gathered from their usage by the participants were quite like what they were perceived to be.

From a total of 15 records, 9 declared the probe cards to be inspirational in terms of material usage of the products that were shown in the cards, i.e., participants took inspiration from the material quality or the structural quality of the products and how they were utilized in a certain probe card. For instance, a participant considered one

of the probe cards (with a chair being utilized as a TV stand) as follows: “the chair contains and the tv needs containment, helped me think of every product in a different way” (P7).

A second majority of responses 6 out of the 15 records mentioned the probe cards to be inspirational in terms of the action words. For context, each probe card had action words mentioned on them based on what action had been implemented as a characteristic of *Jugaad*, e.g., re-using, adapting, upgrading, personalizing etc. Participants based their actions for their final design on said actions mentioned probe cards. “Keywords (Action Words) helped in giving a name to the actions we were previously deploying already but couldn't make sense of” (P9), said one participant. While another said, “the actions mentioned in them [the cards] also helped us in taking starting off points” (P7). While some participants also quoted specific examples of when a certain action word helped them, to quote an example, P5 said that, “personalization ‘action’ from one of the probe cards got us thinking about the hooks for swapping cloth sheets in the mop.”

6.5 Reflections On the Experience of the Design Process

This theme caters to another aspect and a primary aim of this research, which was to understand how participants respond to the design process and their changing roles when Jagaad is introduced as a new way of thinking and doing. As mentioned in the Chapter 3: Methodology, one of the reasons for sampling this group of participants (Designers) was to understand how designers respond to this very un-conventional way of designing and how it makes them feel about their shifting role as designers. Especially, what they felt about the change in the autonomy/ ownership they have over what they design. Because the participants were essentially taking inspiration from a method that is deployed on the streets and mostly by people with no design background or knowledge, this was an especially interesting issue to dig into. Secondly, the design-after-design approach of Jugaad, where people keep iterating on an original design, and how that reflects on the initial design, was also something this theme reports on.

6.5.1 Autonomy over Design

As mentioned above, the participants were asked about how they thought the autonomy of a 'trained designer' over his/her designs would change if Open Design (driven by Jagaad) was used a mode of designing where anyone and everyone can contribute to the process.

The positive and negative responses were very closely balanced. In total, 8 out of 17 records mentioned a positive impact on the autonomy over design, whereas 7 out of 17 declared a negative impact. A significant majority of the positive responses talked about the positivity in terms of needing to 'learn to accept'. Some mentioned how they learnt to accept different perspectives and it helped them not be too possessive of their designs. As mentioned by one of the participants, "Sometimes your approach towards a problem is different and somebody else's iteration could be enlightening and that could help in designing" (P10).

For those who mentioned the impact to be negative: the negativity was quoted to be in terms of the initial intention behind proposing a certain design solution getting lost along the way. Participants also mentioned how it was at times difficult to accept the change and made them feel defensive. "In that moment it was hard to accept, but in the longer run it would help because that would allow us [to] bring out something better than what we already suggested" (P12), mentioned one of the participants. Another commented, "we became a bit possessive of our designs and it was harder to take their [the other group's] insights but their insights were in a technical perspective. I liked their points of view" (P9). As a minority, 2 out of the 17 records suggested that the process of Open Design coupled with *Jugaad* does not challenge or change the autonomy of the process for the designer, since in their view the conventional processes of designing are also iterative in the pursuit of a finalized (or refined) design.

6.5.2 Experience of Iterating on Each Other's Designs

Out of a total of 19 records for this sub-category, 10 entries named the experience of iterating on each other's design to be empathy-generating. This was mentioned in different contexts, for instance some participants mentioned how the process helped them see different perspectives and accept different approaches. One of the participants also named the process as "eye-opening" (P12), leading them to understand how two people can have a different approach towards a similar problem and that this helped generate empathy. "It made me appreciate other people's way of thinking, I wouldn't have gone in that direction had it not been for this process. It made me think of more possible paths to follow for my own process" (P8), said one of the participants.

Fewer records, 7 out of 19, mentioned the experience of iterating to be enlightening. This was mentioned from the perspective of either learning from different approaches, or learning from their peers' iterations on their design, and using that learning to morph their own course of action. One participant mentioned the process to be slightly unsettling for them.

