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Akshita Mishra is a design sophomore at Delhi Technological University and is a part of the pioneering batch of Department of Design. A self-motivated and keen learner and thinker, she strives for excellence in all that she does through perseverance and dedication.

Born and brought up in the metropolitan city of Delhi, she is truly inspired by and appreciates nature. Passionate about books, travelling, painting, crafts, music, photography and, of course design, she can often be found reading about various scientific phenomena as well as memes. A keen linguist, she has learnt German, Japanese, English, Sanskrit and Hindi. She also takes immense interest in Greek, Roman, Egyptian and Hindu mythology. Her creativity flows through her work and she enjoys to experiment around with different styles of graphic design and strongly believes that the rise in need for sustainability and waste reduction strategies in all spheres of life, will mark the beginning of a new era of design.

HAND GRATER

Abstract

The following project had been initiated with the intention to enhance the form of an existing hand grater to make it more functional and comfortable to the user. Various observations were made through different methods of research that contributed to the final concept.

Introduction

A standard hand grater or a shredder may seem like an insignificant and simple kitchen product but the amount of assistance it provides in day to day food preparation activities is immense. The sheer number of times it is used directs to the fact that its simplicity is its greatest feature. The basic intent of this design task was to enhance an existing simple hand grater by working on its physical form and simultaneously increasing its usability and aesthetic appeal.

During the first leg of this project, it was important to study the types of graters that are already existing. It was observed that there were changes generally in the form of a standard box grater with varying perforation sizes, a trapezium or triangular standing grater with varying perforations on all sides and a simple hand grater which is linear in fashion.

The first stage in this process was to empathize with users and make use of basic User Research Methods such as Task Analysis, Contextual Inquiry, User Journey Mapping, Persona and Scenario building, etc. This was all done in an attempt to better understand and relate with the user and observe them while working with the product in real-time. This process also shed light on the frustrations and grievances the users had undergone along various stages of the process of using a hand grater. This helped in defining the problem and arriving on the areas of focus and attributes that were decided to work upon. Stability, fatigue, grip turned out to be key factors that needed to be focussed on, mainly because these were the most recurrent issues that most users seemed to face.

Objective

The objective of this project was to

- Understand how a user interacts with the given product, and study the user-product relationship in-depth try understand their frustrations with the product
- Identify the problem areas and defining the problem that needed to be worked on
- Conceptualize potential solutions by sketching, CAD models and work on the most appealing and functional concept

Need statement

To enhance an existing hand grater ergonomically for better comfort, grip, and stability.

Methodology

The entire design process roughly follows the double diamond process, which includes divergent thinking followed by convergent thinking, which can be represented by a diamond shape. This process widely consists of 4 stages; Discover, Define, Develop and Deliver.

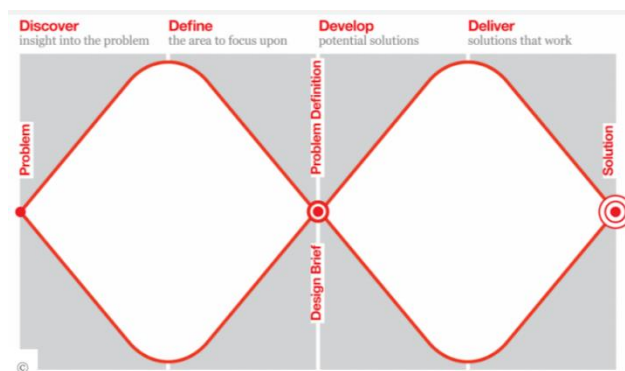


Figure 1 Double Diamond Process

Discover: This stage of the process deals with just mainly gathering insight and educating oneself about the product and existing work done on it. This was done by observing how the grater is used, how the user interacts with it by conducting surveys, questionnaires, etc.

Define: The second stage of the process aims at compiling all the data collected from the first stage and defining the problem areas and potential opportunities for improving the product. The key task was to identify the problems that are of the highest precedence and develop a design brief that captures the essence of the project.

Develop: This is the ideation phase which revolves around generating concepts and solutions according to the design brief. It is an iterative process where prototyping and reiterating through trial and error helps one to refine their ideas.

Deliver: This is the last phase of the design process which includes prototyping, documentation and presentation of one's concept or solution.

Background study and research

The entire research is broadly divided into two sections, the Literature Study which deals with the history of the grater in terms of design and functionality, existing versions of the product, areas from where inspiration was taken and the User Study which aimed at understanding the user and how he or she interacts with the product. Graters were invented in the mid-16th century in France to grate cheese with ease, which used to go hard over a long duration of storage. The first-ever grater was said to be made by sharpening the holes of a metal shower drain, however, it did lead to the production of more sophisticated graters. This invention soon started being used to shred other hard fruits and vegetables, and over the years developed into the various types of box graters and hand graters.



Figure 2 Mouli graters



Figure 3 Cheese graters made in France, 1940s & 1950s

In recent times, the way graters have found their use in the modern kitchen varies vastly. They have proved to be a staple kitchen product in all houses and have added to the overall efficiency greatly.

