MiFro

Milk Frother

P2

Project report
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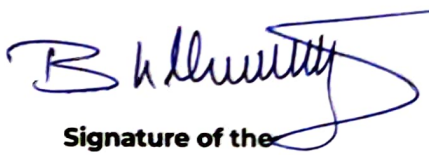
Approval Form

The Design Project II titled “MiFro” by Parth Rathod,
Roll Number - 216130001 is approved in partial fulfillment of the Master of Design degree in Industrial Design at the IDC School of Design, Indian Institute of Technology Bombay.

Prof . Avinash Shende
[Project Guide]

Signature of the Chair Person



Signature of the Internal Examiner

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Declaration Form

I, declare that this written report represents my ideas in my own words, and where others' ideas or words have been included I have adequately cited and referenced the original sources.

I also declare that I have adhered to all principles of academic honesty and integrity and have not falsified, misinterpreted or fabricated any idea, data, facts or source in my submission.

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IDC School of Design
IIT, Bombay
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Acknowledgments

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I would also like to thank my batchmate Aamod Narkar for making sure I don't miss my breakfast every morning. I am also grateful to all the staff and students of Industrial Design Centre (IDC) and Emo Bois of H12 for their kind help and useful opinions and suggestions.

I would like to thank my family and friends for their unconditional support.

Abstract

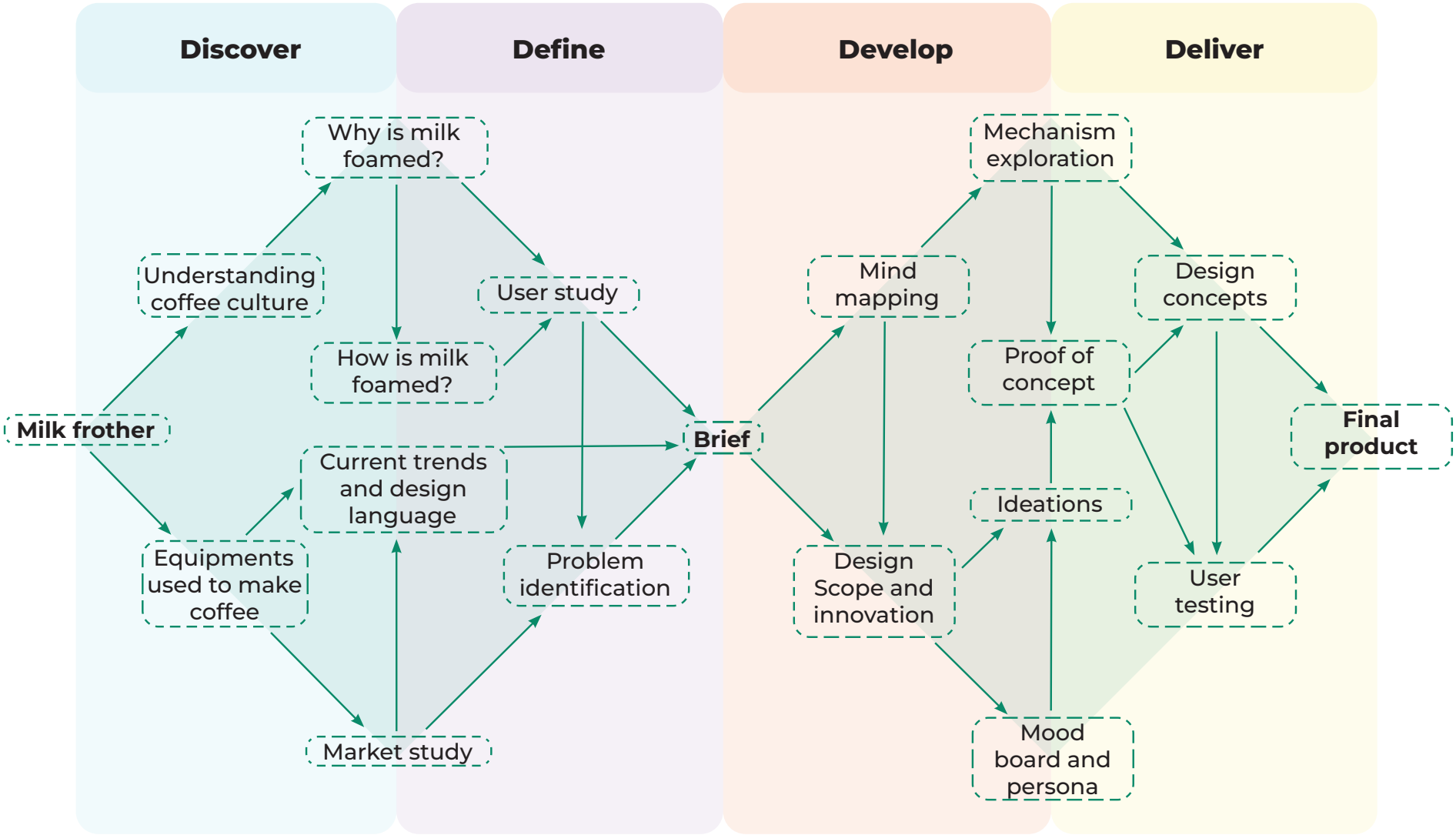
Be it cappuccino or cafe latte, foamed milk is in important part of coffee preparation. Invention of espresso machines enabled baristas to steam milk before adding it into espresso to make coffee taste creamier, rich and enhance the coffee drinking experience.

India's coffee culture is expanding as we move into the Third Wave. This leads to innovation in home brewing techniques and tools. Every year, a number of specialty roasters are born in India, each one vying for market share by using beans that are legitimately sourced and expertly roasted, and promoting best in class machinery to produce the ideal cup of coffee. There are a wide variety of products available to grind and brew coffee at home, but foamed milk receives very little innovation. In cafes, milk is foamed using a steam want that created microfoam that gives milk a velvety texture. Little to no milk frothers used at home can achieve microfoam. To improve the enjoyment of coffee drinkers and makers, this study examines the home production of microfoam using a manual milk frother at home.

This report explores the coffee culture and design trends of the products available in the market, finding a gap to introduce a product that adds to the coffee making experience at home . MiFro is a frother that attempts to produce microfoam that resembles that of a cafe and adheres to the design aesthetic of modern products that may be displayed on your kitchen platform.

Table of Contents

Methodology



Introduction _ Coffee

I would like to start my research with coffee. A beverage consumed by people at home, work cafes and also on the go.

Coffee consumption world wide is increasing day by day and home brewing is an upcoming trend in India.

Coffee in India

The first record of coffee growing in India is following the introduction of coffee beans by Baba Budan, a sufi saint, to the hills of Chikmagalur, Karnataka in 1670. It is said he smuggled seven coffee beans from Yemen.

Coffee Culture

Waves of coffee

Just like the “waves” of the industrial revolution, major moments of transformation in the history of coffee culture are called “waves. The waves of coffee are focused specifically on how consumers interact with or relate to coffee as a consumable good, and that has changed significantly & swiftly with other historical and cultural trends around the world.

First wave late 1800s

The first wave can be categorized as the shift from novelty to commodity.
Coffee became accessible to the average person

Second wave mid 1900s

The second wave of coffee signifies a shift in the expectations of consumers
Coffee became a part of peoples lifestyles
The second wave of coffee introduced the larger market to steamed milk and espresso

Coffee Culture

Third wave mid 2000s

Consumers in the third wave began to value the intricacies of coffee's many origins and flavors.
Coffee brewing instruments for at-home use started becoming affordable options for drinking coffee at home.

The third wave of Coffee as a term was first used by Trish Rothgeb back in 2002 published in the Roasters Guild Publication defining the three Coffee movements as "waves". This wave is made up of a much more sophisticated coffee consumer, a "coffee lover" maybe.

Consumers in this wave are much more interested in having a great cup of coffee that suits the different tastes. In this wave coffee starts to have more and more similarities with wine, people care much more about the origins of the coffee, the processes involved and the way coffee is brewed.

An important feature of this wave is that of the Specialty Coffee which was a turning point on the coffee industry. The quality of the coffee became very important

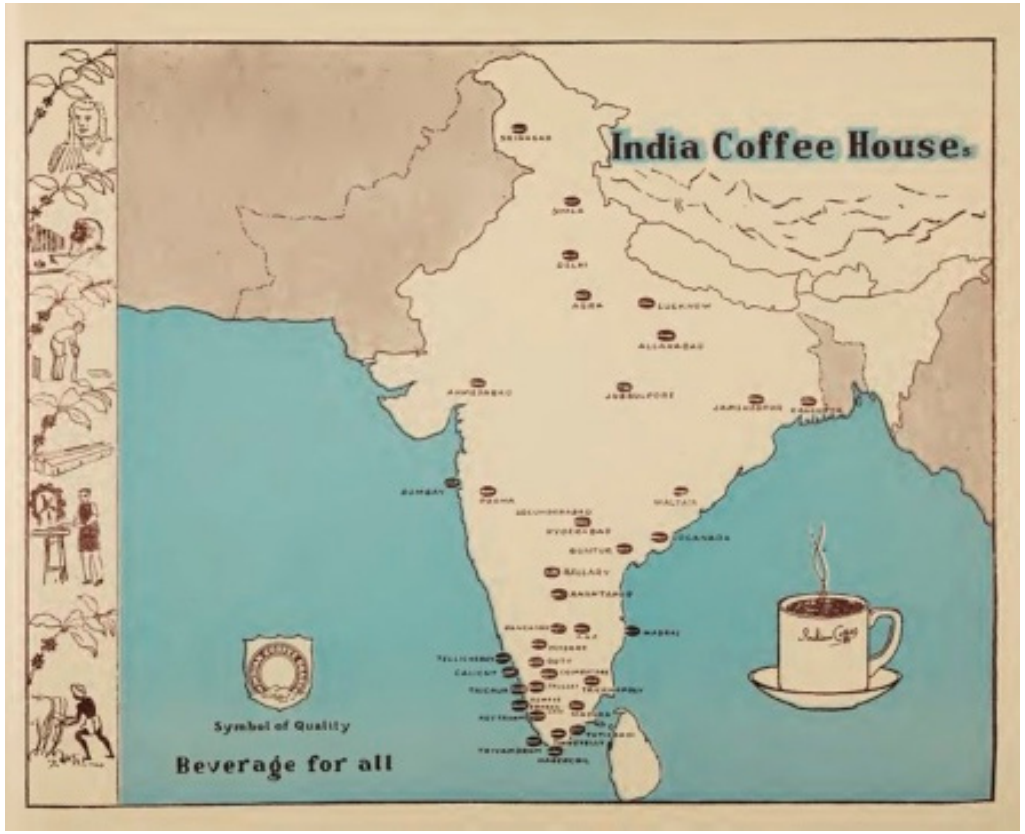
Another important characteristic of the third wave is the industry's focus on sustainability on the whole supply chain. With initiatives such as fair trade coffee which protects the coffee farmers by paying them a fair price, the usage of agricultural products that won't be harmful to the consumers and the collaboration between all of the involved in the coffee industry to make it a more sustainable one, make the third wave more of a global stage that affects in a positive manner everyone involved in the coffee world from the farmer to the consumer, from the seed to the cup.

In India, we are still at the beginning of the third wave and this projects tries to take advantage of this wave to enter into the market.

Coffee Culture

Coffee culture in India

Coffee culture in India is still a relatively new thing. It is continually maturing and evolving thanks to India's youth choosing coffee houses as places to meet up.



A map of Coffee Houses across the country. Image via Twitter

Top : Ambiance within one of the coffee houses
Bottom : The Coffee House at Thiruvananthapuram designed by famous architect Laurie Baker

Coffee Trends

This section looks at some of the trends in India and around the world. India has largely been a tea-drinking nation since time immemorial. However, coffee has become an increasingly popular drink since the turn of the twentieth century. It is now no longer a typical drink, but a refreshing and voguish beverage.

There is no going around the fact that Millenials and Gen-Zs love coffee and cafes. The reasons for the rise in Indian coffee trend and cafe culture are diverse. There is a growing brand awareness amongst the Indian people and a demand for luxury and comfort.

Cafes like Cafe Coffee Day have become a common place for the people to meet up or work

Social media trends influence coffee drinking habits of people

Adoption of innovative coffee-centric tools that make customizations possible

Wide variety of non-milk variants for vegans

Coffee Trends

Indian coffee trends are evolving as youngsters are open to trying new flavours and varieties. As the youngsters are looking for a diverse range of coffees, the cafes need to expand their menus and bring world favours to their plates.
Consumer demand for high-end brands and a comfortable lifestyle serve as the wonderful impetus for cafes and making cafes urban India's "hangout zones". In such a competitive market, brands will have to go above and beyond in developing their brand and creating an emotional connection with the customers, where their coffee becomes a happy habit and ritual.

People have started investing in good coffee brewers and coffee grinders.

Coffee infused alcoholic beverages

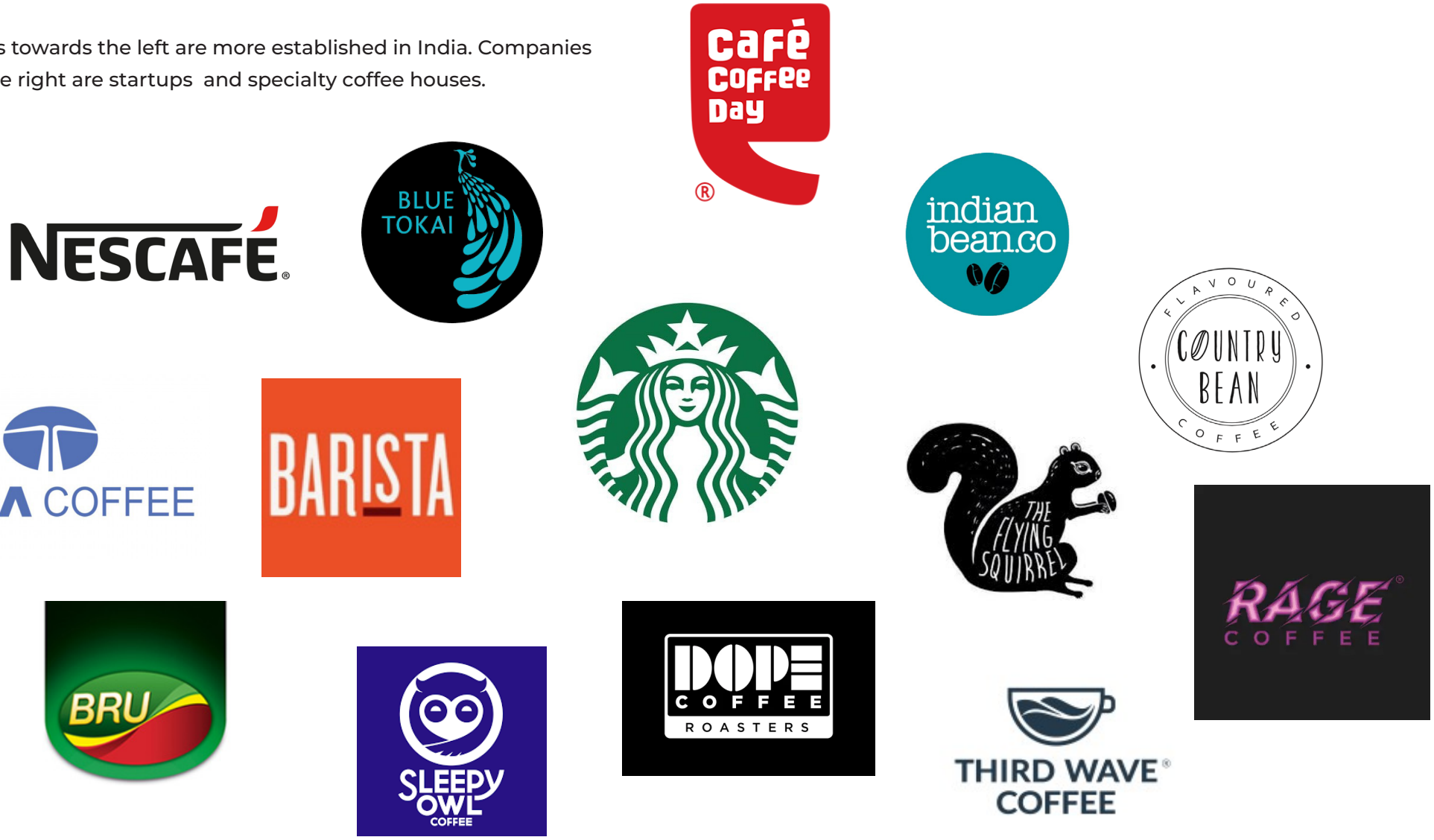
Community meet-ups organized to inform people about source of coffee and its brewing

Sustainability is an initiative adopted not only at the planter level but also businesses and cafes

Coffee Trends

Some prominent coffee companies in India

Companies towards the left are more established in India. Companies towards the right are startups and specialty coffee houses.