6.5.3 Change in Role of Designer

This sub-category was examined to gain insights from participants on their views of the shift in the role of a trained designer if (or when) Open Design and Jagaad is used as a method for designing.

Out of 25 coded records falling under this category, a majority of 14 deemed the changing role of the designer as an opportunity to view design and products from a different perspective. The opportunity was elaborated upon as learning from different perspectives, understanding and adapting different approaches, and accepting one's own faults or short-sightedness at times. As very aptly put by one of the participants, "designers need to think what other people think of their designs to understand the

feasibility and practicality of their designs. Open Design gives an opportunity to do that to achieve the most suited outcome" (P13).

A second cohort of records, 6 out the 25, mentioned 'designing with the user" as a very positive aspect of Open Design. One participant compared Open Design to User-Centered Design and said, "user-centered design makes us design for users, but the open design method makes us step into the user's shoes" (P6).

Another very refreshing comment from one of the participants was how the role of designers could turn into flagbearers of sustainability while using Open Design as a tool for designing, since the approach involves embracing principles of upgrading, re-using, or repurposing what is available to essentially increase suitability to particular users and in specific contexts, which can lead to product longevity.

6.6 Conclusion

While the debriefing session was extremely insightful for helping understand how participants approached the process of Open Design and Jagaad and what they left with as learnings and opinions, there were several aspects that could have been improved in order to get better responses.

A first would have been to not conduct the debriefing session a week after the workshops were conducted, since it took a little recapping for the participants to recall their entire experience and had to be probed into having small discussions in between the debriefing session to get to the final answers. While this process had its own benefits in recharging everyone's memory all over again, the structure can be improved into further research. Secondly, the order of questions the researcher had in mind could also be improved. The insights received from the session were, however, very descriptive and very particular to each participant's experience.

Furthermore, in the debriefing session from the participants of workshop 2, some very valuable insights were revealed about the negative effects of iterating on each other's designs and iterating for the sake of iterating. Participants from the two groups had a

rebuttal with each other on the "need" to change a certain aspect of the green mop and they reported on that experience being an unsettling one. This was also particularly valuable as an experience for the researcher to have observed first-hand, since it gave insight on how sometimes a lack of proper communication and mediation can take the process of iteration in a deconstructive direction. Since the data for this occurrence was negligible in terms of prevalence and coding, compared to the main dataset, they were not reported as an insight in the sections above.

CHAPTER 7

DISCUSSION AND CONCLUSIONS

The aim of this study was to investigate Open Design Practices using Jugaad as a cultural probe, in order to reveal insights for the feasibility of using Jugaad as an approach in design as well as to investigate the changing roles of designers with this shift in design practice.

While the structure of the study has been explained chapter-by-chapter in Chapter 1: Introduction, the purpose of this opening section is intended to give a recap of the structure of the study that was carried out to answer the research questions also laid out in the Introduction chapter.

As a start, a literature review (Chapter 2) to consult Open Design practices archived in academic and practical research were consulted and reviewed with the purpose of framing Open Design and Jugaad so as to explore their attributes and build a base for the practical research that would follow. Chapter 3 covered an in-depth review of the methodology for all the steps taken for the research to find answers to the research questions and reach conclusions. Chapter 3 also included the structure and reasoning for designing the field research (workshops), which were the primary source for testing out all concepts developed for the research and reporting on the results.

Chapters 4 and 5 covered details of the two workshops that were designed to make use of generative exercises with participants in groups, the results of which are also presented in the mentioned chapters. In Chapter 6, the results of the debriefing sessions conducted with workshop participants, who shared their experiences and reflections, are presented. This final chapter, Chapter 7, revisits the research questions and discusses the outcomes and implications of the research. A review of the limitations of the study is also provided.

7.1 Revisiting and Discussing the Research Questions

The aim of this research is to investigate Open Design practices keeping Jugaad a cultural probe and gauging the feasibility of Jugaad as part of a design process. It was also to understand the shift in the role of a designer being a part of such an unconventional process of designing. Some objectives of the study were set in order to achieve said aim.