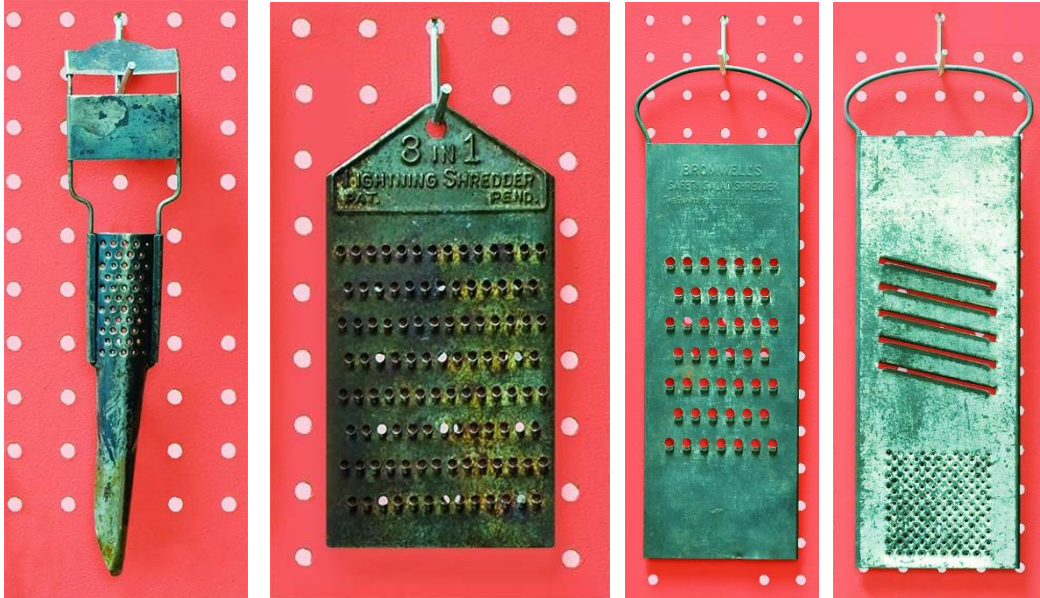


Figure 3 Different cheese graters and shredders made in the USA and England in the 1900's

User study

A number of user research methods were done to delve deeper into the user-product relationship and that would help empathize better with the users. The methods used have been discussed in detail as under.

Task analysis

Job description: To grate a small piece of ginger on a handheld grater

The given task was divided into roughly 6 subtasks, which resulted in better problem solving and decision making.

The entire idea of breaking down the task into subtasks was to generate more simple and mechanical tasks and really observe the user's way of working very closely, in order to understand both the product and the user with a better perspective and hence come up with more empathetic and functional solutions.

The subtasks are as follows:

1. To hold the handheld grater with the non-dominant hand
2. Ensure that the sharp side of the blade is facing upwards

3. Placed hand grater at a 45-degree angle to the working surface
4. Drag the ginger piece in a direction opposite to that of the blades and keep repeating
5. Tap the hand grater gently on the surface to remove ginger stuck on the blades
6. Wash under tap water and wipe with a sponge in direction of blades

This task analysis was carried out for a set of people, and it was observed how common factors like age, profession, gender, being left or right-handed person, prior knowledge and past experiences in the kitchen affected the way the user would go about fulfilling the task. Even though everyone had the same motives to achieve while using a hand grater, they had very different techniques and hence different outcomes.

People who were right-handed as well as left-handed underwent a similar experience using the hand grater. The efficiency of grating or time consumed wasn't effected. However, the hand grater was the position in which it was held varied from person to person.

It was observed that a worker at a tea shop who is skilled in the profession, is quick and completes the task fast, a homemaker is also very efficient in the process of grating but seems to have a certain amount of patience and poise in her actions. A person who enjoys culinary arts as a hobby is less fixated on getting things done quickly but rather seems to enjoy the process. Whereas a teenager has no such emotions and is probably as hasty in their actions as a worker at a tea shop if not more.

Another noteworthy observation was that of the way the hand grater was dealt with while after performing the said task. About 40% of the sample size did not care enough to wash the hand grater and get rid of the stuck ginger particles, while the other 60% who did so, did not yield super impressive results either. This is mostly because there was a general fear that one may nick/cut their fingers in an attempt to remove all the stuck food items. Almost everyone had unpleasant memories related to this and the level of caution has increased to the point they don't care a lot about cleaning the product

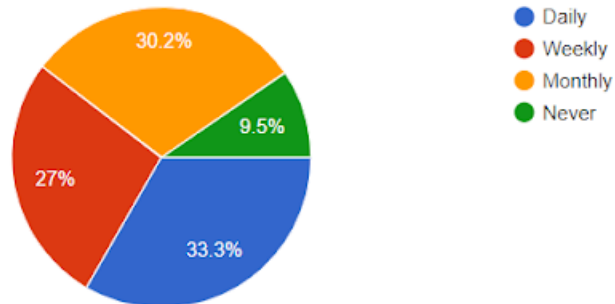
Contextual inquiry

Contextual inquiry revolves around directly communicating with the user and trying to identify the underlying problems, the medium being a semi-structured interview of sorts where the user answers a set of questions. The results of contextual inquiry can be used to define requirements, improve a process, learn what is important to users and customers.