Coffee Trends

Coffee drinking preferences - Questionnaire

I floated a questionnaire with questions regarding peoples coffee choices and preferences.

Who answered the questions?
Majority of the participants were coffee enthusiasts between the age group of 18-30.

How many people answered?
101

Questions:

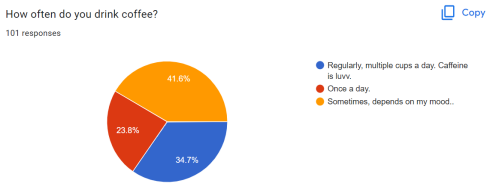
Preference of black coffee or with milk?

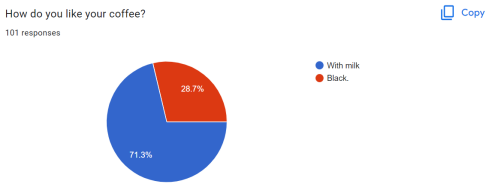
Frequency of drinking coffee?

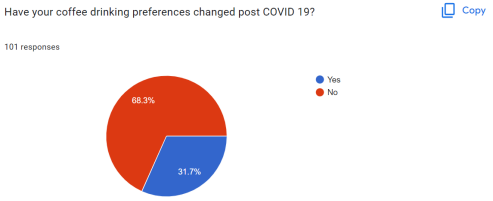
Method of making?

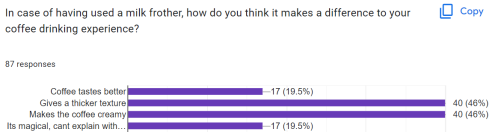
Difference made by frothed milk to coffee?

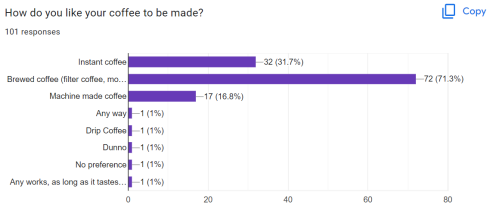
Change in preference post pandemic?











Based on the answers received, there were inferences made as shown on the next page

Coffee Trends

Coffee drinking preferences - Inferences

Questions:

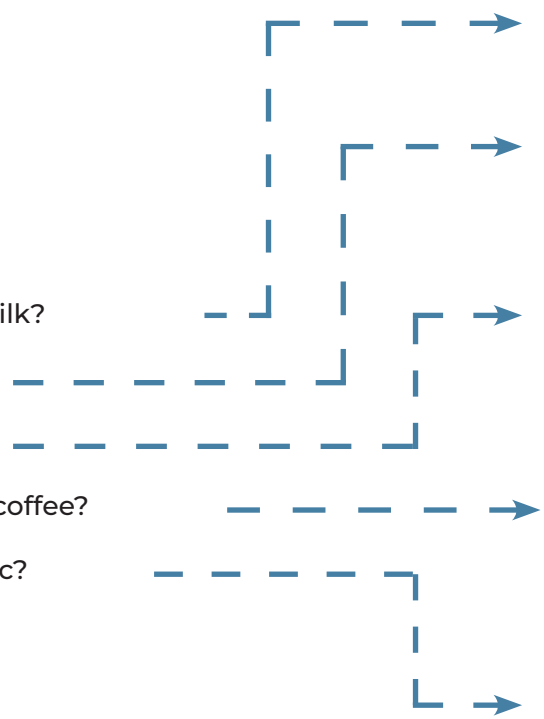
Preference of black coffee or with milk?

Frequency of drinking coffee?

Method of making?

Difference made by frothed milk to coffee?

Change in preference post pandemic?



Consumption of coffee with milk is more than black coffee.

High frequency of consumption. Many people prefer multiple cups per day

Brewing coffee at home using roasted and ground beans is preferred over instant coffee and machine made coffee

People like the creamy, thicker texture of coffee due to foamed milk in it since it enhances the taste and aroma of coffee.

Many people have started drinking more coffee because of WFH, stress, leisure etc. People started experimenting with flavors, brewing methods and bought coffee from newer coffee houses.

Coffee equipment for homes

This chapter looks at the type of coffee brewing products available in the market. It focuses on the visuals and aesthetics of these products which will help create a milk frother that follows the same design language.

Moka pots. Stove top espresso brewing.

The moka pot is a stove-top or electric coffee maker that brews coffee by passing boiling water pressurized by steam through ground coffee. Invented by Italian engineer Alfonso Bialetti in 1933, it quickly became one of the staples of Italian culture. Bialetti Industries continues to produce the same model under the trade name “Moka Express”.

Coffee equipment for homes

French press. Immersion.

A French press, also known as a cafetière, cafetière à piston, caffettiera a stantuffo, press pot, coffee press, or coffee plunger, is a coffee brewing device, although it can also be used for other tasks.
In 1923 Ugo Paolini, an Italian, filed patent documents relating to a tomato juice separator and he developed the idea of making a coffee pot with a press action and a filter. He assigned his 1928 patent to Italian designer Attilio Calimani and Giulio Moneta who filed it in 1929.

Coffee equipment for homes

Chemex. Gravity brew. Drip. Pour over. Infusion

This is one of the devices that use brewing method called ”infusion”, sometimes also called ”drip” or ”gravity brew”.
Infusion is the method where water is running through the coffee bed in a filter and down into a vessel below.

In 1941 German chemist Peter J. Schlumbohm invented this brewing device. He combined a laboratory glass funnel and an Erlenmeyer flask still widely used in laboratories. In this combination, an air funnel was needed to make a space for the air escaping when water was poured in. This funnel is up in the front of the device.










Coffee equipment for homes

Aeropress. Immersion + pressure.

AeroPress is a complete immersion method similar to French Press. You need to put coffee and water in, stir it, let it sit for some time, and then press it through the paper filter into your cup. The AeroPress is a piston-style brewer that plunges coffee through a thin paper filter into a cup.

Though it makes just a single cup, its size and sturdiness make it a favourite device among travellers and campers. Plus, AeroPress delivers a perfect cup of coffee rich in flavour and taste.

Coffee equipment for homes

Grinders.

The way in which beans are ground makes a difference in the flavor of the coffee, because chemical changes take place in the beans depending on the process used to grind them. Flavor is also dependent on the consistency of the grind (how coarse or fine) as different brewing methods have their own requirements. For example, espresso uses very finely ground coffee, virtually powder-like, while drip coffee makers use a medium to coarse particle size.

Types of coffee

There is a huge variety of types of coffee that is consumed across the globe. Here are 25 of the most common ones:

From these, majority of the types required some form of milk.

Milk

This chapter looks at introduction of milk in coffee . It briefly explains why milk is aerated, the processes involved and the factors that affect the outcome.

What is aerated milk?

It is the process of introducing air to the milk. A practice that was introduced centuries ago.

13th century: **Cheese**

16th century: **Whipped cream**

17th century: **Ice cream**

19th century: **Cappuccino**

Milk Foam

Processes used to foam milk

Injection

Steam injection frothing is a non-isothermal method, which employs steam flow to draw air and simultaneously heat up the milk. Like any foam, the milk foams produced by steam injection begin to destabilize soon after the steam flow is switched off, causing their characteristics to change continuously with time. This process is also accompanied by a drop in temperature which further influences foam properties.

Agitation

Mechanical agitation is a method in which air is forced into the milk by continuous vertical or rotational motion of either a coiled spring or a mesh, that creates bubbles in the milk, increasing its volume. The same factors affect the mechanical agitation as observed in injection of air into the milk.

Milk Foam

Types of foams

Microfoam

The term “microfoam” describes a quality of frothed milk in which the bubbles are so small and so numerous that they can’t be seen, but they can be felt on the palate—namely as a texture that is something like liquid velvet.

This type of tight, luscious steamed milk will marry completely with the espresso when poured correctly, rather than separate into distinct layers of thin liquid milk and dry, stiff froth that lays on top of the coffee in question.

Macrofoam

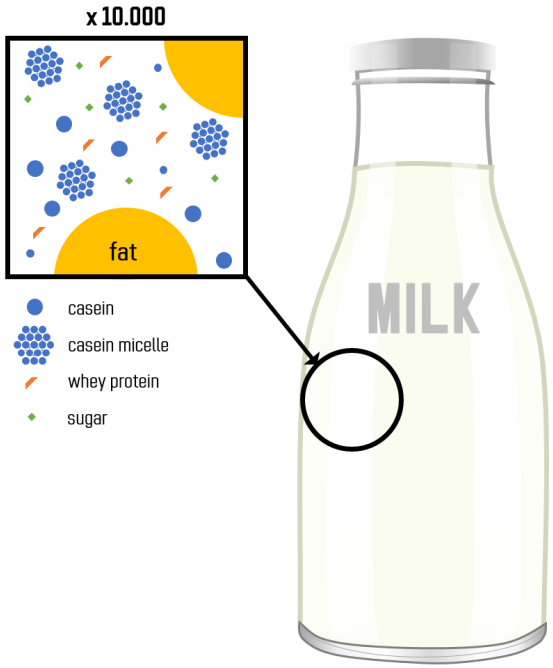
This is similar to microfoam, but with much larger, more visible bubbles. Often called froth, or dry-foam, this is used to top coffees. Frothed milk is typically considered to be drier than steamed milk, because it contains more air.
In this type, the foam layer is separate from the milk and when poured into the coffee, the foam floats on the top. The milk texture on the bottom remains more or less the same.

Milk Foam

Factors that affect the aeration process

Composition of the milk

There are two groups of milk proteins: caseins and whey proteins. They have different structures and behave in different ways under stress conditions. So they do different things when you heat and foam them.
In milk's natural state, reactive chemical groups are buried within the complex structures of whey proteins. Those groups become exposed when the whey protein unfolds during heating.
Because those chemical groups are reactive, they form new bonds within the unfolded structure and with other milk components. And this has an effect on how milk foams.



Temperature of milk

Any heating affects the chemical structure of milk proteins. But how much it impacts the milk depends on the temperature and the duration of heating. When milk is foamed between 30oC and 40oC, it is unstable. Large air bubbles forming within a few minutes. Raising the temperature to 60oC results in more stable foam and improvement of texture and density. Smaller and better-dispersed air bubbles are formed at higher temperatures.
Fat plays a role in stabilising these bubbles. At temperatures above 40oC all of the lipids in milk melt. This liquid fat helps prevent air bubbles from coalescing (joining together to create a large air pocket) by creating a film on the surface of the air bubbles.

Milk Foam

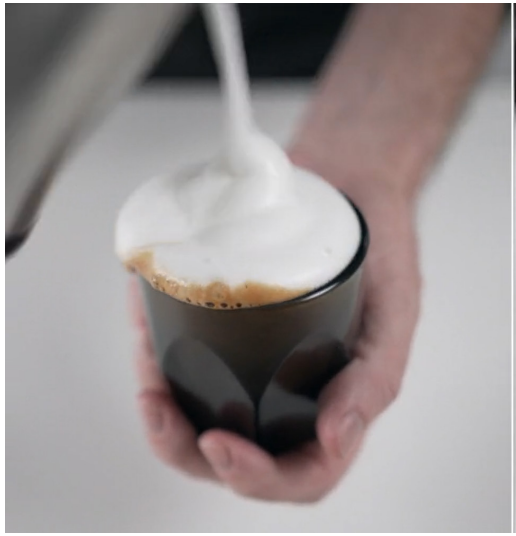
Why aerate milk?

Milk is aerated to create a light and foamy texture. This light and airy foam is essential for many coffee drinks. It adds a richness to the milk as well as a creamy texture to the coffee. It enhances the coffee drinking experience by intensifying the coffee aroma.

Why microfoam over macrofoam?

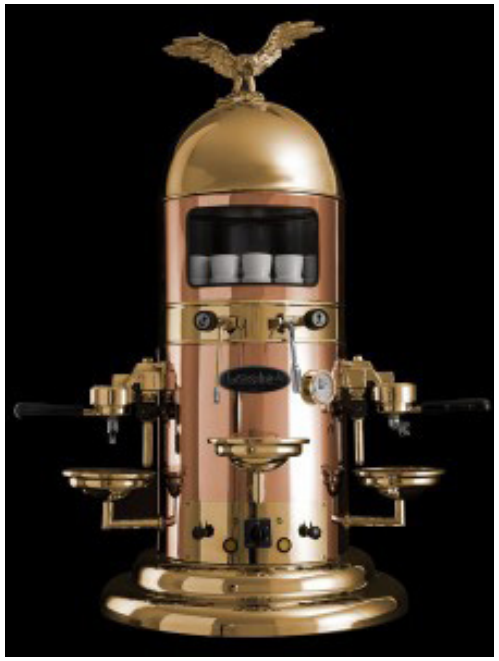
Milk frothers simply whisk the milk creating dry foam, a big bubbly substance that quickly separates into layers. Dry foam does not mix with espresso and crema, instead it sits on top creating separate layers of milk and coffee flavors.

Microfoam seamlessly blends with espresso, enhancing the flavor profiles and mouthfeel of the drink.



Milk Frothers

Milk frothers over the years:



1903 : Espresso machine with steam wand

1927 : The design of present day manual pump frother was inspired by the French press that could also be used as a frother.

1999 : Frothing wand

2000's : Electric frother

Area of intervention

This project focuses on affordable frothing solutions at home. For this the area of focus is the pump frother and the hand held electric wand for the following reasons:

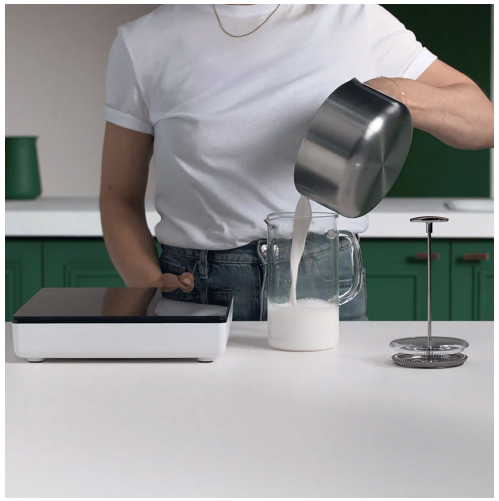
1) Affordable
2) Easy to use
3) Compact
4) Light weight
5) Does not use electricity
6) No heating element required
7) Easy to store

Types Milk Frothers _ market study

Manual frother

Pros
Not dependent on batteries or electricity
Produces lots of thick foam
Price range: Rs. 699 - 2000

How to use



Heat the milk to 140°F. Dont let it boil. Stir occasionally. Pour the warm milk into the coffee press. Leave space for it to double in volume. Raise & lower the plunger to froth. Gradually increase the tempo. Plunge for 30 seconds or until the milk has doubled in volume. The milk is done frothing once it has doubled in volume.