However, since the topics under investigation in this research are relatively contemporary and still in the process of taking shape as dedicated topics of research in academic literature, the research questions were directed towards framing the concepts under investigation first to build a basis for conducting the field study. That is to say, research questions were first addressed through the literature review – as far as it was possible – but it was through the workshops that fuller answers could be constructed, taking into account workshop participants' comments and reflections.

- *RQ1: What categories of problems can Jugaad methodology be applied to (e.g., problem solving**, value addition**, enhanced user experience), and what are typical outcomes? (e.g., types of products…)*

  Also covered in the Chapter 6, the participants responded with their experiences of Jugaad as a cultural practice that they had witnessed around them since childhood, and as designers requested to make a special attention to Jugaad through this study. Some of the participants claimed that Jugaad is already utilized as a source of value-addition and enhancement to user experiences since it is used to fix a problem or increase the product life in certain cases. Participants mentioned that experience for that particular context is already enhanced in such cases. However, how it can be utilized to increase value and enhance user experience on a mass-level would require regulation and feasibility testing. Open Design practices and iteration for improvement in this case can come in useful where this ingenuity goes through peers and phases in terms of being reviewed for feasibility.

- *RQ1a: How is Jugaad used for solving problems locally?*

  This question was mostly answered through the literature review, articles and blogs reporting on Jugaad practices, along with a handful of reports also attempting to break down Jugaad into rational terms. But as a brief overview, Jugaad practices are utilized by either personalizing, upgrading or re-using or repurposing discarded/ malfunctioning products or product parts. In case of personalizing, the products do not even have to be broken or malfunctioning. Instead they are utilized just for their functionality or morphology irrespective of the initial usage. The most common context where Jugaad is applied in Pakistan are transportation vehicles (tractors, motorbikes, trolleys) and other daily use products.

- *RQ1b: Who practices Jugaad?*

  This question, too, was intended to form the basis for the research. However, the initial findings through literature and observation changed after the workshops. While it could be said that before the workshops, Jugaad was understood as a practice of people on the streets, usually as a means to provide a service (e.g., yogurt drink maker who whisks the drink in a washing machine), after the workshops the responses of the participants made the researcher revisit the question again. Participants mentioned the trivial ways Jugaad is also applied in their households where someone uses a water dispenser bottle and inserts it into a water cooler just because “it fits”. And another participant mentioned how their parents turned two discarded sofas and converted them into bunk beds with minor tweaks. This made the researcher realize that Jugaad practices are to be found all around, so much so that it is transparently a part of our daily lives that we have forgotten to take note of it. To answer the question – it would be reasonable to say that everyone in Pakistan practices Jugaad – just on different levels.

- *RQ2: How does the role of the (trained) 'designer' change when using Jugaad as a methodology for designing?*

  While this has been covered in detail in Chapter 6, the 'change in role of designer' was a theme that was generated at the end of the data collection from the de-briefing session. From the point of view of the participants of the workshops, the role changed positively. The positivity was expressed in terms of giving participants the opportunity to view designed products in a different light and an opportunity to view design from a different perspective. However, from the direct observations by the researcher (who also is a designer in her own right), as well as observations on the designers deploying these processes as a part of their design process, there was a sense that the role of the designer will shift to be an efficient mediator, an empath, and a manager. While it is true that every designer does take up that role in one phase of the conventional design process more than another, in order for the Jugaad/Open Design methodology to work and be efficient, designers would be required to be less defensive of their designs and not consider themselves as the 'owners' of the process and outcome. Rather, a successful mentality would be to assume a co-contributor role, seeking the most suited outcome. *Jugaad* while being an extremely inventive practice that has potential as a game-changer for the Pakistani design scene (or even global design scene), if not deployed under proper regulation and caution, could also prove to be hazardous in terms of safety or in some cases, extremely contextual. Hence, the role of a designer does not stop after providing their contribution and moving on. It would require them to provide universal solutions and not take the concept of *Jugaad* literally.