This helps to empathize with the users as they directly open up about their needs, wants, aspirations, past experiences regarding the product and hence come up with better solutions to existing problems.

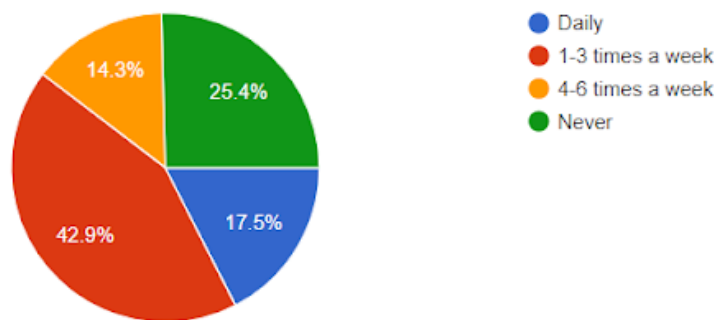
How often do you prepare food in the kitchen?

63 responses



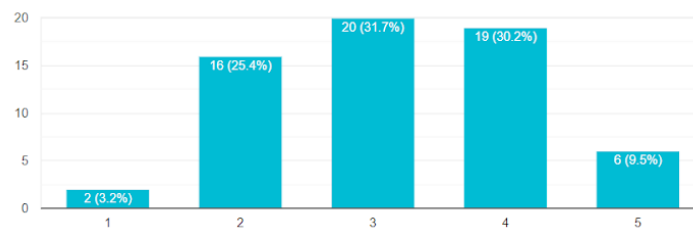
How often do you use a grater in your kitchen?

63 responses



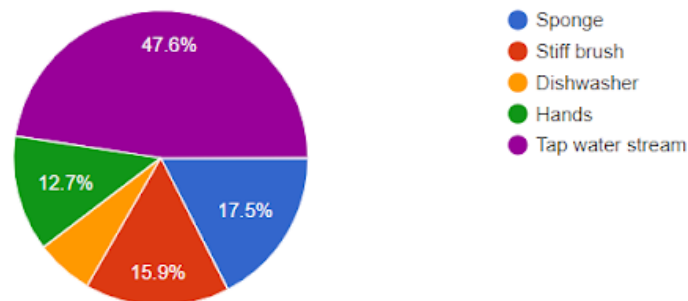
What is the degree of fatigue that develops in your arms while grating for a long interval of time

63 responses



How do you clean your grater?

63 responses



The results of the contextual inquiry which were collected by asking a specific set of questions to about a sample size of about 80 people, were as follows

- About 70% of the users who used a hand grater belong to the age group of 20-40 years, 60% of them being females.
- About 80% of the sample size of users prepared food in the kitchen on a daily/weekly basis and have had past experiences with the product.
- The majority of the people used a hand grater about 1-3 times a week, while the rest used it about 4-6 times a week.
- An average user uses the grater for about 10 minutes or less.
- 70% of the users preferred a handheld grater over a standard box grater.
- Problems faced while cleaning/washing the grater after use included accidentally cutting or nicking fingers, inability to clean it all and the sharp metallic edges.
- About 60% of the users had a granite kitchen counter which affects the way the hand grater interacts with it and provides a good base grip.
- About 30% of the people had problems with having to hold down the hand grater firmly while grating due to the slippery work surface or the material of their kitchen counter.
- About 20% of people faced problems with the handle/ grip of the hand grater.
- 30% of the people were not satisfied with the amount of substance grated with each repetition.
- Users were unable to grate substances completely till the end due to difficulty in holding on the small piece of ginger, sharp edges, space inside the box grater gets filled up or because they're scared they will accidentally cut their fingers.
- About 60% of the people were bothered by the fatigue that develops in the arms after grating for a long interval of time.
- People use various ways to clean handheld graters, including sponge, stiff brush dishwasher, hands, tap water stream, sponge being the most widely used one.

- The material of the handle, Size of blades/holes, Durability and sturdiness, Aesthetic appeal, Functionality are all factors that users consider with functionality being at the top spot.
- About 20% of the people had injured themselves in one way or another while using a grater in the past.

User journey mapping

A user journey map captures users' entire journey while using a product or doing a task. The story is interpreted from the user's perspective and is more user-oriented, focussing on the user's needs, aspirations and expectations while using the said product and evaluating the user's satisfaction level at each moment.

Job description: To grate a small block of cheese on a handheld grater

Persona and Scenario: A 40-year-old working woman, who prepares food for her family. Right-handed and with moderate experience in the kitchen, she enjoys spending the little time she gets to be in the kitchen and cook for her family as she finds it to be mentally relaxing and therapeutic.

Expectations: She plans to grate a small block of mozzarella cheese while preparing pizza for her family. She expects to be done with the entire process of making a pizza in about 20 minutes, and an additional 5 minutes to clear up her working station. The mozzarella cheese is of the packaged kind and had been extracted from the chiller box in the freezer.

Phases: The entire process has been divided into three parts to map the woman's frame of mind and to map the journey in better detail. We shall consider the three phases to be as before, during and after working with the hand-held grater and performing the required task.