Types Milk Frothers

Hand held electric wand

Pros
It is the most compact and affordable option.
Convenient for other light whisking jobs like eggs, matcha, and dressings.
Easy to clean if its water proof
Price range: Rs. 99 - 3500

How to use

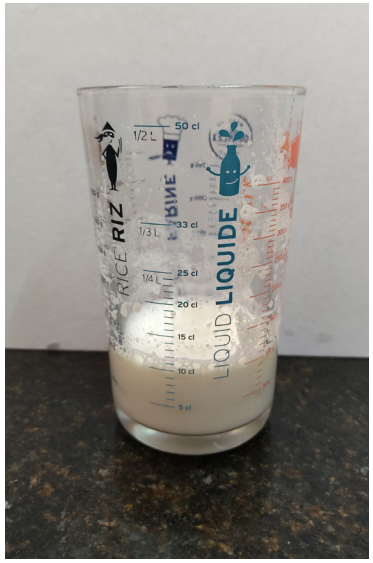
Heat the milk to 140°F. Dont let it boil. Pour the milk into the mug
Leave space for it to double in volume. Place the whisk into the milk
Start whisking close to the mug's base. Whisk in circles for 15–20 seconds.
When the milk starts to thicken, raise your whisk to just below the froth.
Carefully pull the frother out of the milk. The milk is done frothing once it has doubled in volume.

User study

Aim:
Froth different types of milk and observe the amount of foam produced and possibility of creating coffee art with it.
To identify problems in existing products

Full cream milk, Low fat milk, Toned milk, Lactose free milk, Soy milk, Instant coffee, Hand held frothing whisk, Manual whisking pump

Prerequisites



100ml of milk

Instant coffee used as espresso shot

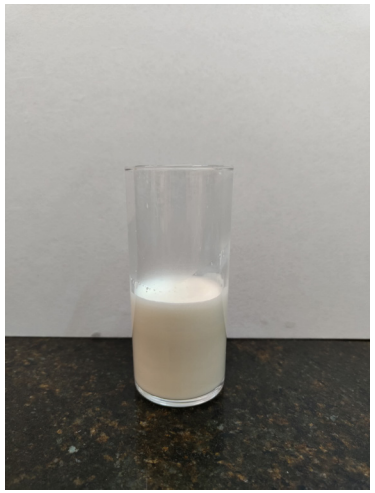
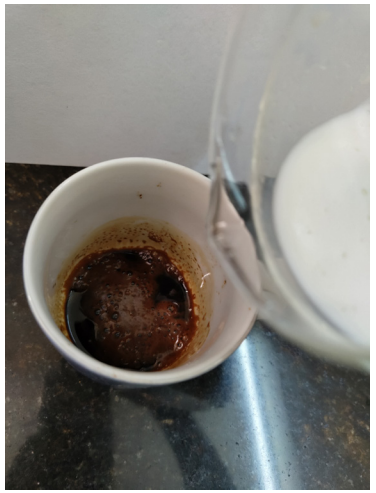
With hand held whisk, milk frothed for 15-20 seconds
With manual frothing pump, milk frothed with 20 pumps

User study

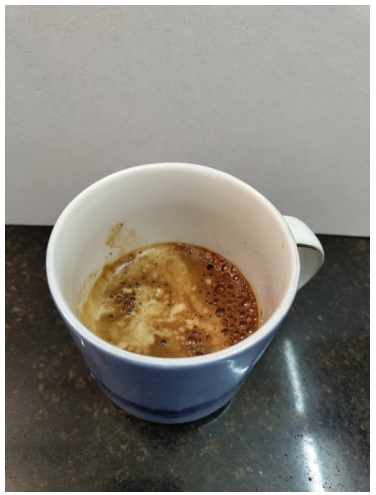
Milk type 1- Toned milk

The same quantity of milk was used to foam with a hand held electric whisk and a manual pump. The foam made was then poured into the espresso with an intent to create coffee art. The foam consistencies were compared and inferences were made based on the observations.



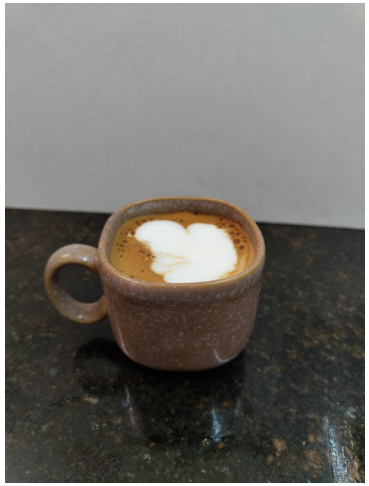




User study

Milk type 2 - Low fat milk

The same quantity of milk was used to foam with a hand held electric whisk and a manual pump. The foam made was then poured into the espresso with an intent to create coffee art. The foam consistencies were compared and inferences were made based on the observations.



User study

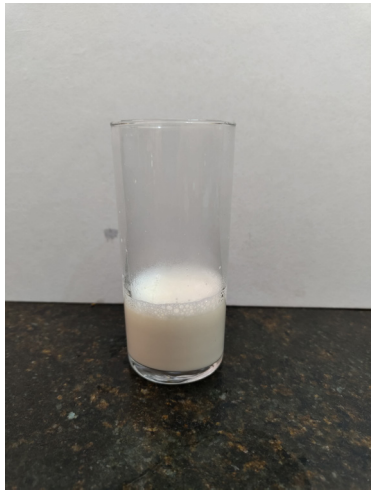
Milk type 3 - Full cream milk

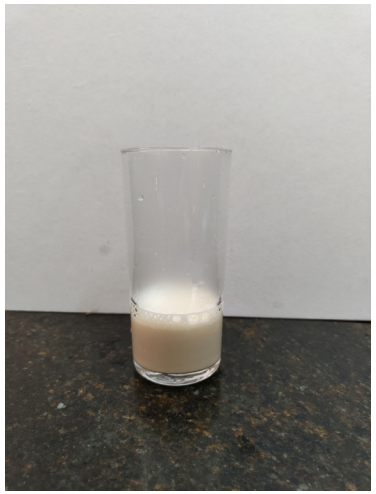
The same quantity of milk was used to foam with a hand held electric whisk and a manual pump. The foam made was then poured into the espresso with an intent to create coffee art. The foam consistencies were compared and inferences were made based on the observations.

User study

Milk type 4 and 5 - Lactose free and Soy milk

The same quantity of milk was used to foam with a hand held electric whisk. The foam made was then poured into the espresso with an intent to create coffee art. The foam consistencies were compared and inferences were made based on the observations.





User study

Inferences

Based on the experiment, it was observed that it is difficult to pour the froth and also make coffee art with containers without a spout. The electric wand produces smaller bubbles compared to the manual pump. It is important to maintain the temperature of the milk in order to produce stable foam. There is a minimum quantity of milk required (more than 200ml) to achieve the desired consistency of foam.

Making Coffee art

From the experiment, it was evident that making coffee art requires a lot of skill and practice and depends on a lot of variables:
Skill of the user
Type of milk- composition of milk
Coffee cup size
Quantity of espresso shot

Why is macrofoam formed?

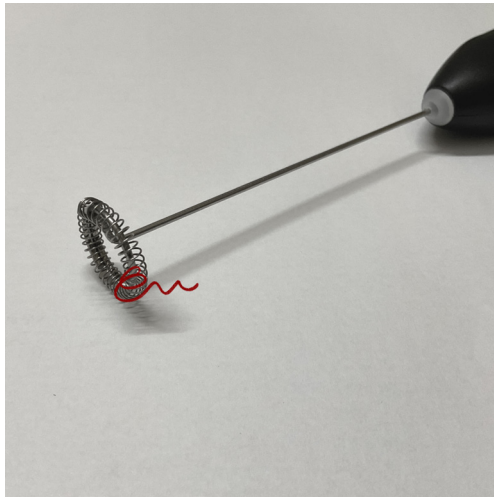
The above conducted experiment produced macro foam which is not desired to be able to make coffee art. It also doesnt give the milk a mouth-feel texture and instead just floats on top. It is important to know why macrofoam is formed, in order to be able to form micro foam.

In the manual pump, continuous pumping motion constantly keeps adding air into the milk.

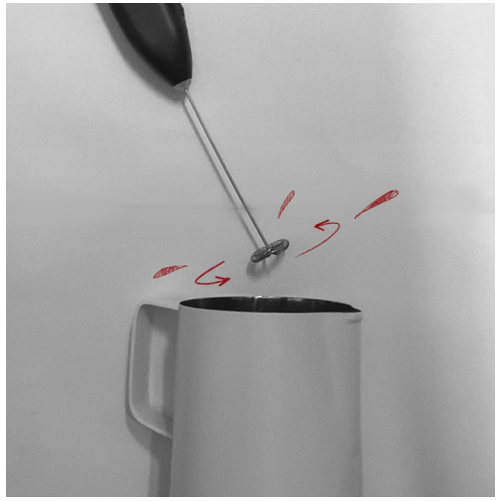
In the electric wand, circular motion creates a whirlpool adding air from the surface. But there is nothing to break the bigger bubbles

Problem Identification

Hand held wand

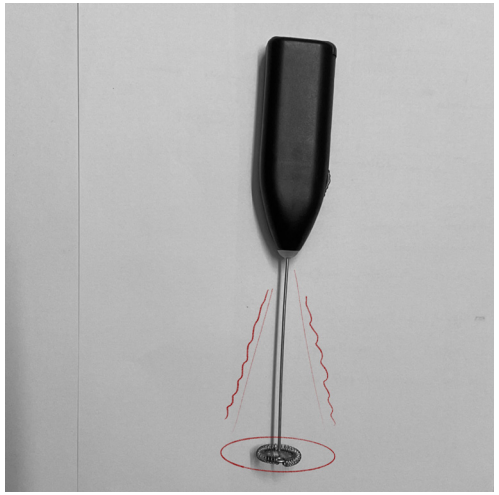


Milk cream gets stuck in the spring, Difficult to clean



Since milk is foamed without a lid, lots of milk splashes out of the jar
Also cools down the milk

Battery operated, battery drains out even when not in use and might stop while frothing

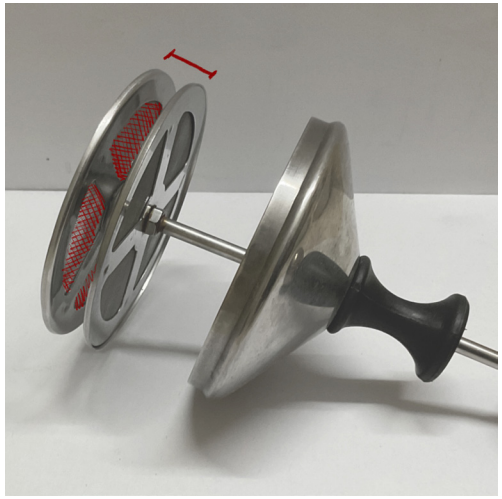


The stem might bend if not stored properly, wand wobbles when used

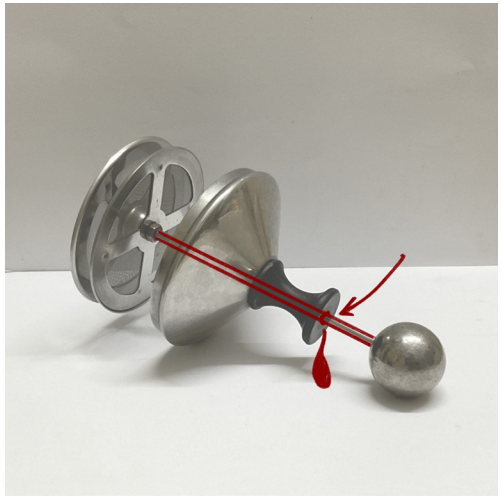
Not all versions are waterproof.

Problem Identification

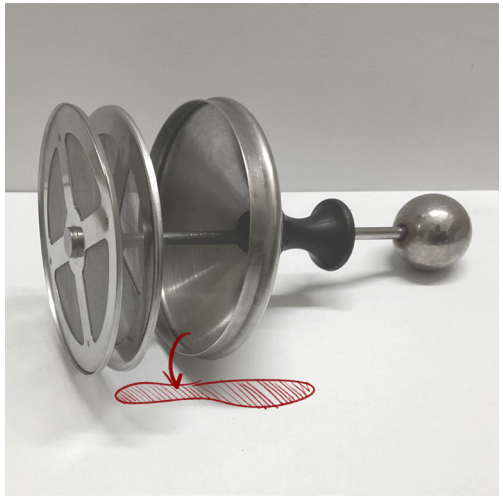
Manual frother



Very less space between mesh to clean inner surface
Milk particles often get stuck



Milk leaks out through the hole in the handle



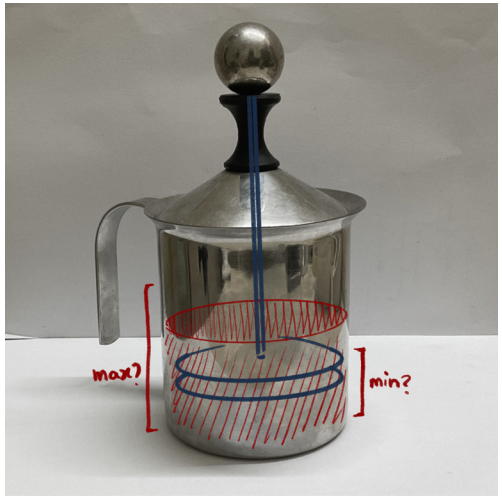
Milk accumulates and spills because of current design

Doesn't have a spout/nose to pour foamed milk

Problem Identification

Manual frother

Not an ergonomic design



No indication for quantity of milk, too less it wont froth, too much it will leak

Operation requires 2 hands

Surface dissipates the heat of the milk, no temperature indicator

Brief

Design a milk frother that produces microfoam, which is affordable and easy to use.

Aim :
To achieve cafe like microfoam using a manual frother instead of macrofoam produced by frothers available in the market

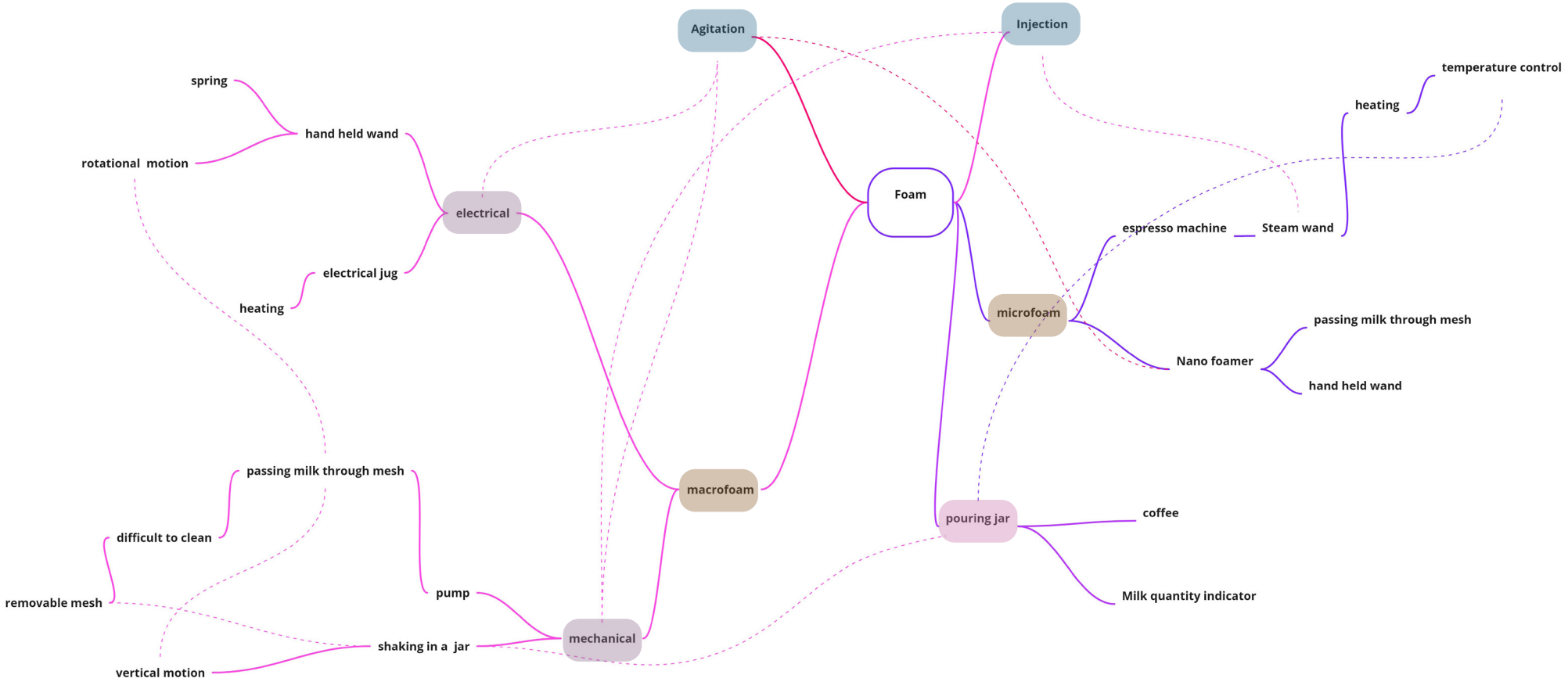
Good to haves :
Uses a simple mechanism which is easy to clean.
Indicator for quantity of milk required, ideal for a cup
Container can maintain the milk temperature

Features :
Should have a spout to pour foam
Must follow the design language of existing coffee making products
Can be operated by one hand
Detachable mechanism which is easy to clean
Small in size so that its easy to store
Should be lead proof

Mind Mapping

Implementing the observations made during market study and user testing, a mind map was made based on four parameters:
Process of foaming, Type of foam, Type of appliance, Other accessories required in the process

Connections were made between the four parameters which revealed the design scope and potential, based on which ideations were made.