- *RQ2a: What convenience/ inconvenience does Jugaad create in initiating an open process of designing?*

Similar to the previous question, this question has also been comprehensively addressed in Chapter 6. However, for the sake of a recap, participants of the research considered *Jugaad* to be inconvenient in terms of feasibility and in terms of the temporary nature of the outcome.

Oppositely, when referencing convenience, participants mentioned aspects of *Jugaad* as being a quick solution, cost effective and functional – even with limited resources.

However, the inconveniences of Jugaad mentioned by some participants can be counted as inconveniences only in the case of *Jugaad* being literally recreated in a product instead of reutilizing the ingenuine thinking behind it as part of the process. By developing frameworks and having regulations for deploying *Jugaad* as a part of an Open process of designing, the likelihood is that it will add to the conveniences of the design process. Most importantly for developing countries, where there is no in-house production of products and where product parts are usually imported from abroad, this process could truly become critical contribution to solving people's needs for functional artefacts. The development of such frameworks and regulations – more tightly operationalizing *Jugaad* and Open Design practices – is a prospect for future research.

- *RQ2b: In what ways is Jugaad similar / dissimilar to Open Design practices?*

Based on the results of the research, the similarities that participants mostly found among Jugaad and Open Design were the fact that both involve iterations in the name of personalization and repurposing. The dissimilarities were focused on the current scenarios in which *Jugaad* is performed, in the name of necessity and with limited resources – whilst Open Design is practiced keeping long-term product goals in mind. But the idea of this research journey was also to find the dissimilarities and common points between the two, to ultimately morph them into a certain method of designing. This, infact, is another future prospect that can be

initiated from this research, where the ingenuity of *Jugaad* is used as a method for designing products, whether the context is open or not.

7.2 Research Reflections

While there have been many insightful occurences throughout the process of conducting the field study and writing this thesis: some extremely valuable take-aways are presented in this section as a discussion.

Selecting the target group for the field research yielded some additional insights that were not necessarily anticipated when the field research was set out. The fact that the participants were Industrial Design students provided a pedagogical insight on how the concept of Jugaad and Open Design can be utilized in academia. As per the responses given by participants in the debriefing session, it was revealed that they found the activities carried out during the workshop pivotal and transformative. Many wished for this excercise to have been conducted at an earlier stage of their academic career. The possibility of breaking down the product's morphology, viewing it for it's functionality and affordances only, and in some cases vice versa, allowed participants to view products/ product parts as words to a design language at large. It provoked the mind in a way that decontextualizes products and allows the mind to recontextualize them, thus touching upon the very fundamentals and building blocks of design.

Additionaly, the workshop in particular can help evoke a very crucial sense of empathy in a designer that most definitely is an extremely important attribute every designer must have. While it is debateable how "empathy" driven design, too, is a very common and in some cases over-used in the current design scene, it still is extremely crucial. More importantly, in a more conventional sense of the word empathy is usually associated with the user, however, this workshop and the practice of *Jugaad* in the light of Open Design really stirs up a sense of relatability and understanding among designers. This was noticed during various instances during the workshop and even after where many participants reported on feeling a connection with their peers and

"understanding their intention" behind a certain design decision. This, in general, can inculcate some extremely important set of traits in designers during their active learning phase. Activities like the ones conducted in the workshop could be used to provoke students to view products and the design process in a different way. It was reported by some of the participants how they wished such an activity were carried out earlier in their academic career and had that been the case, they would have approached many of their projects in a different way.

Moreover, while the concept of *Jugaad* and the ingenuity that comes with it in terms of repurposing, upgrading and adapting products, is very familiar to natives of countries like Pakistan, India, Brazil, Turkey, Japan, China etc., it is still very alien to people in the Western countries where the most production and product wastage occurs. It could specifically be very valuable to make this workshop and activities conducted in it a permanent part of the design pedagogy in the West where this approach could be most utilized. Along with giving a new vantage point for veiwing products and the design process it would also inculcate the empathy in the designers from the other side of the world.