Before using the hand grater

The woman prepares about 90% of the pizza and has to grate mozzarella cheese on the top. She then fetches the cheese from the freezer and let it sit at room temperature for about 5-7 minutes to let it thaw a little bit. She then gets the hand-held grater and tries to decide whether she should grate the cheese directly onto the pizza or first onto a plate or a bowl and then transfer it to the pizza. After about a minute of indecision and confusion, she decides she won't dirty another plate and just grate it directly on to the pizza. She removes the cheese from its plastic packaging and prepares to grate.

While using the hand grater

The woman holds the hand grater almost at right angles, directly above the pizza, which sits on a cutting board. She tries to grate the block of cheese but is unable to do so effectively and gets

very little cheese grated with each swipe, as she is unable to hold the hand grater firmly in the air and grate the medium-sized block of cheese.

She then decides to go with the initial plan of grating first onto a plate and then transfer it onto the pizza. She then holds the grater at an angle of 45 degrees to the plate and grates the mozzarella cheese. She has to apply a considerable amount of pressure since the cheese is solid and frozen. She finds this entire process of grating and the repetitive motion to be very therapeutic and enjoys every repetition.

The handle grip of the hand grater is comfortable for her to hold with her left hand and grate the cheese with her right hand. The hand grater, however, slips about 2 times due to the slippery metal plate and she has to readjust her grip. Since the block is medium-sized she doesn't even need to worry about grazing her fingers and she gets done with the entire task in about 3 minutes.

After using the hand grater

After having used the hand grater, the woman now needs to clean it up for future use. The first step to do this is to bang the grater on the kitchen counter to get rid of the particles. This is also an enjoyable part for her as she likes to the sound the hand grater makes when hitting upon the granite kitchen slab.

She then proceeds with the hand grater towards the sink and just lets tap water pour onto the metal blades. After about 30 seconds of letting it stay under the water stream, she checks to see if it is clean but to her mild frustration, she notices that it's a little greasy. She puts more water on it, only to yield no better results. She then takes a kitchen towel and wipes away the water from the blades and sees the greasiness is gone by almost 80%.

The remaining greasiness doesn't bother her as the entire process was already very time consuming and mentally frustrating and she leaves the hand grater to dry.

PERSONA AND SCENARIO BUILDING

Based on the research done from the previous three research methods the following user persona is come up with.

Age: 35-45 years

Gender: Female

Profession: Home Cook

Dominant Hand: Right

The user works 5 days a week to make ends meet in her lower-middle-class existence. She has a family of 5, with a husband, two children and her mother in law. She cooks in various households to earn a living, multiple times a day, 5 days a week. With minimal educational background, she was never encouraged to pursue a very sought after modern career. Her family comes foremost

for her and their wellbeing and comfort is her number one priority. Her husband is a taxi driver who earns almost the same as her and her children to go to a public school.

As a person who cooks for a living, she is familiar with most of the kitchen utensils, appliances, and tools and knows how to work her way through them, a hand grater being one of them.

She has had many accidental injuries in the kitchen and is afraid of blood, and cautious around oil and fire. She always carries a band-aid or two in her bag as a precaution and believes that hygiene is one of the most important things that she has to maintain while giving out her services as a cook.

Her frustrations with the hand grater are as follows

- Lack of stability when working on the kitchen counter as the hand grater slips
- The constant possibility of grazing her fingers and bleeding
- Inability to clean the hand grater with efficiency due to the fear of cutting herself
- Fatigue in her upper arm muscles due to the repetition and monotonicity of the entire process
- The grip being uncomfortable to hold when working for a long time

Her aspirations/expectations from the ideal hand grater are as follows

- A grater that is stable and easy to hold and does not require a lot of pressure to maintain stability
- Lightweight
- Easy to clean
- A comfortable handgrip made out of a suitable material
- More substance is grated with each hand repetition
- Feeling secure and not having to worry about grazing her finger

Observations

The problems that were observed from all the user research methods are consolidated as under

- Difficult to clean due to the very nature of the blades and hand grater
- Lack of safety while using a hand grater
- Problems in holding onto the hand grater due to design flaws in the grip
- Wastage of small amount of food items that get left in the end
- Generation of muscle fatigue due to the repetition of the same hand movement

- Grating small items right to the end on a grater with sharp blades often leads to grazes, nicks, and cuts on fingertips and this ends up in users being dissatisfied and unwilling to use a grater. This also leads to wastage of a small number of food items.
- Most of the times, small food particles remain inside the blades due to ineffective washing methods and then they lose their water content and dry out and get stuck inside the blades. This becomes really tough to clean without cutting one's fingers.
- The material of surface that one is working on also plays an important role as it is a major deciding factor whether one would be able to establish a firm grip and grate without facing issues related to the hand grater sliding on a slippery surface.
- The material and form of the handle of the hand grater greatly determine the way a user will grip the product while using it and since the pressure is applied while holding on, it determines the usability of the product in general.
- Cleaning the hand grater is one of the problem areas for all users.
- Grazing fingers on the hand grater is something that bothers all users and often leads to wastage of small amounts of food.
- The working environment affects the kind of experience the user has while using the grater as it affects factors like stability and slipping.
- The grip of the hand grater and factors such as the material used and form of the handle also determines the usability of the grater.
- Removing the food particles in the blades is a tedious task as most of the people do not clean it effectively, the food particles lose their water content and are very hard to remove.