Design Innovation

A quick secondary research was conducted to find out innovation and practices in the current range of contemporary coffee making products that can be applied during the process of designing the intervention.

Design for convenience
Filters out three different sizes of coffee grounds

Design for sustainability
Made from recycled coffee husks combined with a binding agent

Pours into two cups at once

Design for multi functionality
Grinding, brewing, filtering, travel cup

Material and process innovation
it is milled out of one solid block of aerospace-grade aluminum using a CNC machine.

Design for senses
Rim sizes and shape allows coffee to interact with different areas of the tongue, designed to focus and trap the aroma.

Product mapping

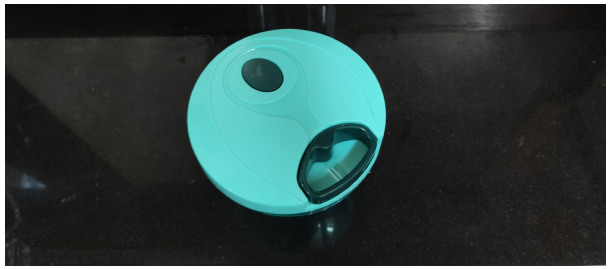
Coffee making products

Product mapping

Frothers

Alternative Mechanism

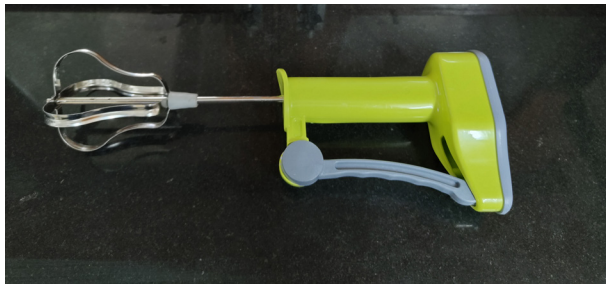
An exploration was done to arrive at the suitable mechanism for a manual frother. There were three mechanisms are as follows:



Onion chopper

Converts horizontal motion to rotational motion

Unidirectional motion



Whisk

Converts horizontal motion to rotational motion

Uni directional motion



Whisk

Converts vertical motion to rotational motion

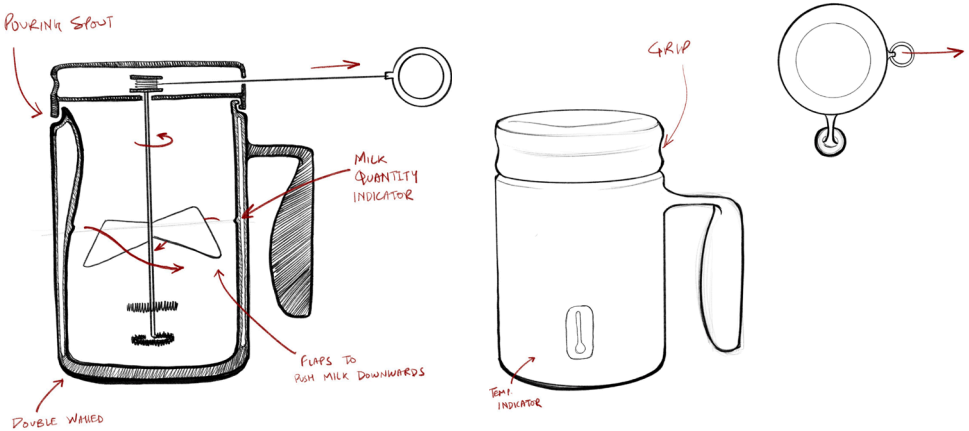
Bi-directional motion

All the three mechanisms were tested to see the kind of foam produced. As seen in the pictures above, all of them produced macrofoam that is separate from the milk.

Mechanism Ideation

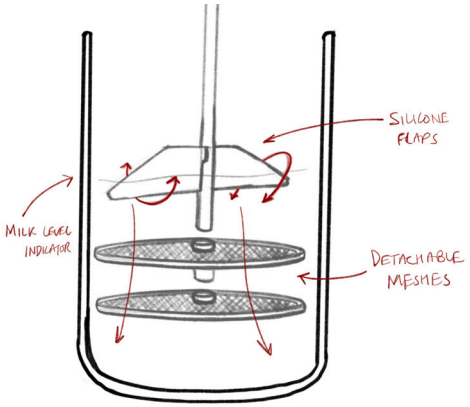
Mechanism 1 - Option 1

This mechanism used the concept of manual onion chopper. The central shaft spins when the string is pulled. To foam the milk, two flaps were added that push the milk downwards, towards the circular springs below. These springs force air into the milk, eventually frothing it. The flaps also keep introducing the foam formed at the top back into the springs to break the bigger bubbles further.



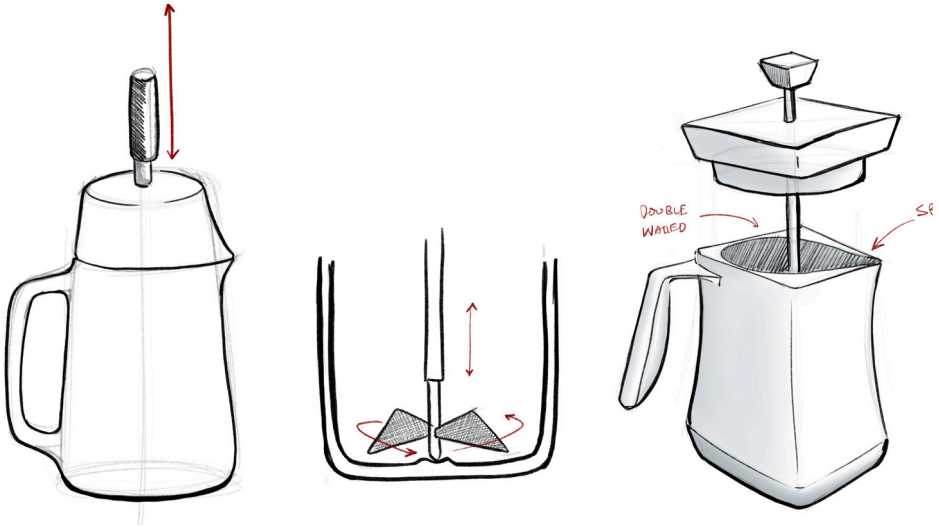
Mechanism 1 - Option 2

Alternatively, the springs can be replaced by circular meshes through which the milk is forced into by the flaps. These mesh frames are attached magnetically, hence making it easy to detach and wash.



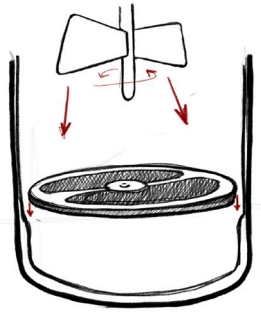
Mechanism 2 - Option 1

This mechanism used the concept of manual whisk which converts vertical motion into rotational motion. There are flaps with mesh attached at the bottom of the central shaft that force air into the milk when they spin. They are inclined so that they create a whirlpool that keeps reintroducing milk into the mesh, breaking it into further tiny bubbles.



Mechanism 2 - Option 2

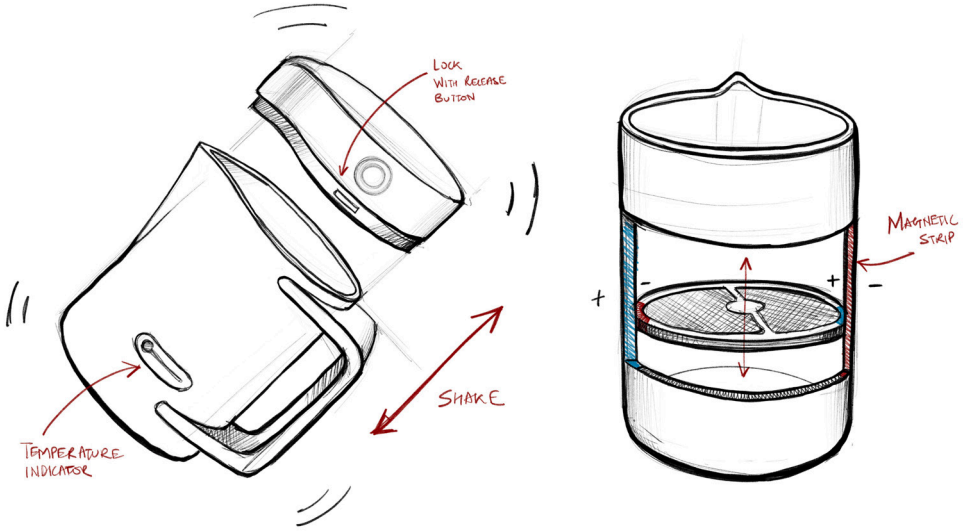
Alternatively, the mesh flaps can be replaced by solid flaps, that push the milk into the mesh below. These flaps also help break the bigger bubbles



Mechanism Ideation

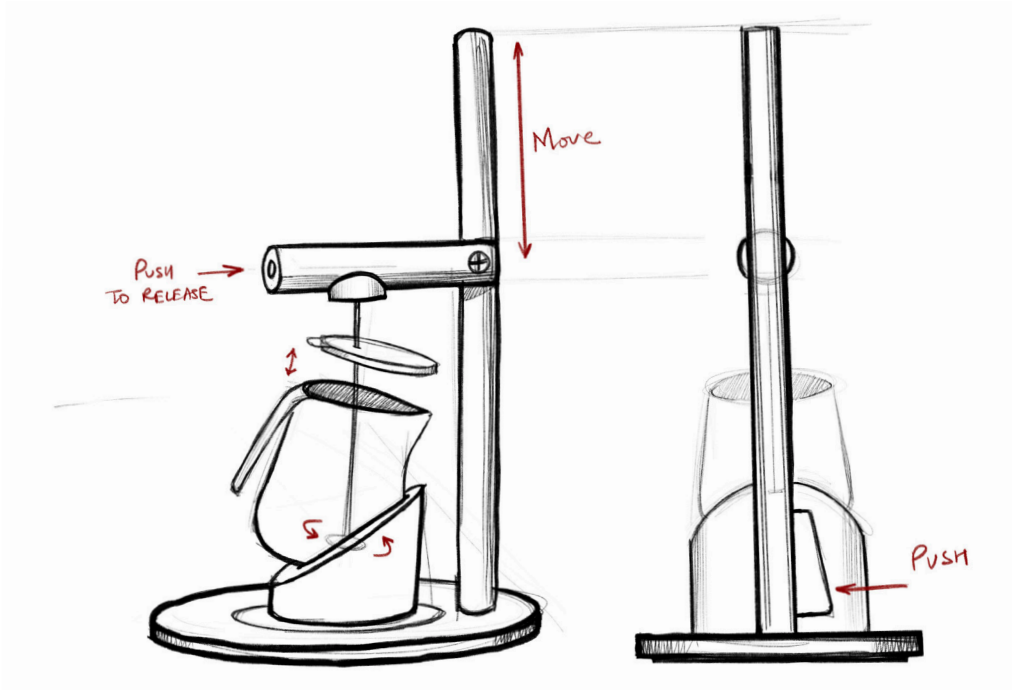
Mechanism 3

This mechanism takes inspiration from the mason jar method. It includes filling a jar with milk, closing the lid tightly and shaking the jar vigorously till the milk froth. Adding to it, a mesh frame can be added to the jar that moves to and for as per the movement of the jar. This mesh adds air to the milk and breaks bigger bubbles. it is kept in horizontal position by magnetic strips along the walls of the container.



Mechanism 4

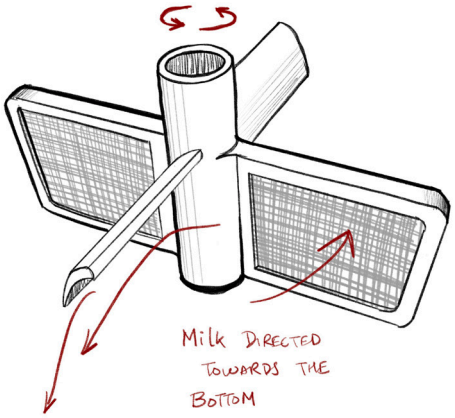
This mechanism uses the hand whisk system which incorporates a pull trigger that rotates the shaft. This mechanism can be incorporated in a sculptural way, breaking away from the form of standard coffee making products.

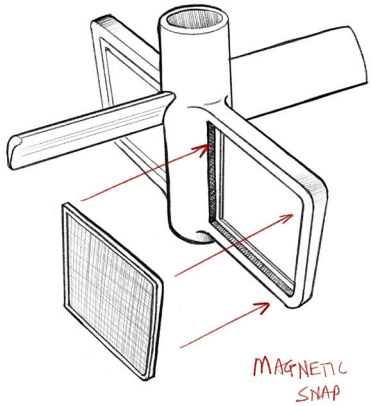


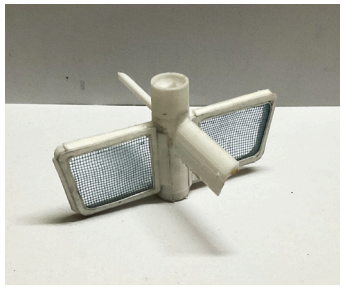
Mechanism Ideation

Mechanism prototype 1

From the above mentioned mechanisms, a prototype was derived to test the concept. It consisted of two flaps that break the bigger bubbles and push the milk towards the mesh frames. These mesh frames also rotate along with the flaps, aerating the milk.
The mechanism was installed in an onion chopper and milk was added to be frothed. The result was compared to the foam consistency achieved from other frothers.



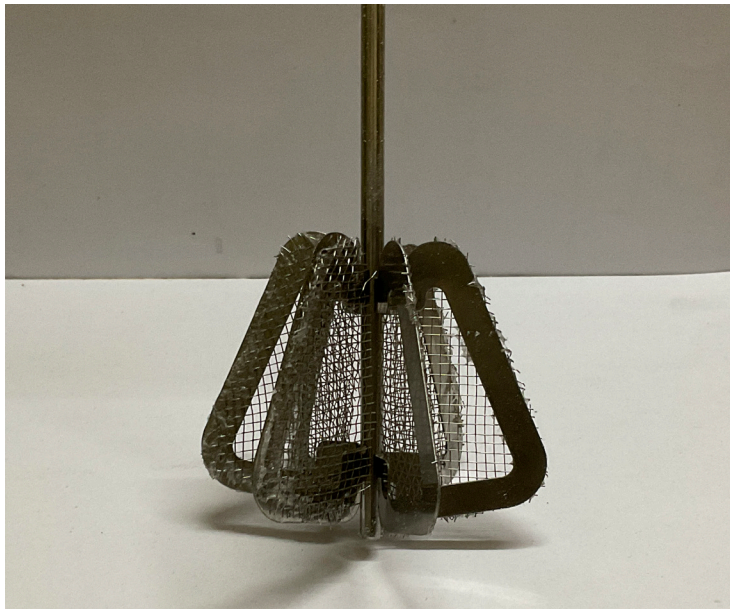




3D printed prototype with plastic mesh. milk added into the container up till the flap, resultant milk texture.