While this thesis wholistically is an attempt to frame *Jugaad* (an unconventioned method of 'invention' deployed on the street) in the light of Open Design (also a rather unconventional and rising design concept): concerns and discussion for both of them falling into the conventional constraints of professionally practiced design still arise. Professionally practiced design and design that can be 'formally taught' is a relatively intellectual and perhaps pragmatic approach. Frameworks and methodologies that can be practiced through a systematic, lengthy process hold their own space in a design process and they should remain being so. But once the ingenuity behind an inventive approach like Jugaad is factored in, a lot of additional value can be achieved in the final outcome and also the process itself. The world is changing at a rapid pace. The pandemic itself is the biggest wake-up call on how rapidly humans require action. Be it in terms of design, medicine, engineering or the economy: adapatability and utilization of exisiting resources to achieve exceptional outcomes has been the ultimate savior. *Jugaad* offers a similar element to the design process. It is almost like the

difference between information and knowledge. While there maybe plenty of information actively accessible online or offline, what turns it into knowledge is one's own skill and genious. 'Knowledge' is about personalizing the 'information' available to ones own experience and understanding. *Jugaad* can offer a similar value to a design process where an inventive approach provides an extremely accurate, ingenious and problem-specific solution with the skill of an instinct.

Similarly, another important distinction between the process of *Jugaad* and design are the steps taken to create a working artefact. Design requires a series of steps that could range from mockups, low-fidelity prototypes to high-fidelity ones and then the final product. Conventional *Jugaad*, however, often immediately leads to the creation of an artefact. Hence, it is important to emphasize that this thesis argues the implementation of *Jugaad* as possible part of a design process instead of replacing it. A certain phase of a design process requires being hands-on and experimental, utilizing Jugaad as a prototyping tool (similar to how it was conducted in the field study of this thesis) could yield many benefits in terms of the final outcome.

Another important reflection has been about the "open-ness" of *Jugaad*, the design process and Open Design itself. While the open-ness of Open Design itself is still under discussion in the academic literature, the open-ness of *Jugaad* as a practice is something this research intends to shed a light upon. While some may say that the final outcome created as part of the *Jugaad* deployed on the street is a "closed' object, this thesis investigates the open-ness of the possibility of the said closed object to be taken apart and re-assembled by someone else again. The accessibility of that object in a public space and the constant intervention on its initial design is what is Open about it.

It can also be open-source in the context of a certain *Jugaad* product being disseminated and distributed for people to replicate themselves. The product being repurposed, re-used or upgraded is usually always a conventional consumer product that is available to the masses. If a certain successful *Jugaad* solves a problem or adds value to a consumer product, an open access to the method and reasoning behind it

could empower many people. An example of this is a tricycle manufacturer in Turkey who manufacters trikes by repurposing existing products and trains apprentices on manufacturing them in a similar way: the apprentices then travel around to other parts of the country and pass-on their skills. It is an unconventional open-source model but it is open afterall!

7.3 Limitations of the Study and Avenues for Further Research

This study took many detours owing to the on-going COVID-19 pandemic. Initially, the course of action was different since the research was based in Turkey but after the COVID outbreak, the researcher had to repatriate to their home country and plan the field research from scratch.

While mostly the outcomes of the research were good, the workshops had to be conducted in two phases with the same structure because of the COVID Standard Operatings Procedures of the institution it was carried out in. The workshops were carried out a week apart from each other. Had there been more time in between the two for data analysis, the second one could have been structured differently based on the insights generated from the first one.

Another limitation was the time limit for the research. The total dataset collected from this study is more than the dataset that is analyzed and presented in the thesis, because of a purposeful limiting of the scope of the study. In the workshops, a second phase was conducted by reversing the roles of the research: i.e., Open Design being deployed on a Jugaad-prone object (a transportation vehicle). This phase was not analyzed or presented as a part of the thesis because of the said decisions on focusing the scope of the study.

Upon availability of more time, a framework for formally deploying Jugaad as a part of the Open Design process could also be developed. This is now being considered as a future prospect of this study.

During the workshops, the prototypes that participants created were low fidelity joineries. They were often make-shift and executed using adhesives. But upon availability of proper resources, the participants could have created prototypes of solutions that were as close to reality as possible.

Lastly, the outcomes that this research presents are based on a small number of participants only. Repeating the generative exercises and practices with a larger group and with people from no design background would be insightful for a future prospective direction.

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