Concept generation

The basic intent of designing the grater was to work on its stability, balance and how to make it easier for someone who uses it on a daily basis. In the early ideations form was played around with and how it could have modified to suit the user better.

Inspiration board

An inspiration board was made to study design elements that were taken inspiration from.

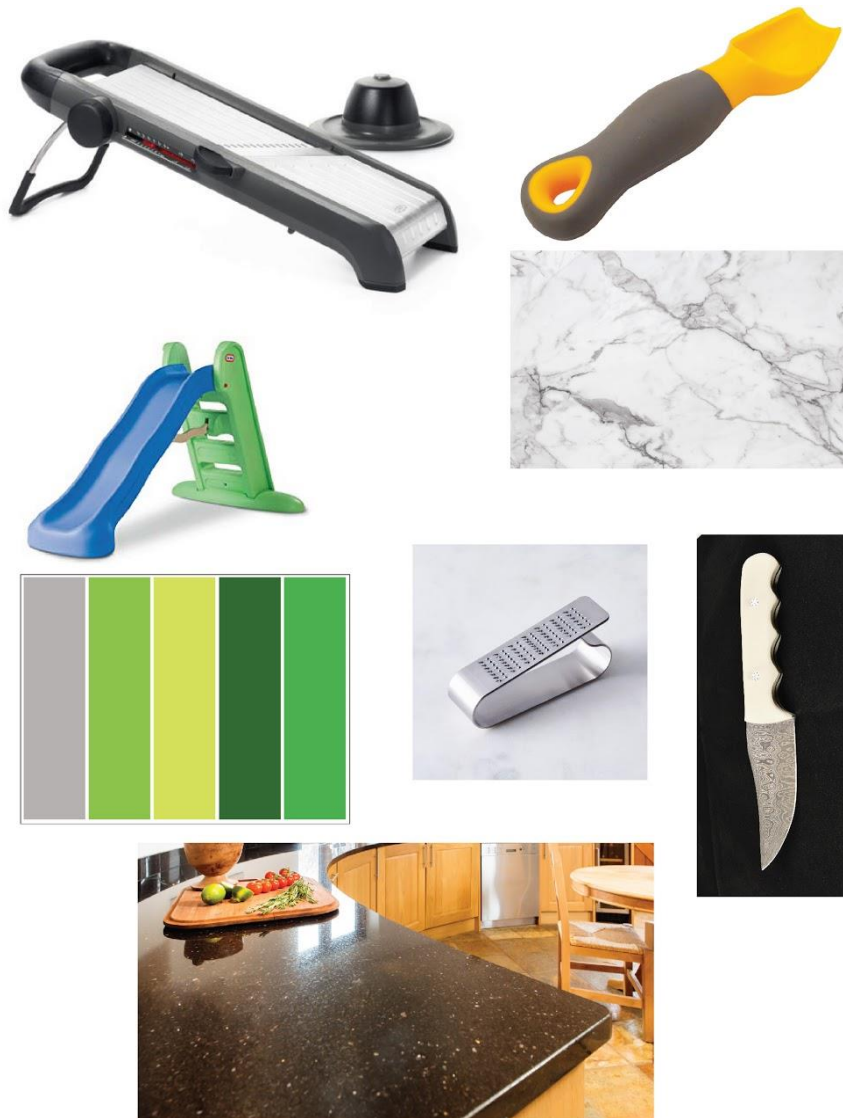


Figure 4 Inspirational Board

Concept 1

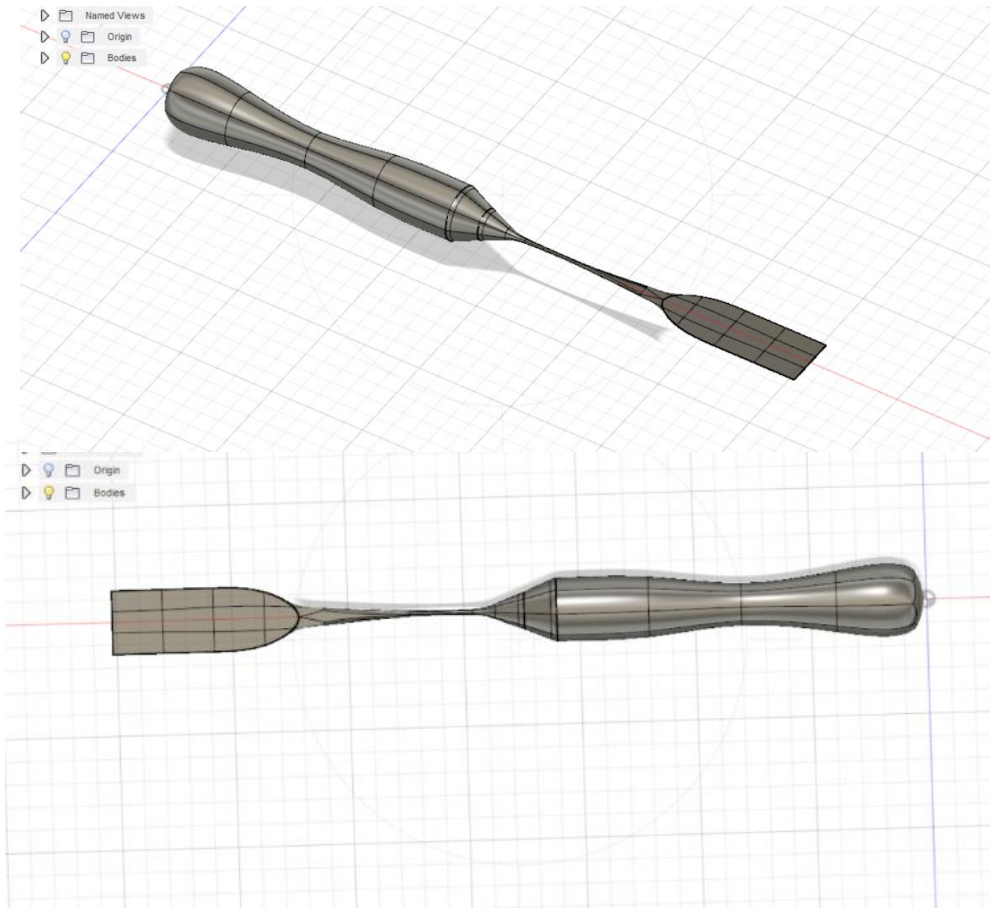


Figure 5 Concept1 images of hand grater

The idea behind this concept was to add the comfort of holding a knife or peeler to a hand grater since a knife is used in most of the kitchen activities