Mechanism prototype 2

Another mechanism was devised to compare the outcomes. Prototype two incorporated a mesh attached to the manual whisk. The resultant foam was compared to ad electric wand and prototype 1.



Proof of concept

Foam comparison

The foam achieved from an electric whisk, prototype 1 and prototype 2 were compared.
As seen below, the texture of milk achieved by prototype 1 is very different from the other two. Foam from electric wand and prototype 2 is thick with bigger bubbles. It is also separate from the milk. For prototype 1, the consistency is smooth, the bubbles are smaller and the froth is not separate from the milk.
This is the kind of foam achieved by steaming milk, and it prototype 1 mimics it closely. Hence proving the concept

Electric wand

Prototype 1

Prototype 2

Current coffee products

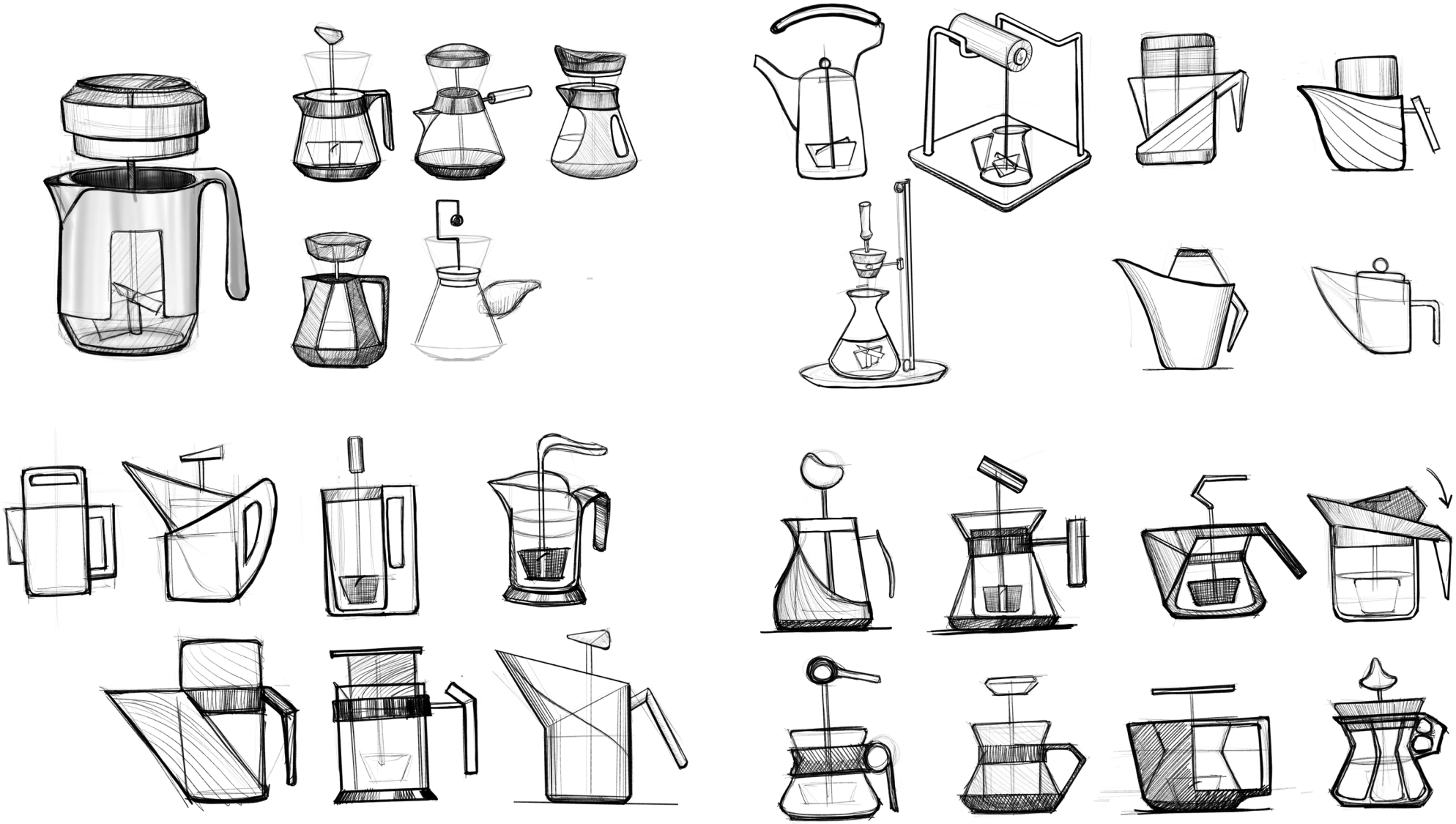
This section looks at the overall design of a large variety of coffee making products, eventually leading to a selection of them that will form the moodboard

Current coffee products

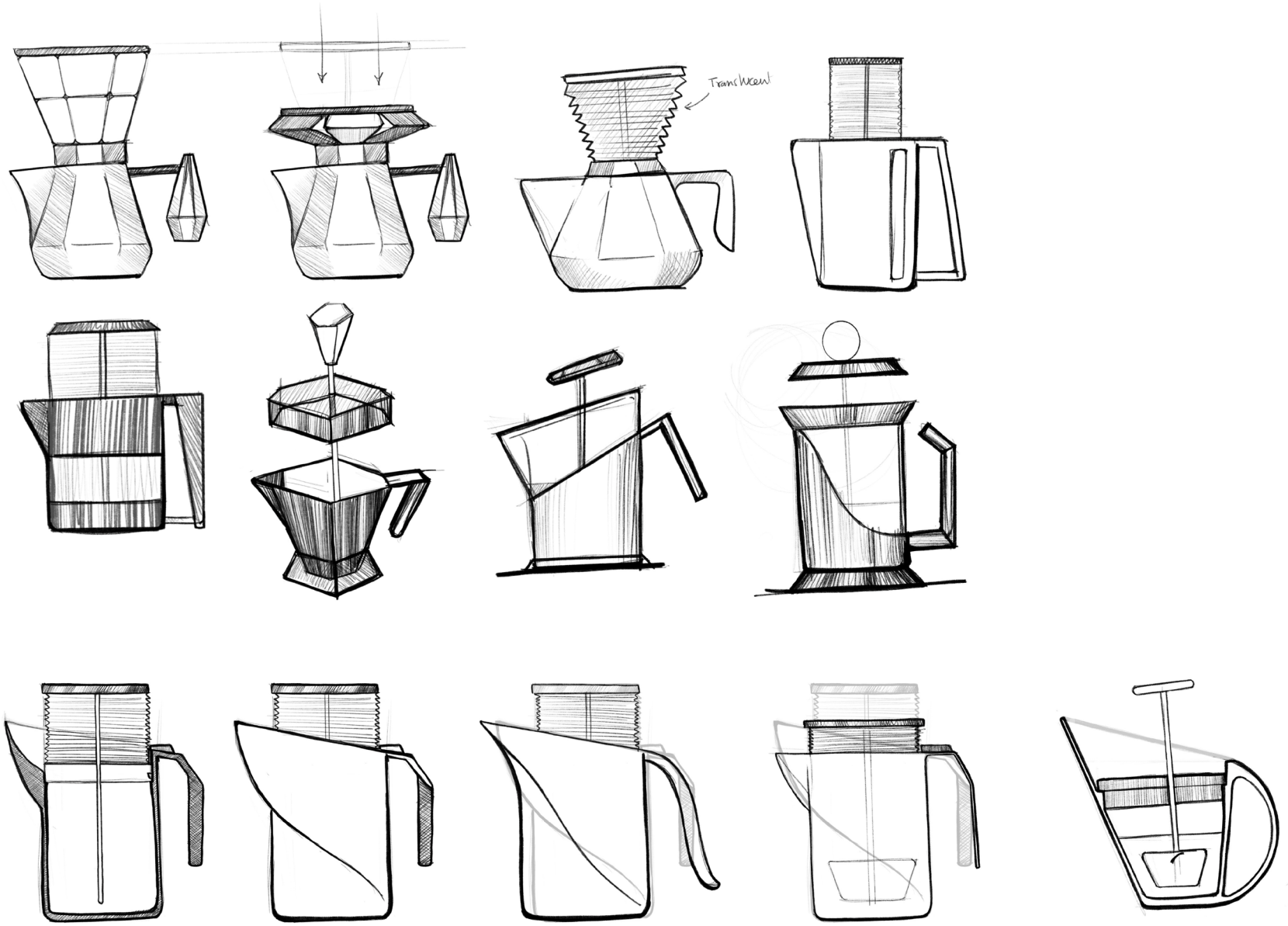
Current coffee products

Moodboard

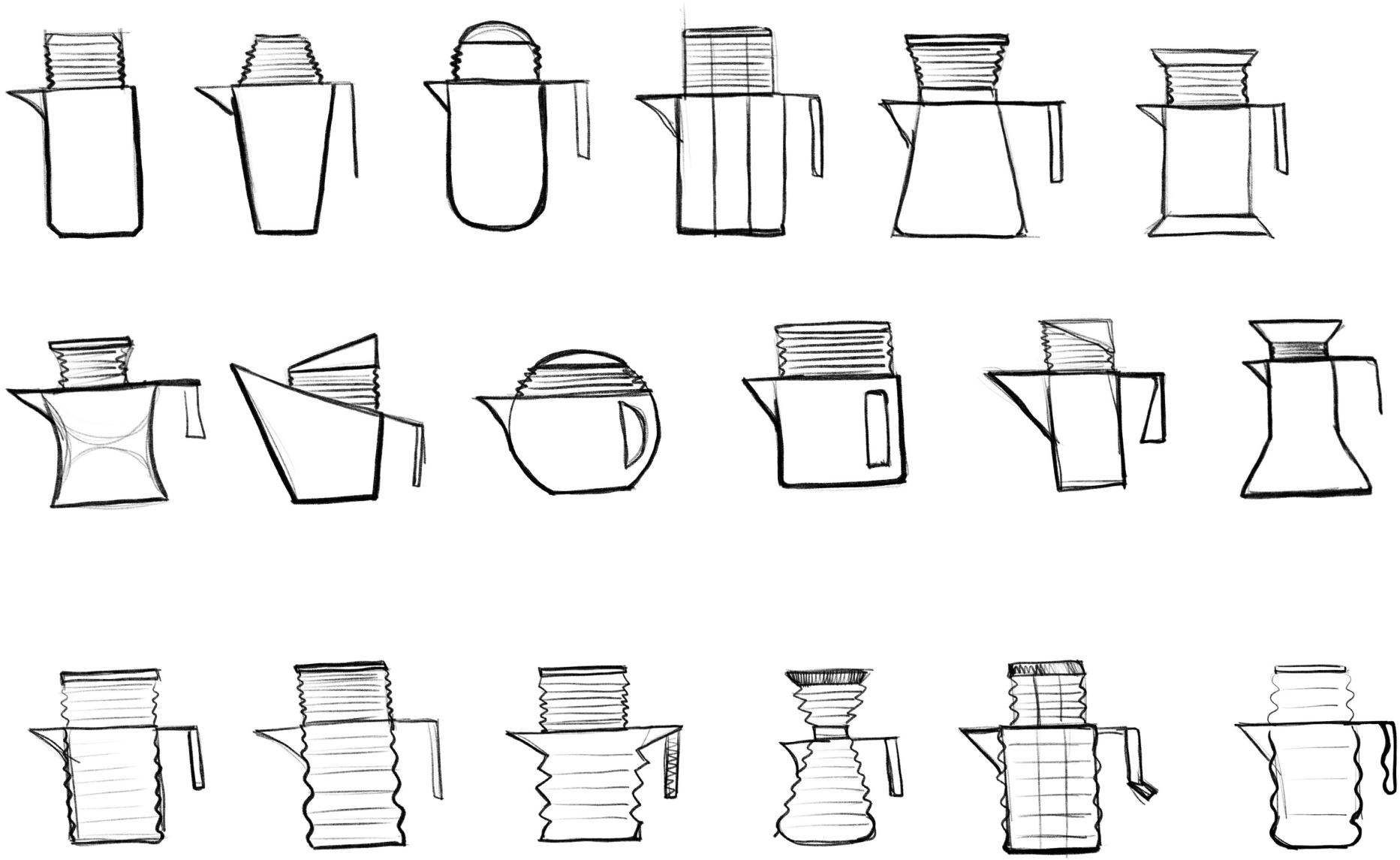
Formal exploration



Formal exploration



Formal exploration



Concept 1

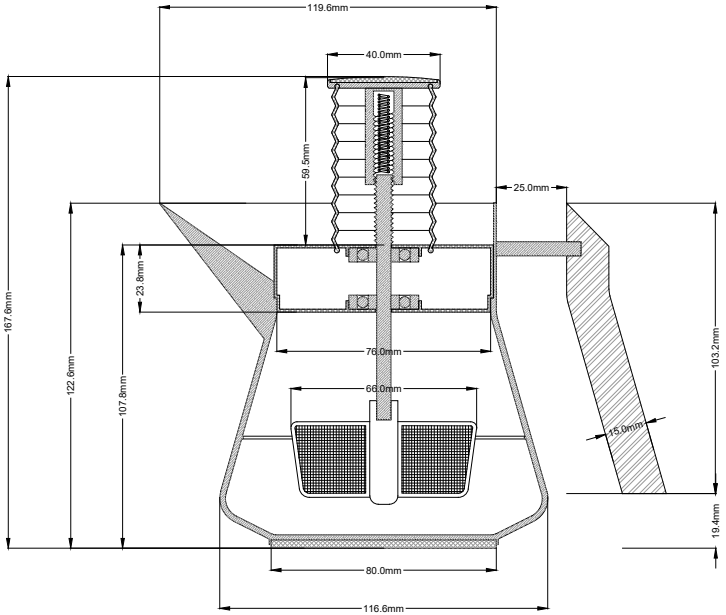
Most common form of coffee making products