that one is involved in. However, the main issue with this was whether or not people would adapt to such a drastic change since a knife and hand grater are poles apart.

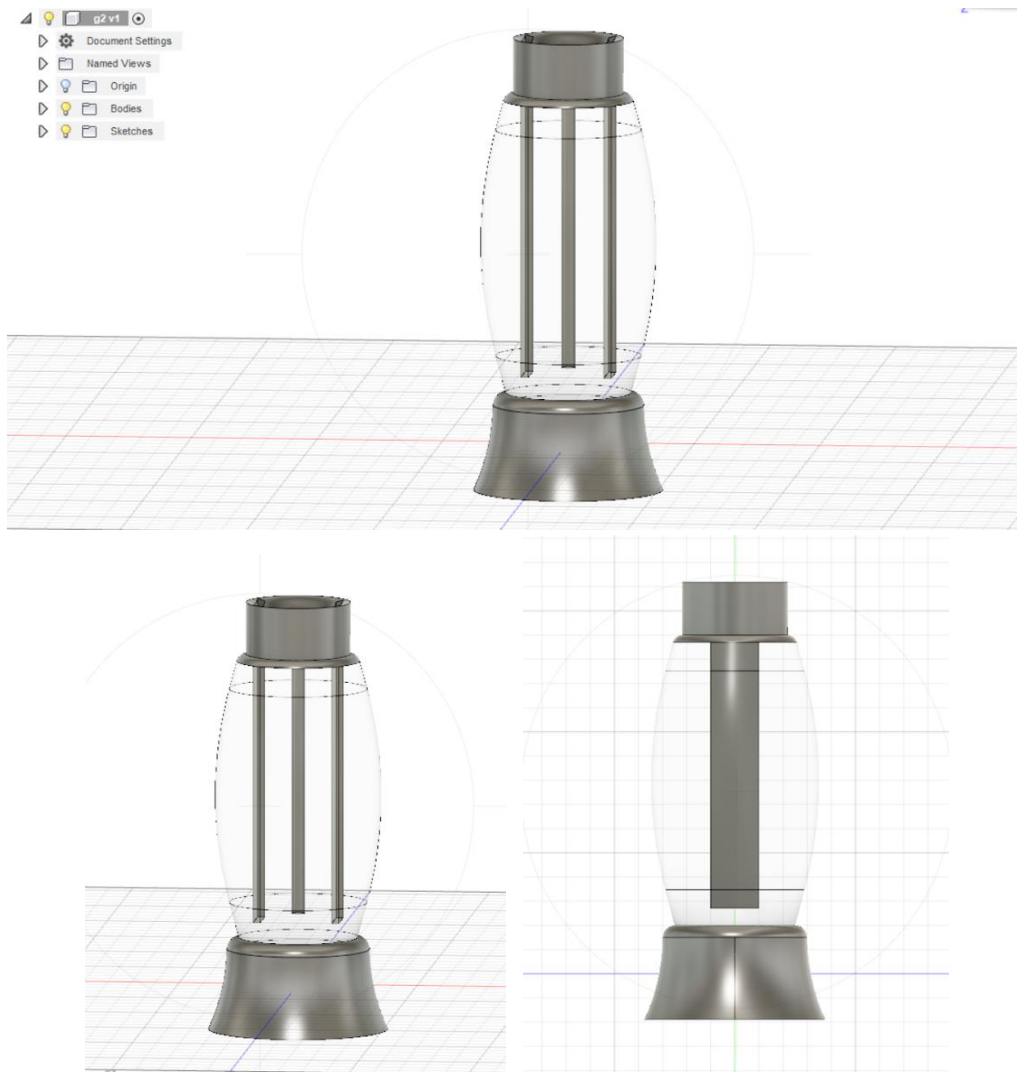


Figure 6 Concept 2 images of hand grater

Concept 2

The basis of this concept lies in the conversion of linear motion to rotational motion. The central spike would have the food particle poked through and on rotating the top part, it would get grated through both the perforated metal sheets and get collected at the bottom grater. The mean position of the two plates is when they both are stuck together and that way the food item would always be in contact with the walls of the plates.