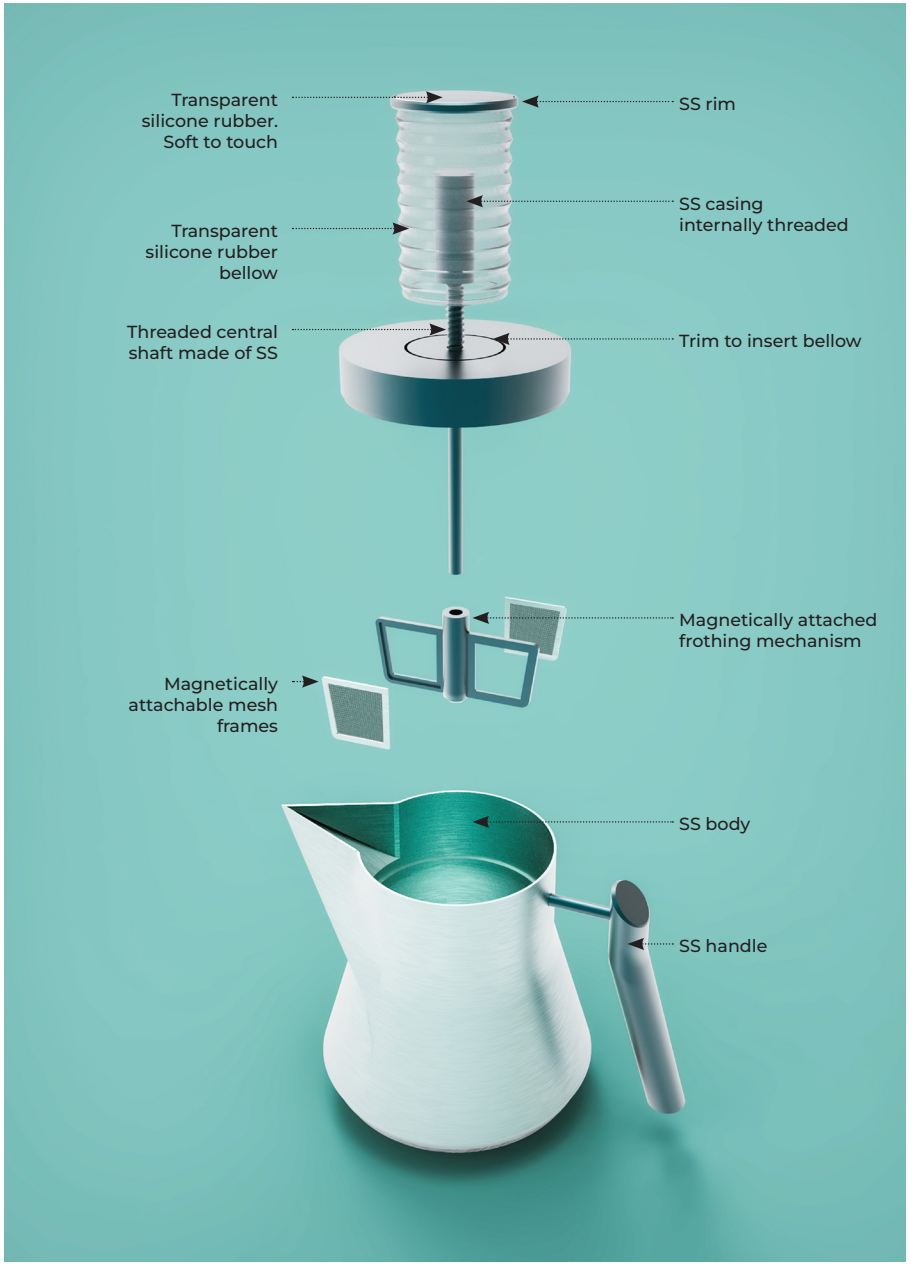
Pulling out a spout and indicating curvature for flow

Handle follows body's form, inclined top to rest thumb

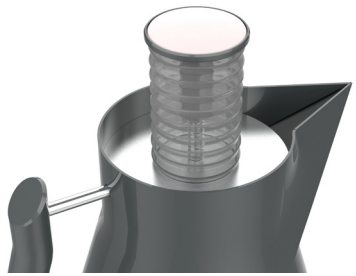
Bellow added to suggest pushing down. motion inspired from french press and areo press