Although it would have greatly increased the efficiency and speed of grating food items, the rotational force would generate way more fatigue in the wrist than linear motions create in the upper arm. Only hard food items would be able to get grated and the rest would get squished.

Moreover, in an attempt to oversimplify things, the entire task of grater a simple cheese block now seems so complicated.

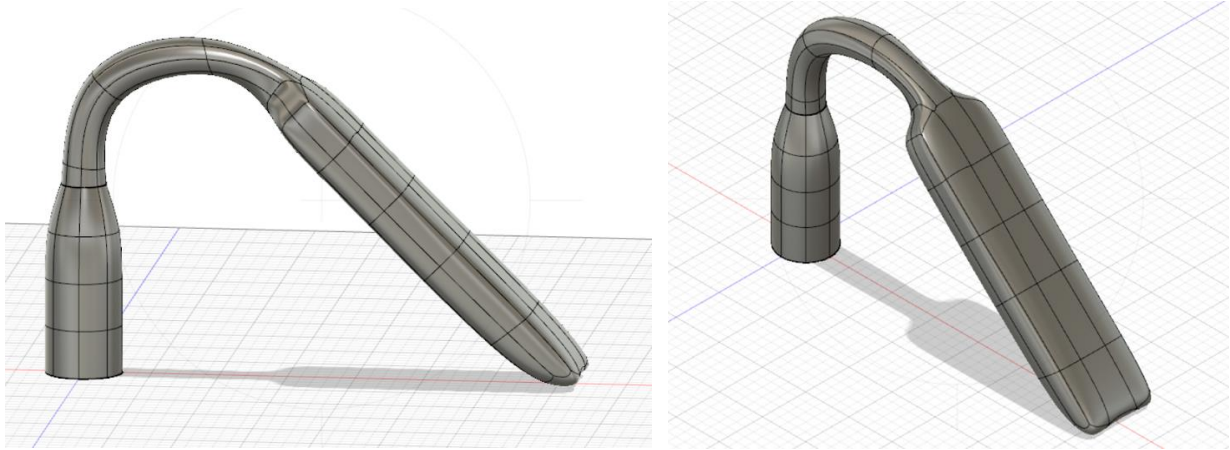


Figure 7 Concept3 images of hand grater

Concept 3

The idea of this concept was to lessen the amount of pressure applied to keep the hand grater stable on the kitchen platform by making the grating surface slant downwards and therefore decreasing the amount of physical fatigue generated due to work done against gravity.

The main problem here, however, was that due to the heavy bottom part, the grater would never be stabilized and extra energy would be spent in making the grater stay still.



Concept 4

Since stability was an issue in the third concept the shape more balanced while also keeping in mind the slanting grating surface.

The reason for not going with any of these designs was mainly that in the process of making the hand movement minimum to reduce fatigue, it was felt that designs were getting more complicated than it was required.

While being very focused on specific areas of problem, the product as a whole was disregarded and this proved to be very important learning.

Final concept

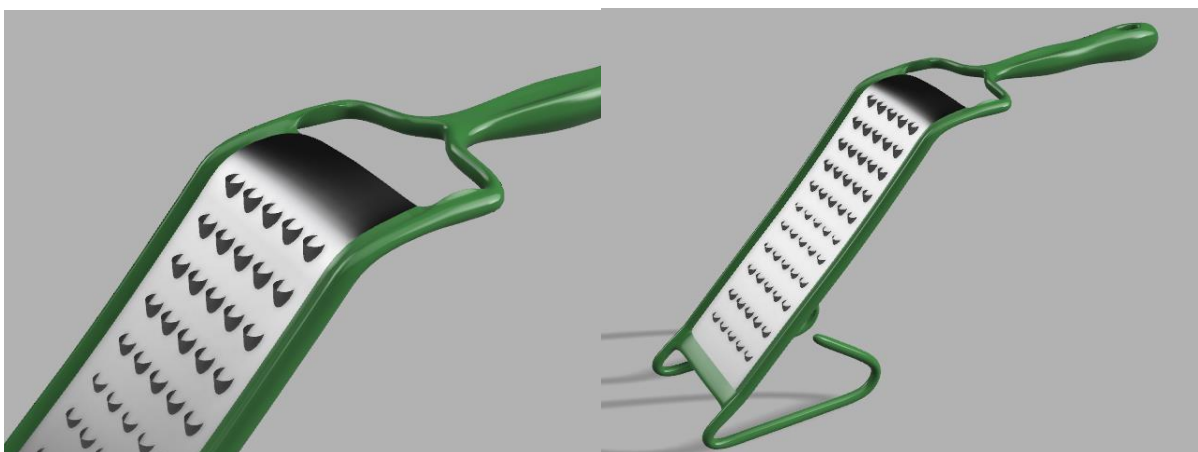


Figure 8(i) Final concept images of hand grater

- The grip facilitates the arm movement and enhances the grating experience.
- Ergonomically designed grip for better comfort levels for long usage.