Dimensional drawings

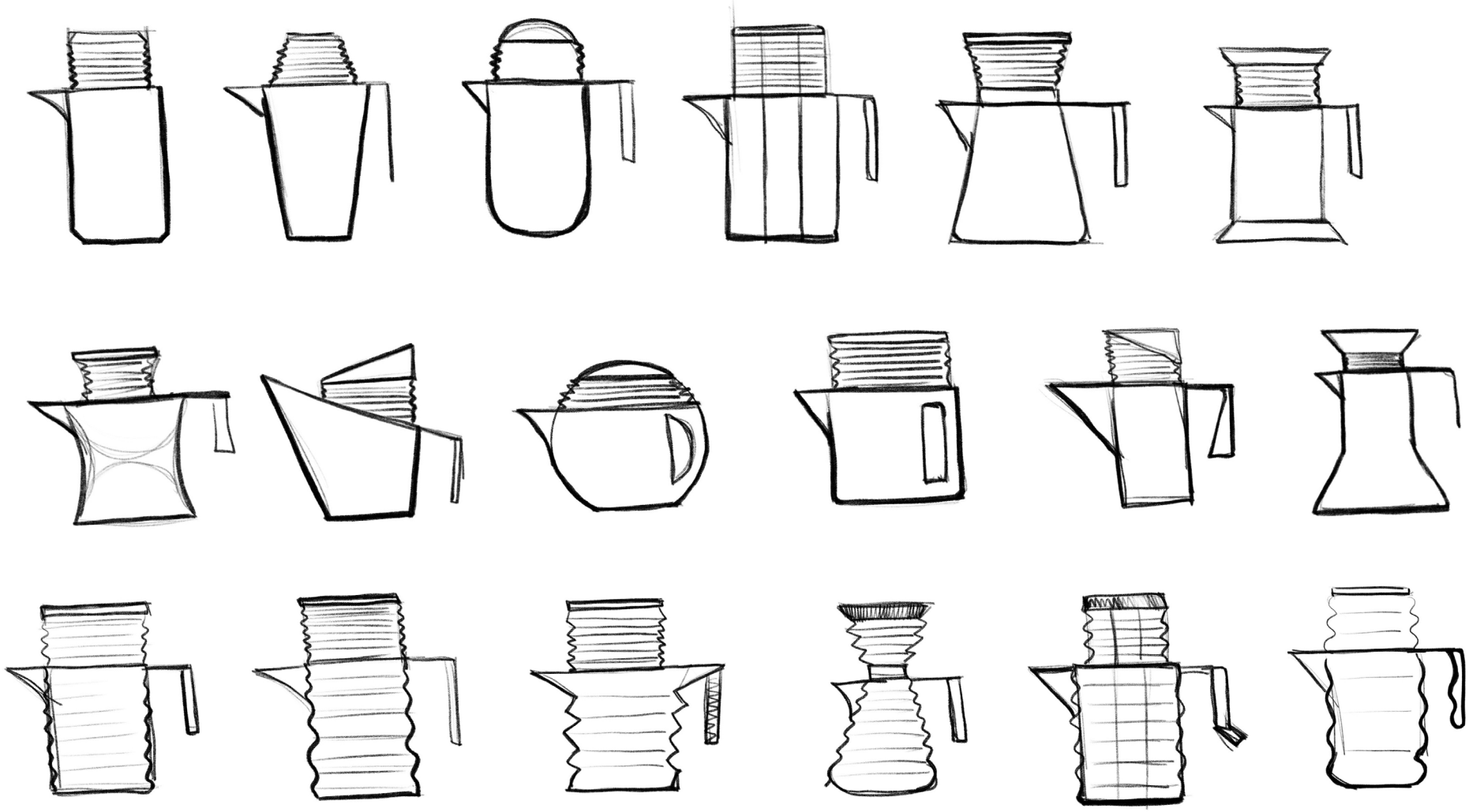




Concept 1

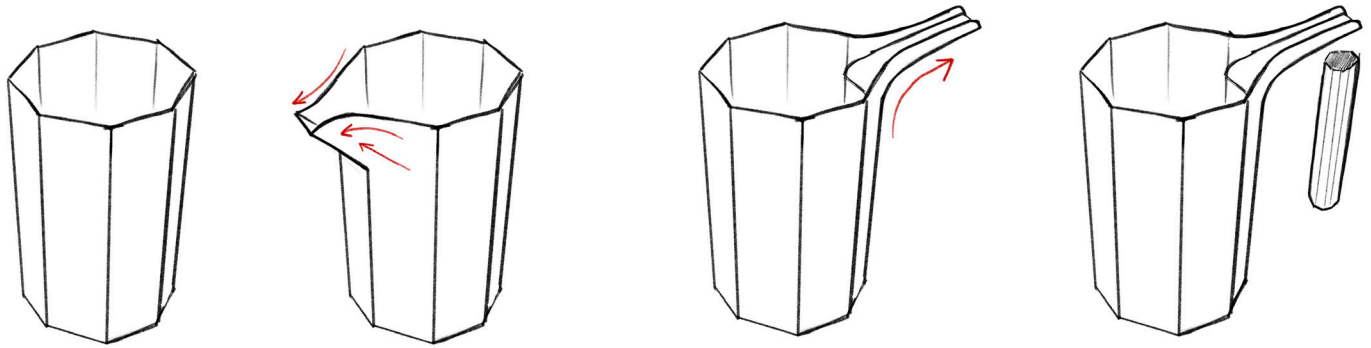


Concept 2



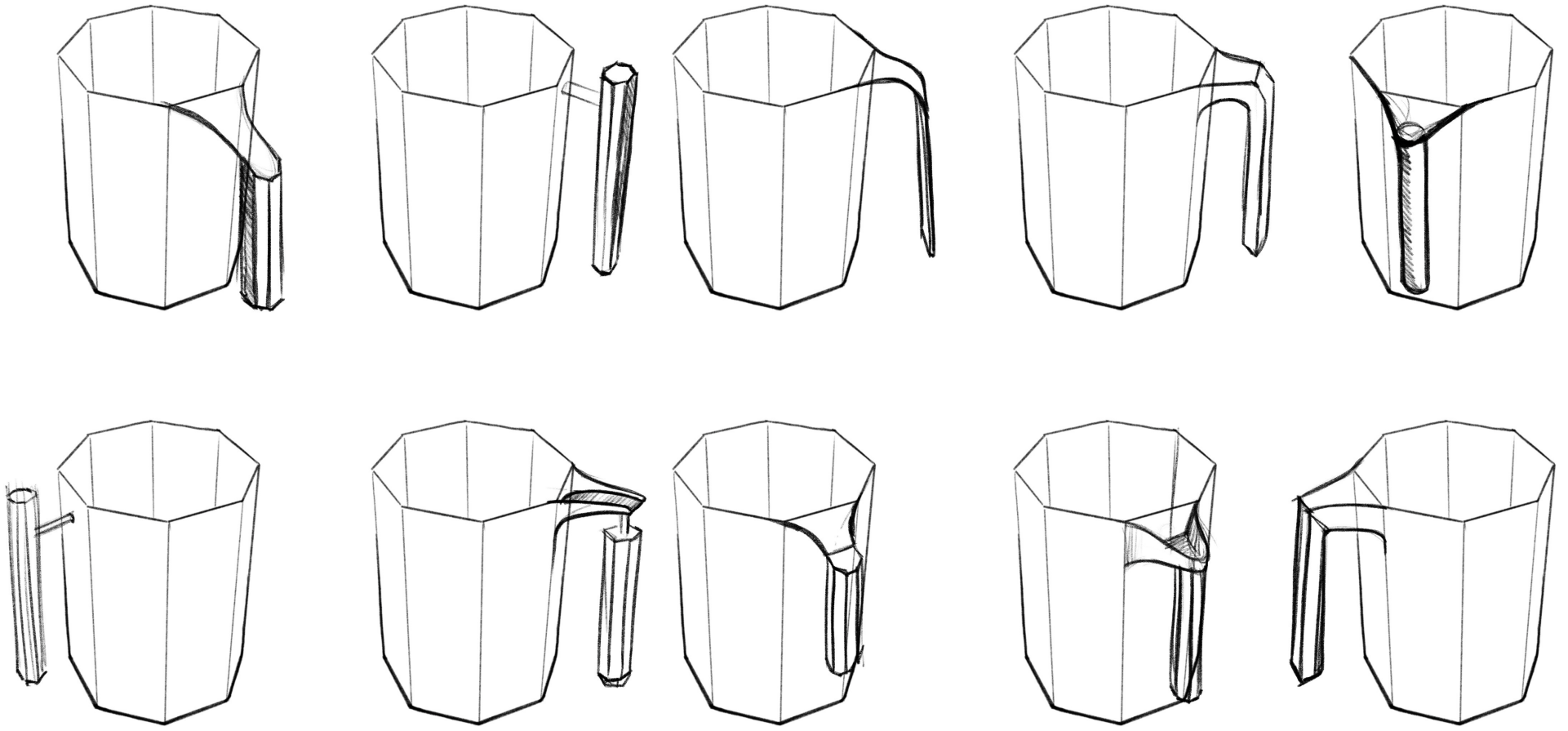
Concept 2

Existing products



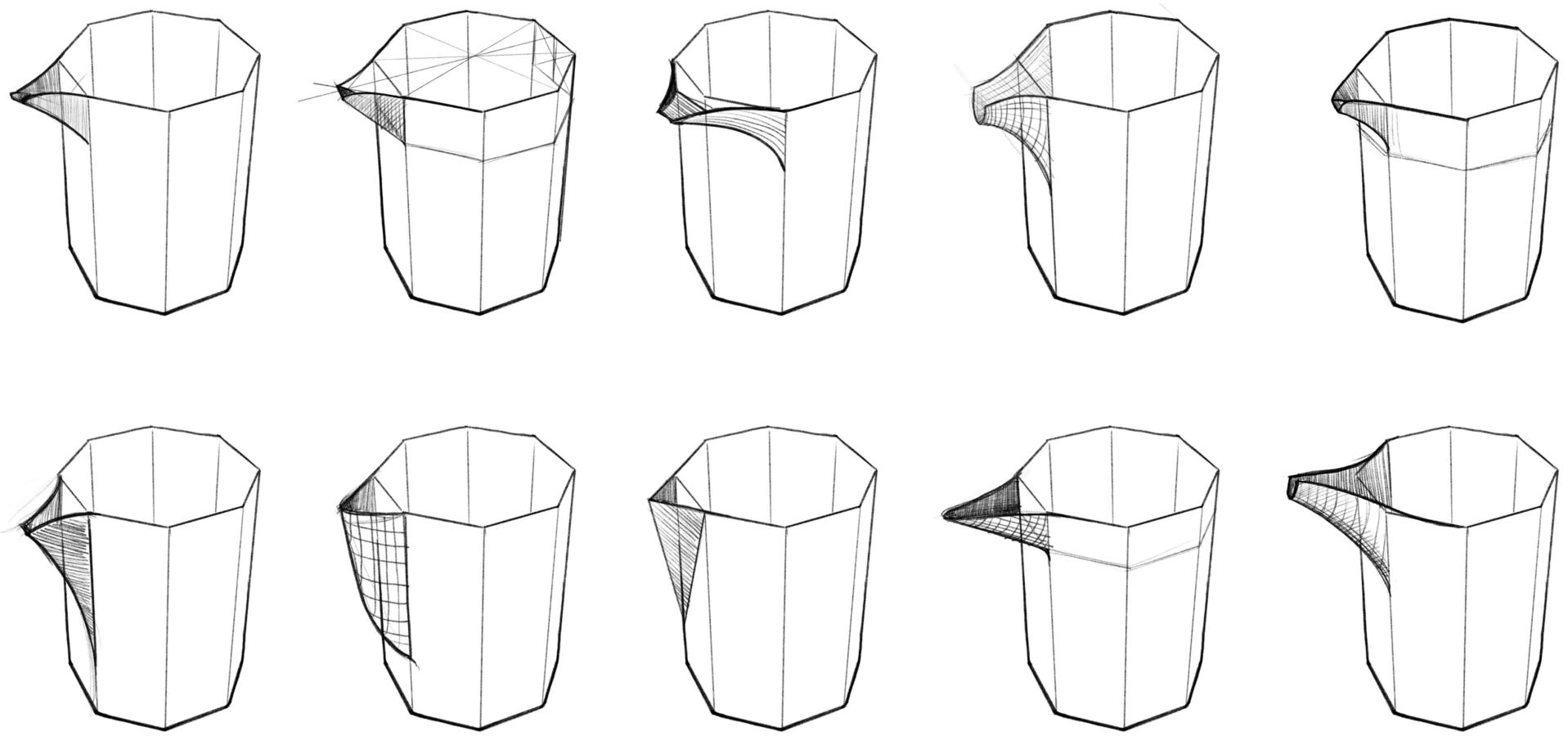
Concept 2

Handle exploration



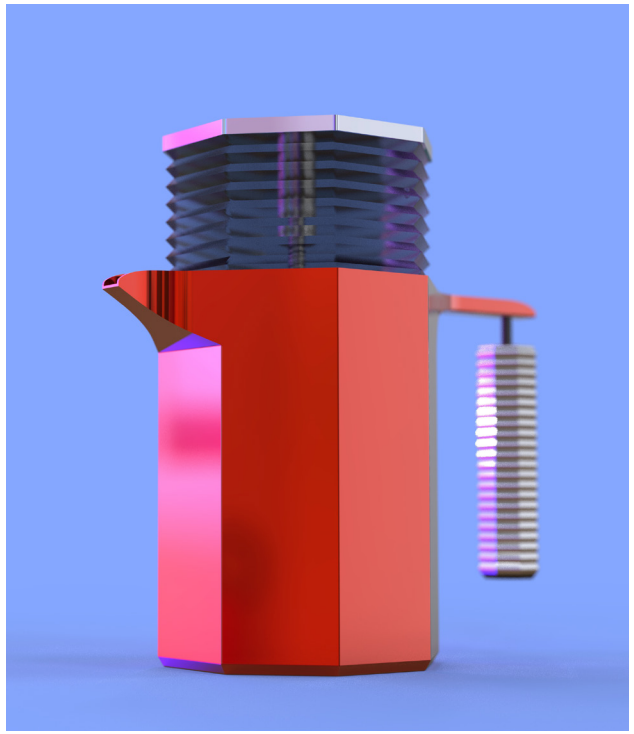
Concept 2

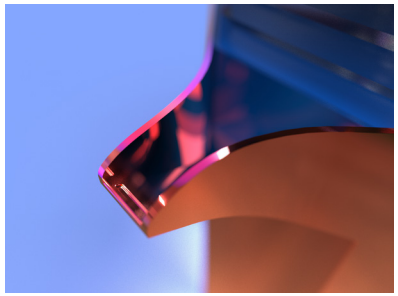
Spout derivation



Concept 2

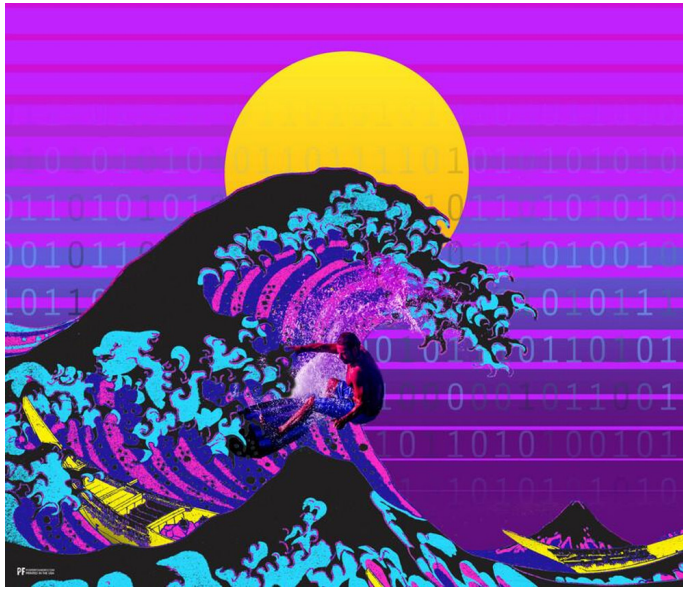
Aesthetic exploration





Aesthetic inspiration

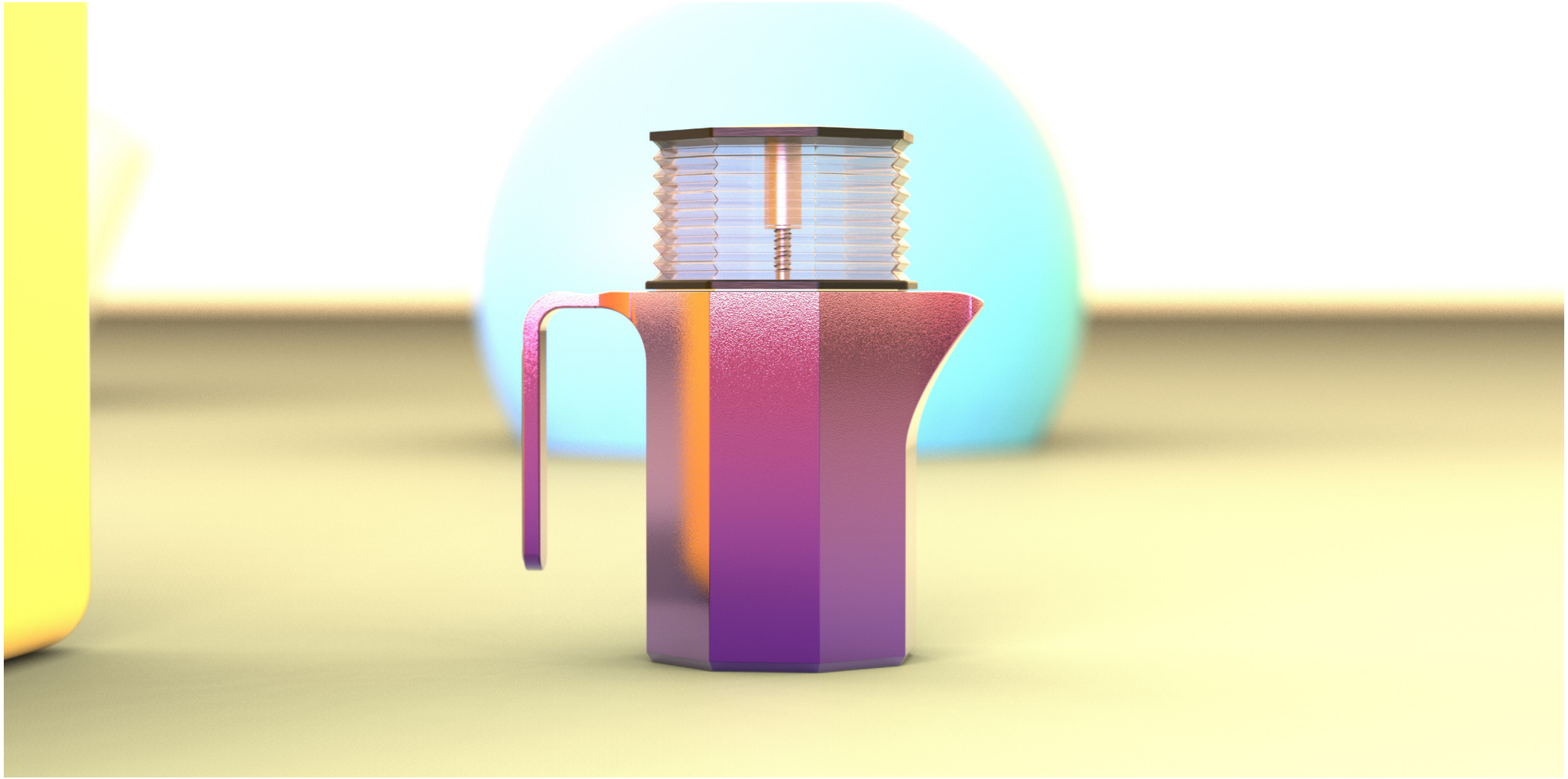
Vaporwave design trend



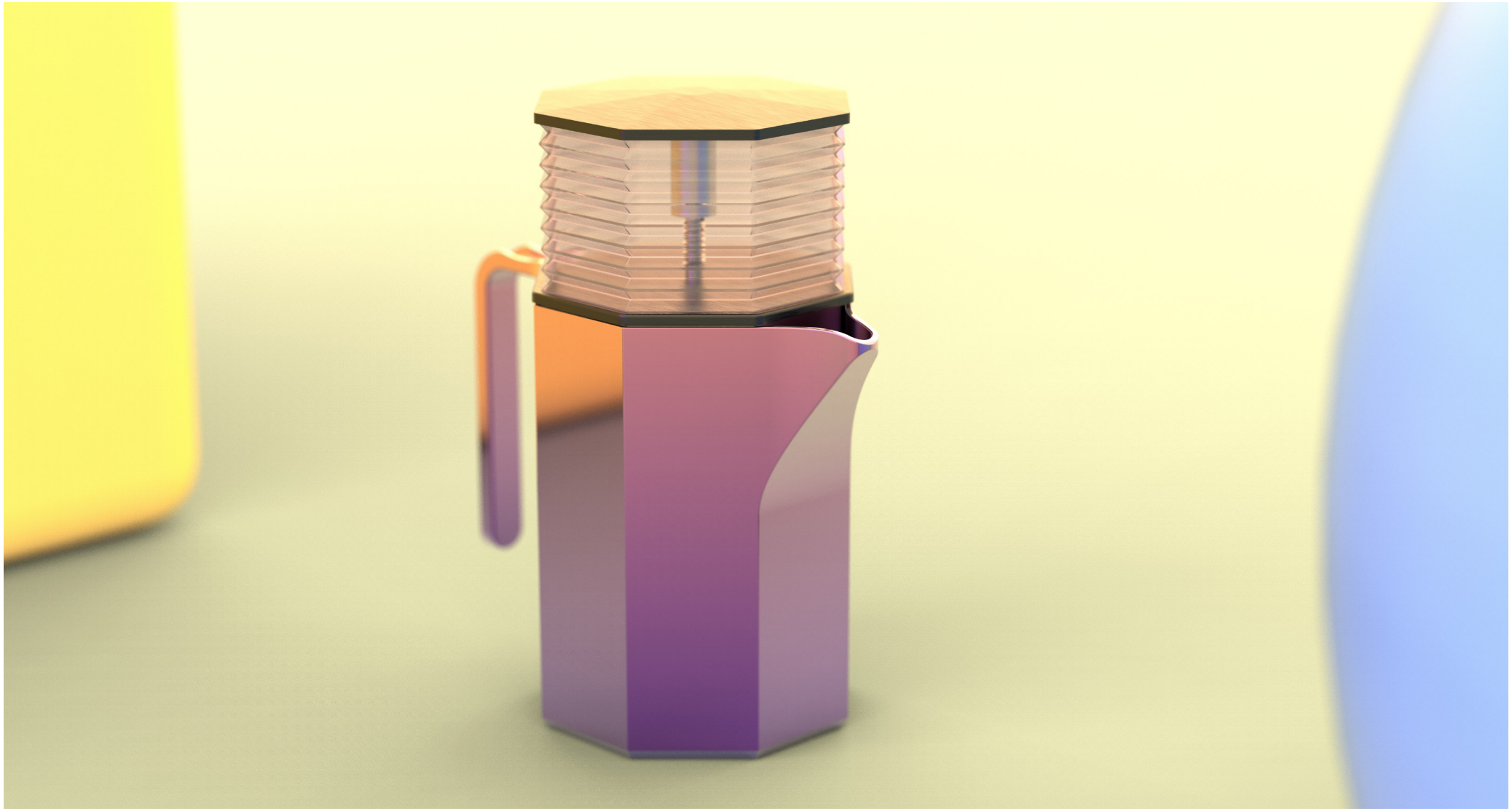
Gradient

Transparency

Final Form



Final Form



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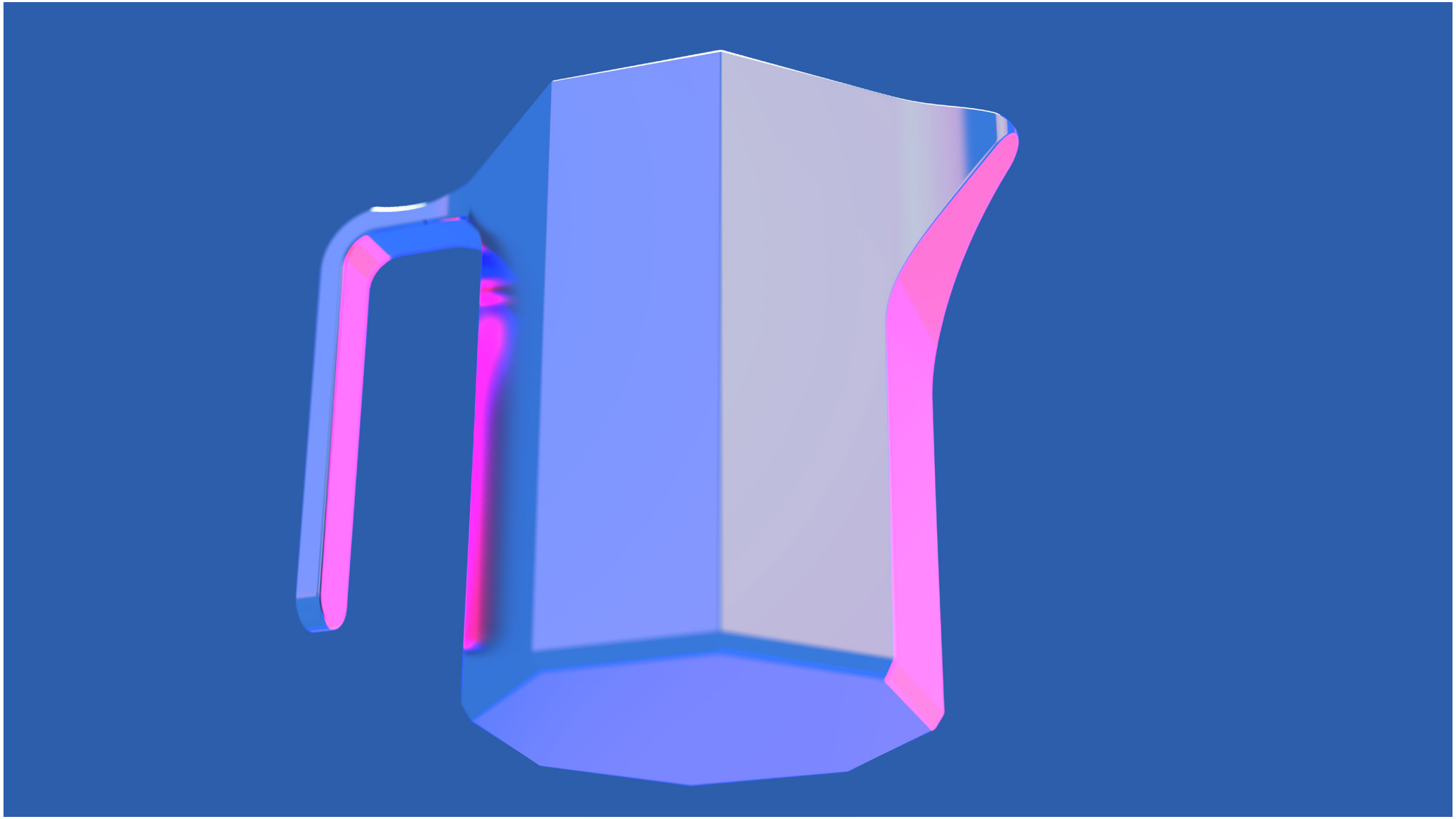

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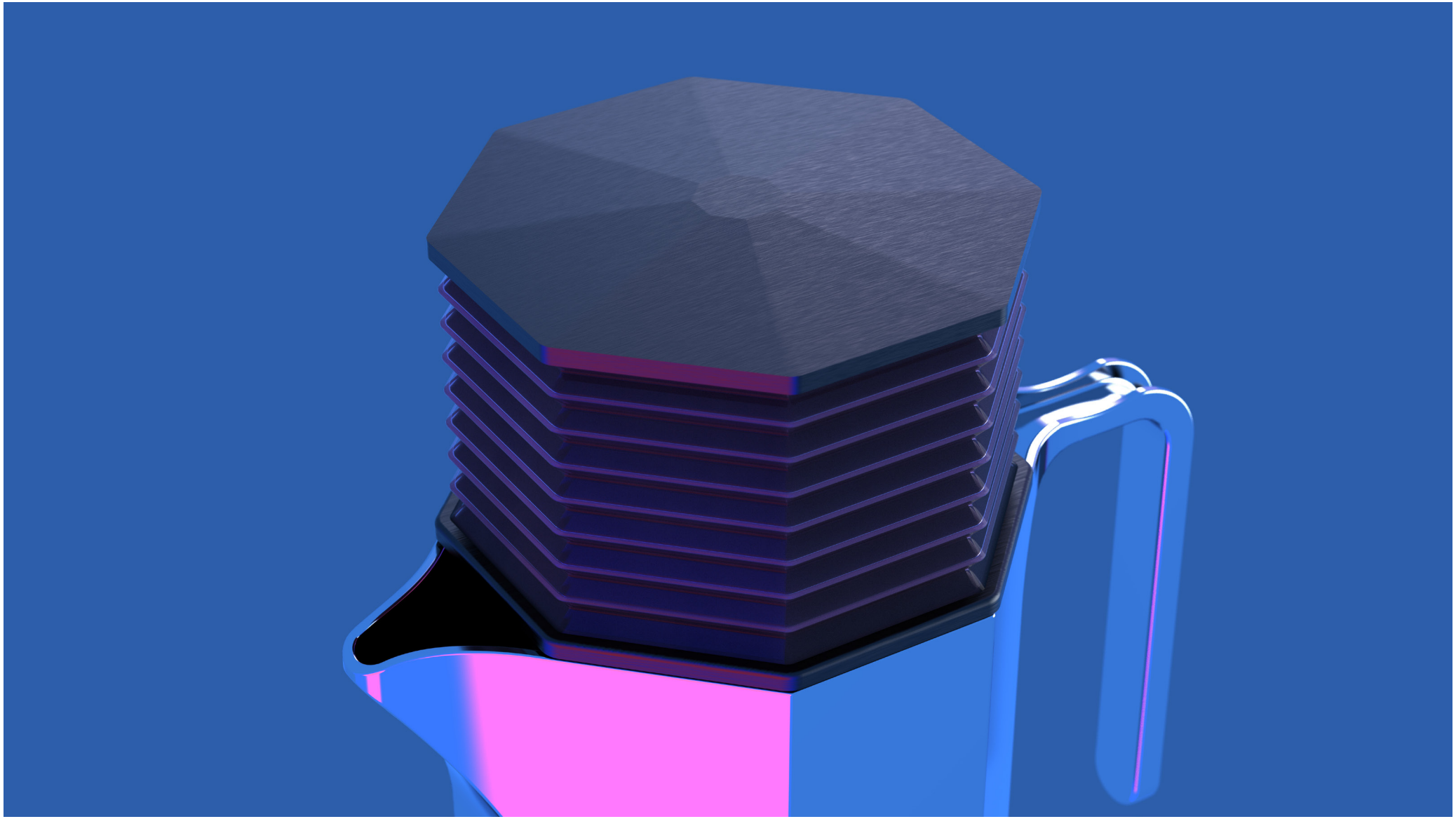
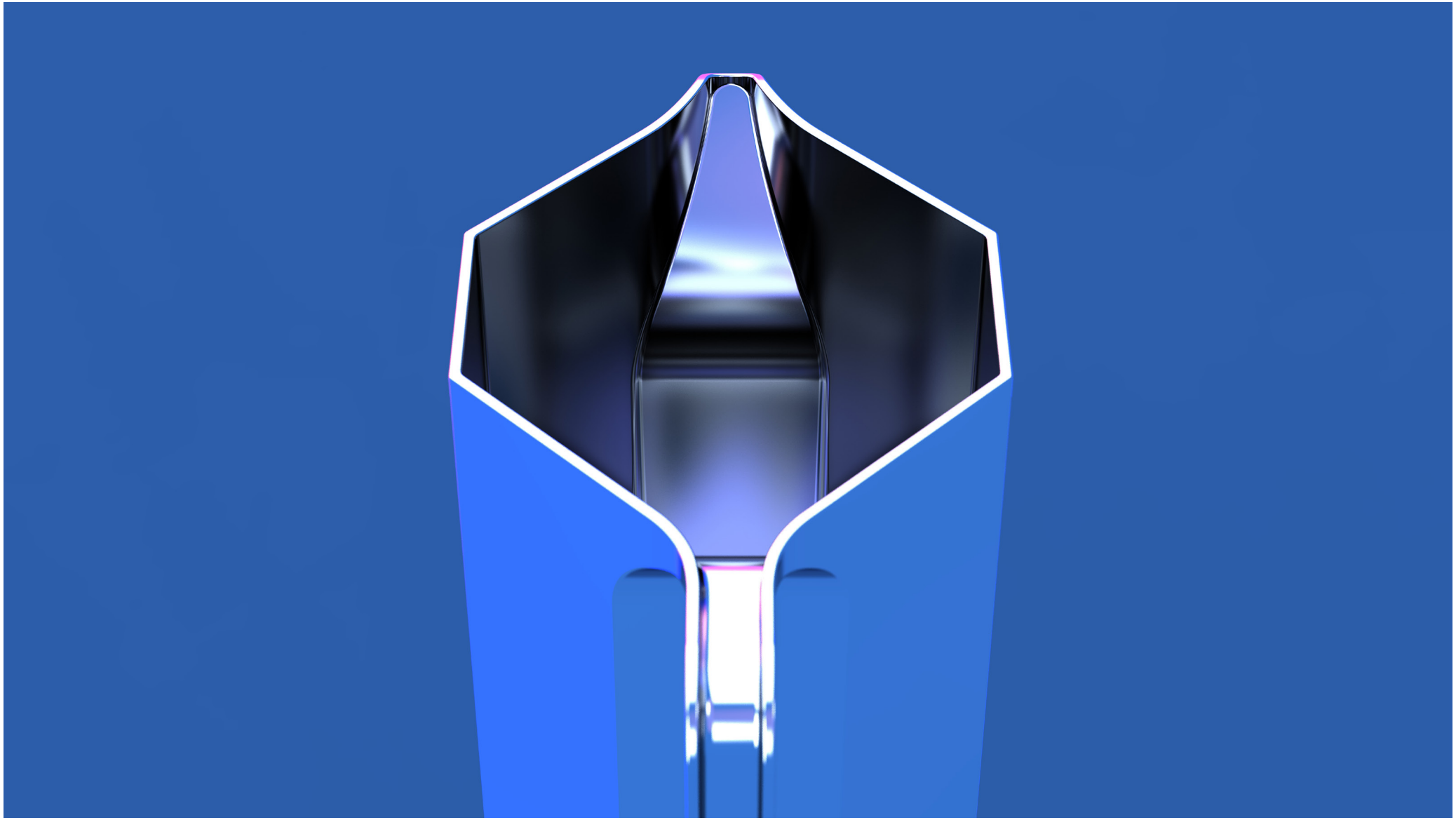
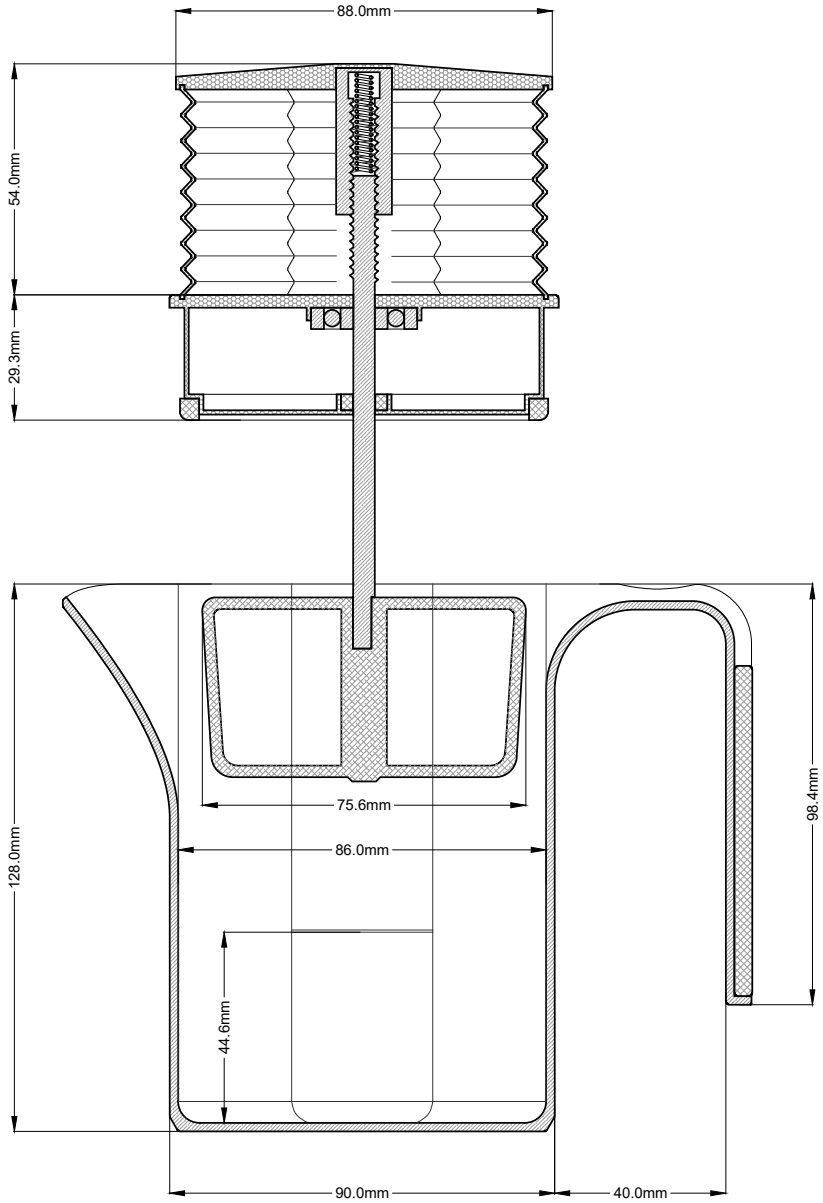


Final Form

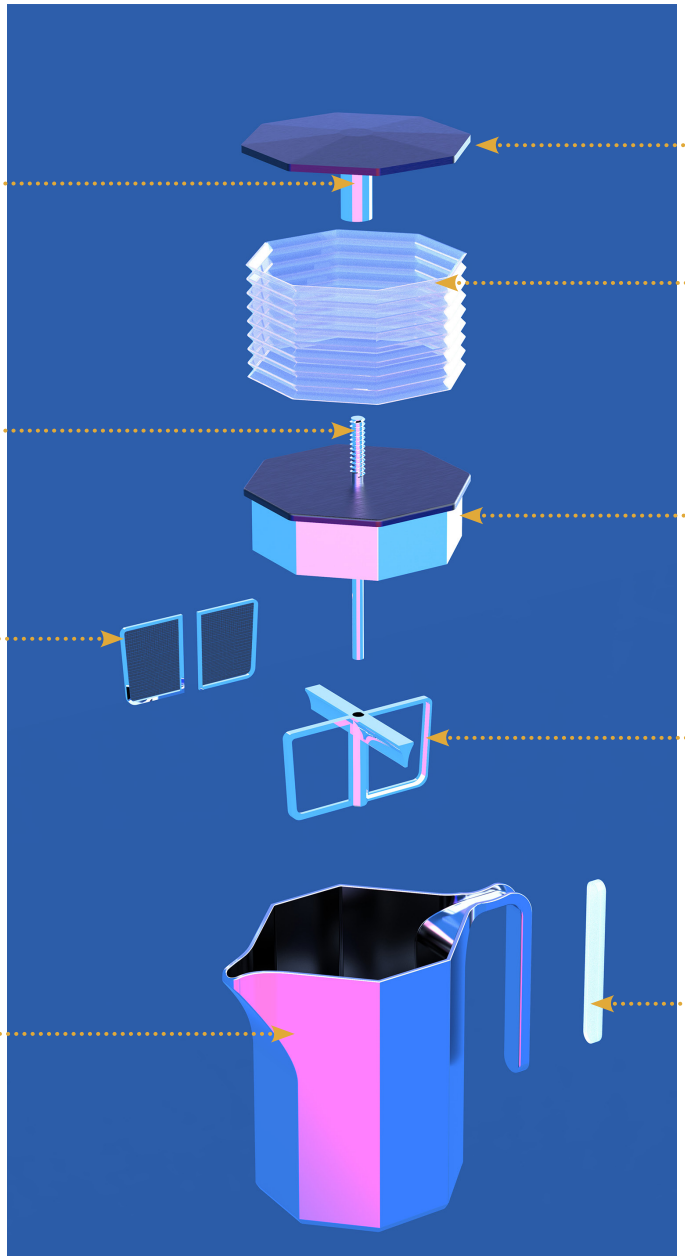
Final Form



Dimension drawings



Materials and processes



SS casing internally threaded

Threaded central shaft made of SS

Magnetically attachable mesh frames

SS body
Stamping, forming, deep drawing, cutting and polishing

SS cap
Bending and stamping. Arc welding.

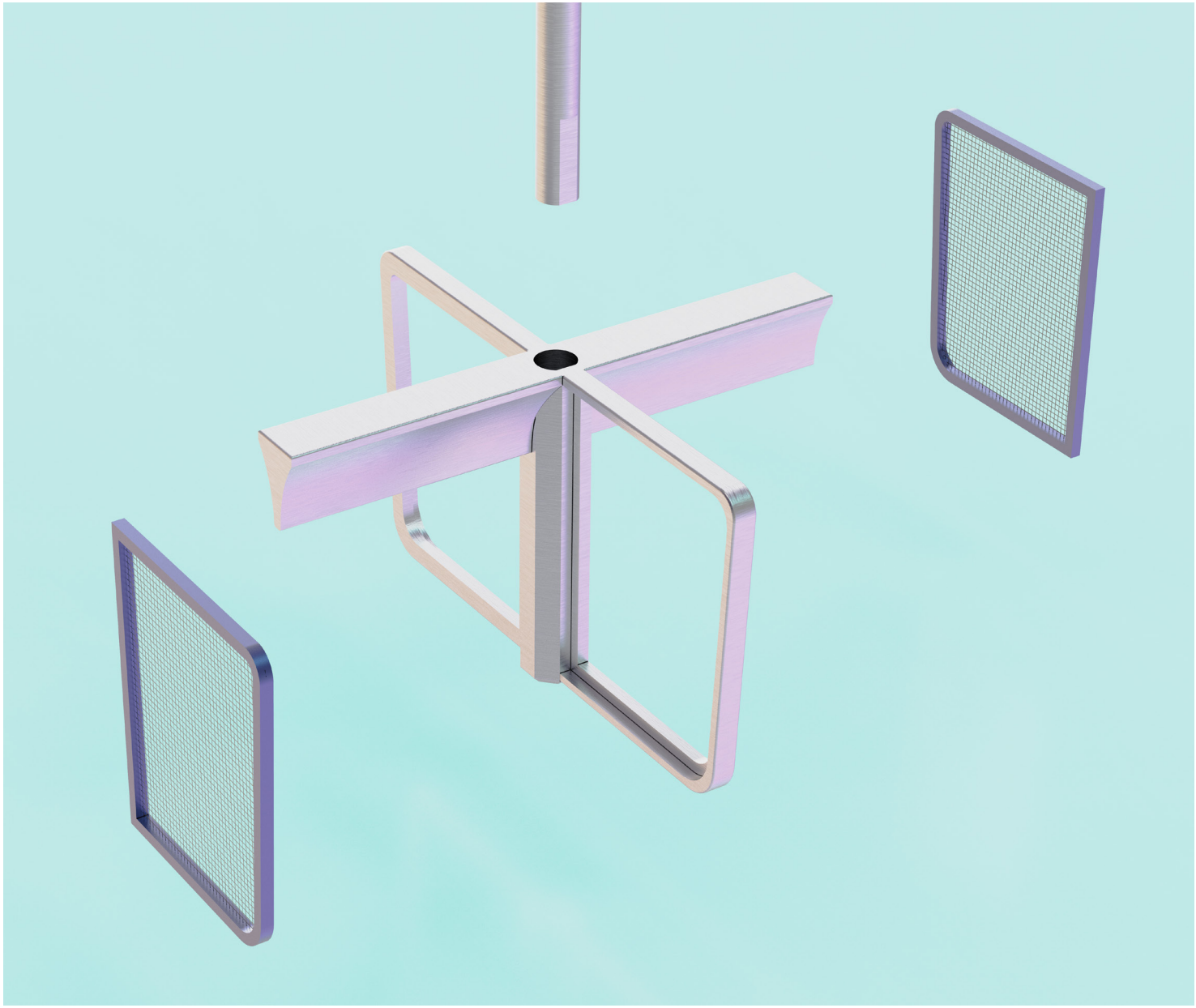
Transparent silicone rubber bellow
Compression molding

SS cap with ball bearing
Bending and stamping. Arc welding.

Frothing mechanism
Casting, milling

Transparent silicone grip
Compression molding

Mechanism design



Product render

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