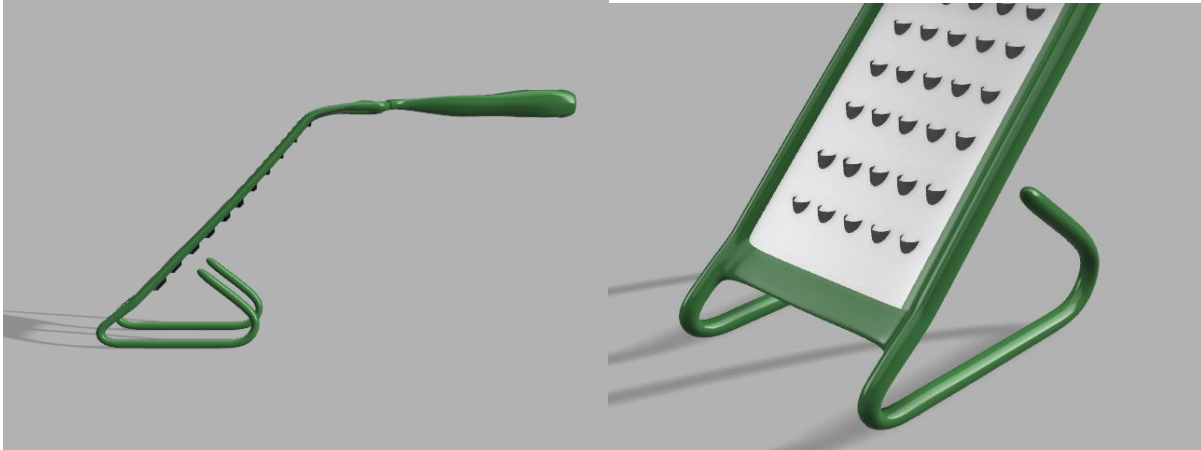


Figure 8(ii) Final concept images of hand grater

- The resting rubber-coated base provides extra stability and ensures that the grater doesn't slip on slippery surfaces and causes injuries.

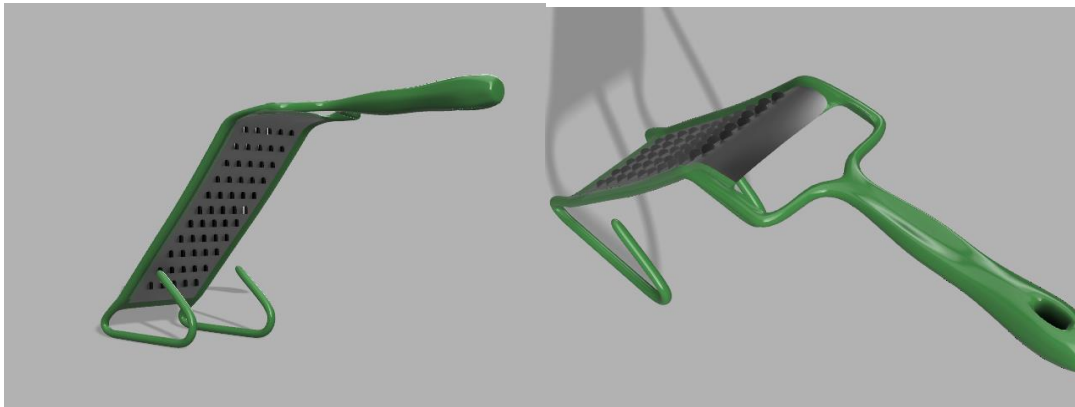


Figure 8(iii) Final concept images of hand grater

- Sloping perforated surface facilitates grating motion and reduces the pressure required to keep it in place as it directly rests on the base.

The aim of this grater tries to fulfil is to provide more stability and comfort while grating any food substance. The slanting perforated surface aims to reduce the fatigue generated in one's arm while doing an intense repetitive action in a short duration of time.

The ergonomically designed handle makes sure the hand rests in a comfortable position and this has been done by providing a groove for the thumb to be in whilst holding the handle.

The handle is attached to the metal plate in such a way that it runs parallel to the working surface and the hand of the user rests in a neutral position. The rubber grip provides comfort and the rubber-coated base also makes it easy to stand on marble and granite kitchen counters.

Conclusion

The entire project helped in realising the extreme importance of user-centric design. There's a massive difference between the type of people who use the same product which depends vastly on their background, profession, gender, age and so on. The user study is essentially the most important part to truly understand and empathize with the user in all aspects to come up with the persona for whom the product will be designed. While going through the continuous and iterative process of converging mere ideas into concepts, many problems faced by users were identified. This was a major step in developing designs that offered good user feedback.

References

<https://culturecheesemag.com/photo-essay/a-grate-look>

<https://www.thesarcasticnutritionist.com/blogs/news/the-history-of-the-grater>

<https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond>

<https://www.oxo.com/box-grater.html>

<https://www.chatelaine.com/food/kitchen-tips/box-grater/>